ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ವಿಶ್ವವಿದ್ಯಾಲಯ

Visvesvaraya Technological University

(State University of Government of Karnataka Established as per the VTU Act, 1994)
"Jnana Sangama" Belagavi-590018, Karnataka, India
Phone: (0831) 2498100, Fax: (0831) 2405467, Website: vtu.ac.in

Dr. A. S. Deshpande B.E., M.Tech., Ph.D.
Registrar

Phone: (0831) 2498100
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Ref: VTU/BGM/BOS/A9/2021-22 / 3991

Date: 03 DEC 2021

CIRCULAR

Subject: 1st and 2nd -semester scheme(2021) of Teaching and Examinations regarding...

Reference: Hon'ble Vice-Chancellor's approval dated: 03.12.2021

The courses, 21IDT19- Innovation and Design Thinking (offered in 1st semester both for chemistry and physics groups) and 21SFH29- Scientific Foundations of Health (offered in 2nd semester both for chemistry and physics group) are compulsory courses for the students admitting to 1st year B.E./B.Tech. programs.

A slight modification is made in the scheme of teaching and examinations to offer both the courses in 1st as well as 2ndsemester for 50:50 strength of intake. The scheme is attached with this circular for reference and needful. Also, 3-8 semesters scheme template has been attached for stakeholder's information.

All the principals of Engineering Colleges are hereby informed to bring the content of this circular to the notice of the concerned. Please note: corrected scheme of programs is made available @ **https://vtu.ac.in/en/b-e-scheme-syllabus/#menu05**

Sd/-

Registrar

Encl: As mentioned above.

To,

- All the Principals of the Engineering Colleges under the ambit of VTU Belagavi.

Copy to:

1. The Hon'ble Vice-Chancellor through the secretary to VC for information
2. The Registrar(Evaluation) for information and needful
3. The Registrar's Office, VTU, Belagavi, for information.
4. The Special Officer, Academic Section, VTU Belagavi, for information.
5. The Director ITI SMU CNC for information and to upload the circular on the VTU web portal

REGISTRAR

Visvesvaraya Technological University, Belagavi
Scheme of Teaching and Examinations 2021
Outcome-Based Education(OBE) and Choice Based Credit System (CBCS)
(Effective from the academic year 2021 – 22)

I Semester (Physics Group) **[Common to all B.E./B.Tech. Programs]**

Sl. No	Course and Course Code		Course Title	Teaching Department (TD)and Paper Setting Board(PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self-Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	BSC	21MAT11	**Calculus & Differential Equations**	TD and PSB: Mathematics	2	2	--		03	50	50	100	3
2	BSC	21PHY12	Engineering Physics	TD and PSB: Physics	2	2	--		03	50	50	100	3
3	ESC	21ELE13	Basic Electrical Engineering	TD and PSB: E and E Engineering	2	2	--		03	50	50	100	3
4	ESC	21CIV14	Elements of Civil Engineering and Mechanics	TD and PSB: Civil Engineering	3	--	--		03	50	50	100	3
5	ESC	21EVN 15	Engineering Visualization	TD: ME, Auto, IP, IEM, Mfg. Engineering PSB: Mechanical Engg	2	--	2		03	50	50	100	3
6	BSC	21PHYL16	Engineering Physics Laboratory	TD and PSB: Physics	--	--	2		03	50	50	100	1
7	ESC	21ELEL17	Basic Electrical Engineering Laboratory	TD and PSB: E and E Engineering	--	--	2		03	50	50	100	1
8	HSMC	21EGH18	Communicative English	TD and PSB: Humanities	1	1	1		02	50	50	100	2
9	AEC	21IDT19/29	Innovation and Design Thinking	Any Engineering Department	1	--	--		01	50	50	100	1
		OR											
		21SFH19/29	Scientific Foundations of Health										
				TOTAL	**13**	**07**	**07**		**24**	**450**	**450**	**900**	**20**

Note: BSC: Basic Science Course, **ESC**: Engineering Science Course, **HSMC**: Humanity and Social Science & Management Courses, **AEC** –Ability Enhancement Courses.

L –Lecture**, T –** Tutorial, **P-** Practical/ Drawing, **S –** Self Study Component, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Examination	
Credit definition: 1hour Lecture **(L)** per week = **1 Credit** 2 hours Tutorial **(T)** per week = **1 Credit** 2 hours Practical /Drawing (P) per week = **1 Credit**	(a) **Four-credit** courses are to be designed for **50** hours of Teaching-Learning process. (b) **Three credit** courses are to be designed for **40** hours of Teaching-Learning process. (c) **Two credit** courses are to be designed for **25** hours of Teaching-Learning process. (d) **One-credit** courses are to be designed for **15** hours of Teaching-Learning process.

AICTE Activity Points to be earned by students admitted to BE/B.Tech., /B.Plan day college programme (For more details refer to Chapter 6,AICTE Activity Point Programme, Model Internship Guidelines):

Over and above the academic grades, every Day College regular student admitted to the 4 years Degree programme and every student entering 4 years Degree programme through lateral entry, shall earn 100 and 75 Activity Points respectively for the award of degree through AICTE ActivityPoint Programme. Students transferred from other Universities to the fifth semester are required to earn 50 Activity Points from the year of entry toVTU. The Activity Points earned shall be reflected on the student's eighth semester Grade Card.

The activities can be spread over the years, anytime during the semester weekends and holidays, as per the liking and convenience of the student from the year of entry to the programme. However, the minimum hours' requirement should be fulfilled. Activity Points (non-credit) do not affect SGPA/CGPA and shall not be considered for vertical progression.

In case students fail to earn the prescribed activity Points, an Eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of the degree only after the release of the Eighth semester Grade Card.

Summer Internship - I (21INT36): All the students admitted to engineering programmes shall have to undergo a mandatory summer internship of **03 weeks** during the intervening vacation of II and III semesters. Summer Internship shall include Inter / Intra Institutional activities. A University Viva-voce examination (Presentation followed by question-answer session) shall be conducted during III semester and the prescribed credit shall be included in III semester. The internship shall be consideredas a head of passing and shall be considered for the award of degree. Those, who do not take up / complete the internship shall be declared fail and shall have to complete during subsequent University examination after satisfying the internship requirements. (The faculty coordinator or mentor has to monitor the students' internship progress and interact to guide them for the successful completion of the internship.)

Visvesvaraya Technological University, Belagavi

Scheme of Teaching and Examinations 2021

Outcome-Based Education(OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2021 – 22)

II Semester (For students who attended I semester under Physics Group) **[Common to all B.E./B.Tech Programs]**

Sl. No	Course and Course Code		Course Title	Teaching Department(TD) and Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self-Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	BSC	21MAT21	Advanced Calculus and Numerical Methods	TD and PSB: Mathematics	2	2	--		03	50	50	100	3
2	BSC	21CHE22	Engineering Chemistry	TD and PSB: Chemistry	2	2	--		03	50	50	100	3
3	ESC	21PSP23	Problem-Solving through Programming	TD and PSB: Computer Science and Engineering	2	2	--		03	50	50	100	3
4	ESC	21ELN24	Basic Electronics & Communication Engineering	TD: ECE/E and I/ TC PSB: ECE	2	2	--		03	50	50	100	3
5	ESC	21EME25	Elements of Mechanical Engineering	TD: ME, Auto, IP,IEM, Mfg . Engineering PSB: Mechanical Engg	2	--	2		03	50	50	100	3
6	BSC	21CHEL26	Engineering Chemistry Laboratory	TD and PSB: Chemistry	--	--	2		03	50	50	100	1
7	ESC	21CPL27	Computer Programming Laboratory	TD and PSB: Computer Science and Engineering	--	--	2		03	50	50	100	1
8	HSMC	21EGH28	Professional Writing Skills in English	TD and PSB: Humanities	1	1	1		02	50	50	100	2
9	AEC	21SFH19/29	Scientific Foundations of Health	Any Department	1	--	--		01	50	50	100	1
		OR											
		21IDT19/29	Innovation and Design Thinking										
				TOTAL	**13**	**09**	**07**		**24**	**450**	**450**	**900**	**20**

Note: BSC: Basic Science Course, **ESC**: Engineering Science Course, **HSMC**: Humanity and Social Science & Management Courses, **AEC** –Ability Enhancement Courses.

L –Lecture, **T** – Tutorial, **P**- Practical/ Drawing, **S** – Self Study Component, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Examination

Credit definition: 1hour Lecture **(L)** per week = **1 Credit** 2 hours Tutorial **(T)** per week = **1 Credit** 2 hours Practical /Drawing (P) per week = **1 Credit**	(a) **Four credit** courses are to be designed for **50** hours of Teaching – Learning process. (b) **Three credit** courses are to be designed for **40** hours of Teaching – Learning process. (c) **Two credit** courses are to be designed for **25** hours of Teaching – Learning process. (d) **One credit** courses are to be designed for **15** hours of Teaching – Learning process.

AICTE Activity Points to be earned by students admitted to BE/B.Tech.,/B.Plan day college programme (For more details refer to Chapter 6,AICTE Activity Point Programme, Model Internship Guidelines):

Over and above the academic grades, every Day College regular student admitted to the 4 years Degree programme and every student entering 4 years Degree programme through lateral entry, shall earn 100 and 75 Activity Points respectively for the award of degree through AICTE Activity Point Programme. Students transferred from other Universities to the fifth semester are required to earn 50 Activity Points from the year of entry to VTU. The Activity Points earned shall be reflected on the student's eighth semester Grade Card.

The activities can be can be spread over the years, anytime during the semester weekends and holidays, as per the liking and convenience of the student from the year of entry to the programme. However, the minimum hours' requirement should be fulfilled. Activity Points (non-credit) do not affect SGPA/CGPA and shall not be considered for vertical progression.

In case students fail to earn the prescribed activity Points, an Eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of the degree only after the release of the Eighth semester Grade Card.

Summer Internship - I (21INT36): All the students admitted to engineering programmes shall have to undergo a mandatory summer internship of 03 weeks during the intervening vacation of II and III semesters. Summer Internship shall include Inter / Intra Institutional activities. A University Viva-voce examination (Presentation followed by question-answer session) shall be conducted during III semester and the prescribed credit shall be included in III semester. The internship shall be consideredas a head of passing and shall be considered for the award of degree. Those, who do not take up / complete the internship shall be declared fail and shall have to complete during subsequent University examination after satisfying the internship requirements. (The faculty coordinator or mentor has to monitor the students' internship progress and interact to guide them for the successful completion of the internship.)

Visvesvaraya Technological University, Belagavi
Scheme of Teaching and Examinations 2021
Outcome-Based Education(OBE) and Choice Based Credit System (CBCS)
(Effective from the academic year 2021 – 22)

I Semester (Chemistry Group) **[Common to all B.E./B.Tech. Programmes]**

Sl. No	Course and Course Code		Course Title	Teaching Department (TD)and Paper Setting Board(PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self-Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	BSC	21MAT11	**Calculus & Differential Equations**	TD and PSB: Mathematics	2	2	--		03	50	50	100	3
2	BSC	21CHE12	Engineering Chemistry	TD and PSB: Chemistry	2	2	--		03	50	50	100	3
3	ESC	21PSP13	Problem-Solving through Programming	TD and PSB: Computer Science and Engineering	2	2	--		03	50	50	100	3
4	ESC	21ELN14	Basic Electronics & Communication Engineering	TD: ECE/E and I/ TC PSB: ECE	2	2	--		03	50	50	100	3
5	ESC	21EME15	Elements of Mechanical Engineering	TD: ME, Auto, IP,IEM, Mfg .Engineering PSB: Mechanical Engg	2	--	2		03	50	50	100	3
6	BSC	21CHEL16	Engineering Chemistry Laboratory	TD and PSB: Chemistry	--	--	2		03	50	50	100	1
7	ESC	21CPL17	Computer Programming Laboratory	TD and PSB: Computer Science and Engineering	--	--	2		03	50	50	100	1
8	HSMC	21EGH18	Communicative English	TD and PSB: Humanities	1	1	1		02	50	50	100	2
9	AEC	21IDT19/29	Innovation and Design Thinking	Any Engineering Department	1	--	--		01	50	50	100	1
		OR											
		21SFH19/29	Scientific Foundations of Health										
				TOTAL	**13**	**09**	**07**		**24**	**450**	**450**	**900**	**20**

Note: BSC: Basic Science Course, **ESC**: Engineering Science Course, **HSMC**: Humanity and Social Science & Management Courses, **AEC** –Ability Enhancement Courses.

L –Lecture**, T –** Tutorial, **P-** Practical/ Drawing, **S –** Self Study Component, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Examination	
Credit definition: 1hour Lecture **(L)** per week = **1 Credit** 2 hours Tutorial **(T)** per week = **1 Credit** 2 hours Practical /Drawing (P) per week = **1 Credit**	(a) **Four-credit** courses are to be designed for **50** hours of Teaching-Learning process. (b) **Three credit** courses are to be designed for **40** hours of Teaching-Learning process. (c) **Two credit** courses are to be designed for **25** hours of Teaching-Learning process. (d) **One-credit** courses are to be designed for **15** hours of Teaching-Learning process.

AICTE Activity Points to be earned by students admitted to BE/B.Tech., /B.Plan day college programme (For more details refer to Chapter 6,AICTE Activity Point Programme, Model Internship Guidelines):

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The activities can be spread over the years, anytime during the semester weekends and holidays, as per the liking and convenience of the student from the year of entry to the programme. However, the minimum hours' requirement should be fulfilled. Activity Points (non-credit) do not affect SGPA/CGPA and shall not be considered for vertical progression.

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Summer Internship - I (21INT36): All the students admitted to engineering programmes shall have to undergo a mandatory summer internship of **03 weeks** during the intervening vacation of II and III semesters. Summer Internship shall include Inter / Intra Institutional activities. A University Viva-voce examination (Presentation followed by question-answer session) shall be conducted during III semester and the prescribed credit shall be included in III semester. The internship shall be consideredas a head of passing and shall be considered for the award of degree. Those, who do not take up / complete the internship shall be declared fail and shall have to complete during subsequent University examination after satisfying the internship requirements. (The faculty coordinator or mentor has to monitor the students' internship progress and interact to guide them for the successful completion of the internship.)

Visvesvaraya Technological University, Belagavi

Scheme of Teaching and Examinations 2021

Outcome-Based Education(OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2021 – 22)

II Semester (For students who attended 1st semester under Chemistry Group) **[Common to all B.E./B.Tech Programs]**

Sl. No	Course and Course Code		Course Title	Teaching Department(TD) and Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self-Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	BSC	21MAT21	Advanced Calculus and Numerical Methods	TD and PSB: Mathematics	2	2	--		03	50	50	100	3
2	BSC	21PHY22	Engineering Physics	TD and PSB: Physics	2	2	--		03	50	50	100	3
3	ESC	21ELE23	Basic Electrical Engineering	TD and PSB: E and E Engineering	2	2	--	--	03	50	50	100	3
4	ESC	21CIV24	Elements of Civil Engineering and Mechanics	TD and PSB: Civil Engineering	3	--	--		03	50	50	100	3
5	ESC	21EVN 25	Engineering Visualization	TD: ME, Auto, IP,IEM, Mfg. Engineering PSB: Mechanical Engg	2	--	2		03	50	50	100	3
6	BSC	21PHYL26	Engineering Physics Laboratory	TD and PSB: Physics	--	--	2		03	50	50	100	1
7	ESC	21ELEL27	Basic Electrical Engineering Laboratory	TD and PSB: E and E Engineering	--	--	2		03	50	50	100	1
8	HSMC	21EGH28	Professional Writing Skills in English	TD and PSB: Humanities	1	1	1		02	50	50	100	2
9	AEC	21SFH19/29	Scientific Foundations of Health	Any Department	1	--	--		01	50	50	100	1
		OR											
		21IDT19/29	Innovation and Design Thinking										
				TOTAL	**13**	**07**	**07**		**24**	**450**	**450**	**900**	**20**

Note: BSC: Basic Science Course, **ESC**: Engineering Science Course, **HSMC**: Humanity and Social Science & Management Courses, **AEC** –Ability Enhancement Courses.

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AICTE Activity Points to be earned by students admitted to BE/B.Tech.,/B.Plan day college programme (For more details refer to Chapter 6,AICTE Activity Point Programme, Model Internship Guidelines):

Over and above the academic grades, every Day College regular student admitted to the 4 years Degree programme and every student entering 4 years Degree programme through lateral entry, shall earn 100 and 75 Activity Points respectively for the award of degree through AICTE Activity Point Programme. Students transferred from other Universities to the fifth semester are required to earn 50 Activity Points from the year of entry to VTU. The Activity Points earned shall be reflected on the student's eighth semester Grade Card.

The activities can be can be spread over the years, anytime during the semester weekends and holidays, as per the liking and convenience of the student from the year of entry to the programme. However, the minimum hours' requirement should be fulfilled. Activity Points (non-credit) do not affect SGPA/CGPA and shall not be considered for vertical progression.

In case students fail to earn the prescribed activity Points, an Eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of the degree only after the release of the Eighth semester Grade Card.

Summer Internship - I (21INT36): All the students admitted to engineering programmes shall have to undergo a mandatory summer internship of 03 weeks during the intervening vacation of II and III semesters. Summer Internship shall include Inter / Intra Institutional activities. A University Viva-voce examination (Presentation followed by question-answer session) shall be conducted during III semester and the prescribed credit shall be included in III semester. The internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take up / complete the internship shall be declared fail and shall have to complete during subsequent University examination after satisfying the internship requirements. (The faculty coordinator or mentor has to monitor the students' internship progress and interact to guide them for the successful completion of the internship.)

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

B.E. in Artificial Intelligence and Machine Learning

Scheme of Teaching and Examinations2021

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2021 - 22)

III SEMESTER

Sl. No	Course and Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week: Theory Lecture (L)	Tutorial (T)	Practical/ Drawing (P)	Self -Study (S)	Examination: Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
1	BSC 21MAT31	Transform Calculus, Fourier Series and Numerical Techniques	Maths	3	0	0		03	50	50	100	3
2	IPCC 21CS32	Data Structures and its Applications	Any CS Board Department	3	0	2		03	50	50	100	4
3	IPCC 21CS33	Analog and Digital Electronics		3	0	2		03	50	50	100	4
4	PCC 21CS34	Computer Organization and Architecture		3	0	0		03	50	50	100	3
5	PCC 21CSL35	Object Oriented Programming with JAVA Laboratory		0	0	2		03	50	50	100	1
6	UHV 21UH36	Social Connect and Responsibility	Any Department	0	0	1		01	50	50	100	1
7	HSMC 21KSK37/47	Samskrutika Kannada	TD and PSB: HSMC	1	0	0		01	50	50	100	1
	HSMC 21KBK37/47	Balake Kannada										
	OR											
	HSMC 21CIP37/47	Constitution of India and Professional Ethics										
8	AEC 21CS38X/21CSL38X	Ability Enhancement Course - III	TD: Concerned department PSB: Concerned Board	If offered as Theory Course					50	50	100	1
				1	0	0		01				
				If offered as lab. course								
				0	0	2		02				
								Total	**400**	**400**	**800**	**18**

Sl. No	Scheduled activities for III to VIII semesters	Course Code	Course Title	TD/PSB	Remarks
9	Scheduled activities for III to VIII semesters	NMDC 21NS83	National Service Scheme (NSS)	NSS	All students have to register for any one of the course namely National Service Scheme, Physical Education (PE)(Sports and Athletics) and Yoga with the concerned coordinator of the course during the first week of III semester. The activities shall be carried out from (for 5 semesters) between III semester to VIII semester. SEE in the above courses shall be conducted during VIII semester examinations and the accumulated CIE marks shall be added to the SEE marks. Successful completion of the registered course is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the colander prepared for the NSS, PE and Yoga activities.
		NMDC 21PE83	Physical Education (PE) (Sports and Athletics)	PE	
		NMDC 21YO83	Yoga	Yoga	

Course prescribed to lateral entry Diploma holders admitted to III semester B.E./B.Tech programs

Sl. No	Course and Course Code	Course Title	TD/PSB	L	T	P	S	Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
1	NCMC 21MATDIP31	Additional Mathematics - I	Maths	02	02	--	--	---	100	---	100	0

Note: BSC: Basic Science Course, **IPCC:** Integrated Professional Core Course, **PCC:** Professional Core Course, **INT** –Internship, **HSMC:** Humanity and Social Science & Management Courses, **AEC**–Ability Enhancement Courses. **UHV:** Universal Human Value Course.

L –Lecture, **T –** Tutorial, P- Practical/ Drawing, **S –** Self Study Component, **CIE:** Continuous Internal Evaluation, **SEE:** Semester End Examination. **TD-** Teaching Department, **PSB**: Paper Setting department

21KSK37/47 Samskrutika Kannada is for students who speak, read and write Kannada and **21KBK37/47** Balake Kannada is for non-Kannada speaking, reading, and writing students.

Integrated Professional Core Course (IPCC): Refers to Professional Theory Core Course Integrated with Practical's of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (BE/B.Tech.) 2021-22 may be referred.

21INT49 Inter/Intra Institutional Internship: All the students admitted to engineering programs under the lateral entry category shall have to undergo a mandatory 21INT49 Inter/Intra Institutional Internship of 03 weeks during the intervening period of III and IV semesters. The internship shall be slated for CIE only and will not have SEE. The letter grade earned through CIE shall be included in the IV semester grade card. The internship shall be considered as a head of passing and shall be considered for vertical progression and for the award of degree. Those, who do not take up / complete the internship shall be declared fail and shall have to complete during subsequently after satisfying the internship requirements. The faculty coordinator or mentor shall monitor the students' internship progress and interact with them for the successful completion of the internship.

Non–credit mandatory courses (NCMC):
(A) Additional Mathematics I and II:
(1) These courses are prescribed for III and IV semesters respectively to lateral entry Diploma holders admitted to III semester of B.E./B.Tech., programs. They shall attend the classes during the respective semesters to complete all the formalities of the course and appear for the Continuous Internal Evaluation (CIE). In case, any student fails to register for the said course/fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have secured an F grade. In such a case, the student has to fulfill the course requirements during subsequent semester/s to earn the qualifying CIE marks. These courses are slated for CIE only and has no SEE.
(2) Additional Mathematics I and II shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses shall be mandatory for the award of degree.
(3) Successful completion of the courses Additional Mathematics I and II shall be indicated as satisfactory in the grade card. Non-completion of the courses Additional Mathematics I and II shall be indicated as Unsatisfactory.
(B) National Service Scheme/Physical Education (Sport and Athletics)/ Yoga:
(1) Securing 40 % or more in CIE,35 % or more marks in SEE and 40 % or more in the sum total of CIE + SEE leads to successful completion of the registered course.
(2) In case, students fail to secure 35 % marks in SEE, they have to appear for SEE during the subsequent examinations conducted by the University.
(3) In case, any student fails to register for NSS, PE or Yoga/fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have not completed the requirements of the course. In such a case, the student has to fulfill the course requirements during subsequent semester/s to earn the qualifying CIE marks.
(4) Successful completion of the course shall be indicated as satisfactory in the grade card. Non-completion of the course shall be indicated as Unsatisfactory.
(5) These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses shall be mandatory for the award of degree.

Ability Enhancement Course - III			
21CSL381	Mastering Office	21CS383	
21CS382	Programming in C++	21CS384	

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

B.E. in Artificial Intelligence and Machine Learning

Scheme of Teaching and Examinations 2021

Outcome-Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2021 - 22)

IV SEMESTER

Sl. No	Course and Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week: Theory Lecture (L)	Tutorial (T)	Practical/ Drawing (P)	Self -Study (S)	Examination: Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
1	BSC 21CS41	Mathematical Foundations for Computing	Maths	2	2	0		03	50	50	100	3
2	IPCC 21CS42	Design and Analysis of Algorithms	Any CS Board Department	3	0	2		03	50	50	100	4
3	IPCC 21CS43	Microcontroller and Embedded Systems		3	0	2		03	50	50	100	4
4	PCC 21CS44	Operating Systems		2	2	0		03	50	50	100	3
5	AEC 21BE45	Biology For Engineers	BT, CHE, PHY	2	0	0		02	50	50	100	2
6	PCC 21CSL46	Python Programming Laboratory	Any CS Board Department	0	0	2		03	50	50	100	1
7	HSMC 21KSK37/47	Samskrutika Kannada	HSMC	1	0	0		01	50	50	100	1
	HSMC 21KBK37/47	Balake Kannada										
	OR											
	HSMC 21CIP37/47	Constitution of India & Professional Ethics										
8	AEC 21CS48X/21CSL48X	Ability Enhancement Course- IV	TD and PSB: Concerned department	If offered as theory Course				01	50	50	100	1
				1	0	0						
				If offered as lab. course				02				
				0	0	2						
9	UHV 21UH49	Universal Human Values	Any Department	1	0	0		01	50	50	100	1
10	INT 21INT49	Inter/Intra Institutional Internship	Evaluation By the appropriate authorities	Completed during the intervening period of II and III semesters by students admitted to first year of BE./B.Tech and during the intervening period of III and IV semesters by Lateral entry students admitted to III semester.				3	100	--	100	2
								Total	550	450	1000	22

Course prescribed to lateral entry Diploma holders admitted to III semester of Engineering programs

Sl. No	Course and Course Code	Course Title	TD/PSB	L	T	P	S	Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
1	NCMC 21MATDIP41	Additional Mathematics - II	Maths	02	02	--	--	--	100	--	100	0

Note: BSC: Basic Science Course, IPCC: Integrated Professional Core Course, PCC: Professional Core Course, AEC –Ability Enhancement Courses, HSMC: Humanity and Social Science and Management Courses, UHV- Universal Human Value Courses.
L –Lecture, T – Tutorial, P- Practical/ Drawing, S – Self Study Component, CIE: Continuous Internal Evaluation, SEE: Semester End Examination.

21KSK37/47 Samskrutika Kannada is for students who speak, read and write Kannada and 21KBK37/47 Balake Kannada is for non-Kannada speaking, reading, and writing students.

Integrated Professional Core Course (IPCC): Refers to Professional Theory Core Course Integrated with Practical's of the same course. Credit for IPCC can be 04 and its Teaching – Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from practical part of IPCC shall be included in the SEE question paper. For more details the regulation governing the Degree of Bachelor of Engineering /Technology (BE/B.Tech.) 2021-22 may be referred.

Non – credit mandatory course (NCMC):
Additional Mathematics - II:
(1) Lateral entry Diploma holders admitted to III semester of B.E./B.Tech., shall attend the classes during the IV semester to complete all the formalities of the course and appear for the Continuous Internal Evaluation (CIE). In case, any student fails to register for the said course/fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have secured an F grade. In such a case, the student has to fulfil the course requirements during subsequent semester/s to earn the qualifying CIE marks. These courses are slated for CIE only and has no SEE.
(2) Additional Mathematics I and II shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses shall be mandatory for the award of degree.
(3) Successful completion of the course Additional Mathematics II shall be indicated as satisfactory in the grade card. Non-completion of the courses Additional Mathematics II shall be indicated as Unsatisfactory.

Ability Enhancement Course - IV

21CSL481	Web Programming	21CSL483	R Programming
21CS482	Unix Shell Programming	21CS484	

Internship of 04 weeks during the intervening period of IV and V semesters; 21INT68 Innovation/ Entrepreneurship/ Societal based Internship.
(1) All the students shall have to undergo a mandatory internship of 04 weeks during the intervening period of IV and V semesters. The internship shall be slated for CIE only and will not have SEE. The letter grade earned through CIE shall be included in the VI semester grade card. The internship shall be considered as a head of passing and shall be considered for vertical progression and for the award of degree. Those, who do not take up / complete the internship shall be considered under F (fail) grade and shall have to complete during subsequently after satisfying the internship requirements.
(2) Innovation/ Entrepreneurship Internship shall be carried out at industry, State and Central Government /Non-government organizations (NGOs), micro, small and medium enterprise (MSME), Innovation centers or Incubation centers. Innovation need not be a single major breakthrough; it can also be a series of small or incremental changes. Innovation of any kind can also happen outside of the business world.
Entrepreneurship internships offers a chance to gain hands on experience in the world of entrepreneurship and helps to learn what it takes to run a small entrepreneurial business by performing intern duties with an established company. This experience can then be applied to future business endeavours. Start-ups and small companies are a preferred place to learn the business tack ticks for future entrepreneurs as learning how a small business operates will serve the intern well when he/she manages his/her own company. Entrepreneurship acts as a catalyst to open the minds to creativity and innovation. Entrepreneurship internship can be from several sectors, including technology, small and medium-sized, and the service sector.
(3) Societal or social internship.
Urbanization is increasing on a global scale; and yet, half the world's population still resides in rural areas and is devoid of many things that urban population enjoy. Rural internship, is a work-based activity in which students will have a chance to solve/reduce the problems of the rural place for better living.
As proposed under the AICTE rural internship programme, activities under Societal or social internship, particularly in rural areas, shall be considered for 40 points under AICTE activity point programme.

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V SEMESTER

Sl. No	Course and Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
				Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
				L	T	P	S					
1	BSC 21CS51	Automata Theory and compiler Design	Any CS Board Department	3	0	0		03	50	50	100	3
2	IPCC 21CS52	Computer Networks		3	0	2		03	50	50	100	4
3	PCC 21CS53	Database Management Systems		3	0	0		03	50	50	100	3
4	PCC 21AI54	Principles of Artificial Intelligence		3	0	0		03	50	50	100	3
5	PCC 21CSL55	Database Management Systems Laboratory with Mini Project		0	0	2		03	50	50	100	1
6	AEC 21XX56	Research Methodology & Intellectual Property Rights	TD: Any Department PSB: As identified by university	2	0	0		02	50	50	100	2
7	HSMC 21CIV57	Environmental Studies	TD: Civil/ Environmental /Chemistry/ Biotech. PSB: Civil Engg	1	0	0		1	50	50	100	1
8	AEC 21CS58X/21 CSL58X	Ability Enhancement Course-V	Concerned Board	If offered as Theory courses				01	50	50	100	1
				1	0	0						
				If offered as lab. courses				02				
				0	0	2						
								Total	**400**	**400**	**800**	**18**

Ability Enhancement Course - IV

21CSL581	Angular JS and Node JS	21CS583	
21CS582	C# and .Net Framework	21CS584	

Note: BSC: Basic Science Course, PCC: Professional Core Course, IPCC: Integrated Professional Core Course, AEC –Ability Enhancement Course INT – Internship, HSMC: Humanity and Social Science & Management Courses.
L –Lecture, T – Tutorial, P- Practical/ Drawing, S – Self Study Component, CIE: Continuous Internal Evaluation, SEE: Semester End Examination.

Integrated Professional Core Course (IPCC): refers to Professional Theory Core Course Integrated with Practical of the same course. Credit for IPCC can be 04 and its Teaching – Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). Theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by CIE only and there shall be no SEE. For more details the regulation governing the Degree of Bachelor of Engineering /Technology (BE/B.Tech.) 2021-22 may be referred.

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VI SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	HSMC	21CS61	Software Engineering and Project Management	Any CS Board Department	2	2	0		03	50	50	100	3
2	IPCC	21AD62	Data Science and its Applications	Any CS Board Department	3	0	2		03	50	50	100	4
3	PCC	21AI63	Machine Learning	Any CS Board Department	3	0	0		03	50	50	100	3
4	PEC	21XX64x	Professional Elective Course-I	Any CS Board Department	3	0	0		03	50	50	100	3
5	OEC	21XX65x	Open Elective Course-I	Concerned Department	3	0	0		03	50	50	100	3
6	PCC	21AIL66	Machine Learning Laboratory	Any CS Board Department	0	0	2		03	50	50	100	1
7	MP	21AIMP67	Mini Project		Two contact hours /week for interaction between the faculty and students.				--	100	--	100	2
8	INT	21INT68	Innovation/Entrepreneurship /Societal Internship	Completed during the intervening period of IV and V semesters.					--	100	--	100	3
									Total	**500**	**300**	**800**	**22**

Professional Elective - I

21AI641	Business Intelligence	21AI643	Natural Language Processing
21CS642	Advanced JAVA Programming	21AI644	Computer Graphics and Fundamentals of Image Processing

Open Electives – I offered by the Department to other Department students

21CS651	Introduction to Data Structures	21CS653	Introduction to Cyber Security
21CS652	Introduction to Database Management Systems	21CS654	Programming in JAVA

Note: HSMC: Humanity and Social Science & Management Courses, **IPCC:** Integrated Professional Core Course, **PCC:** Professional Core Course, **PEC:** Professional Elective Courses, OEC–Open Elective Course, **MP** –Mini Project, INT –Internship.
L –Lecture, T – Tutorial, P - Practical / Drawing, S – Self Study Component, CIE: Continuous Internal Evaluation, SEE: Semester End Examination.

Integrated Professional Core Course (IPCC): Refers to Professional Theory Core Course Integrated with Practical of the same course. Credit for IPCC can be 04 and its Teaching – Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by CIE only and there shall be no SEE. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (BE/B.Tech) 2021-22 may be referred.

Professional Elective Courses (PEC):
A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an option to select one course out of five courses. The minimum students' strength for offering professional electives is 10. However, this conditional shall not be applicable to cases where the admission to the programme is less than 10.

Open Elective Courses:
Students belonging to a particular stream of Engineering and Technology are not entitled for the open electives offered by their parent Department. However, they can opt an elective offered by other Departments, provided they satisfy the prerequisite condition if any. Registration to open electives shall be documented under the guidance of the Program Coordinator/ Advisor/Mentor.
Selection of an open elective shall **not be allowed** if,

- **(i)** The candidate has studied the same course during the previous semesters of the program.
- **(ii)** The syllabus content of open electives is similar to that of the Departmental core courses or professional electives.
- **(iii)** A similar course, under any category, is prescribed in the higher semesters of the program.

In case, any college is desirous of offering a course (not included in the Open Elective List of the University) from streams such as Law, Business (MBA), Medicine, Arts, Commerce, etc., can seek permission, at least one month before the commencement of the semester, from the University by

submitting a copy of the syllabus along with the details of expertise available to teach the same in the college.
The minimum students' strength for offering open electives is 10. However, this conditional shall not be applicable to cases where the admission to the programme is less than 10.

Mini-project work: Mini Project is a laboratory-oriented course which will provide a platform to students to enhance their practical knowledge and skills by the development of small systems/applications.
Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary Mini- project can be assigned to an individual student or to a group having not more than 4 students.

CIE procedure for Mini-project:

(i) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two faculty members of the Department, one of them being the Guide. The CIE marks awarded for the Mini-project work shall be based on the evaluation of project report, project presentation skill, and question and answer session in the ratio of 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

(ii) Interdisciplinary: Continuous Internal Evaluation shall be group-wise at the college level with the participation of all the guides of the project.
The CIE marks awarded for the Mini-project, shall be based on the evaluation of project report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

No SEE component for Mini-Project.

VII semester Classwork and Research Internship /Industry Internship (21INT82)

Swapping Facility

Institutions can swap VII and VIII Semester Scheme of Teaching and Examinations to accommodate research internship/ industry internship after the VI semester**.**

(2) Credits earned for the courses of VII and VIII Semester Scheme of Teaching and Examinations shall be counted against the corresponding semesters whether VII or VIII semester is completed during the beginning of IV year or later part of IV year of the program.

Elucidation:

At the beginning of IV year of the programme i.e., after VI semester, VII semester classwork and VIII semester Research Internship /Industrial Internship shall be permitted to be operated simultaneously by the University so that students have ample opportunity for internship. In other words, a good percentage of the class shall attend VII semester classwork and similar percentage of others shall attend to Research Internship or Industrial Internship.
Research/Industrial Internship shall be carried out at an Industry, NGO, MSME, Innovation centre, Incubation centre, Start-up, Centers of Excellence (CoE), Study Centre established in the parent institute and /or at reputed research organizations / institutes. The internship can also be rural internship.
The mandatory Research internship /Industry internship is for 24 weeks. The internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take up/complete the internship shall be declared fail and shall have to complete during the subsequent University examination after satisfying the internship requirements.

INT21INT82 Research Internship/ Industry Internship/Rural Internship

Research internship: A research internship is intended to offer the flavour of current research going on in the research field. It helps students get familiarized with the field and imparts the skill required for carrying out research.

Industry internship: Is an extended period of work experience undertaken by students to supplement their degree for professional development. It also helps them learn to overcome unexpected obstacles and successfully navigate organizations, perspectives, and cultures. Dealing with contingencies helps students recognize, appreciate, and adapt to organizational realities by tempering their knowledge with practical constraints.

Rural internship: A long-term goal, as proposed under the AICTE rural internship programme, shall be counted as rural internship activity.
The student can take up Interdisciplinary Research Internship or Industry Internship.
The faculty coordinator or mentor has to monitor the students' internship progress and interact with them to guide for the successful completion of the internship.
The students are permitted to carry out the internship anywhere in India or abroad. University shall not bear any expenses incurred in respect of internship.

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Swappable VII and VIII SEMESTER

VII SEMESTER

Sl. No	Course and Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week: Theory Lecture (L)	Tutorial (T)	Practical/ Drawing (P)	Self -Study (S)	Examination: Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
1	PCC 21AI71	Advanced AI and ML	Any CS Board Department	3	0	0		3	50	50	100	3
2	PCC 21CS72	Cloud Computing		2	0	0		3	50	50	100	2
3	PEC 21XX73X	Professional elective Course-II		3	0	0		3	50	50	100	3
4	PEC 21XX74X	Professional elective Course-III		3	0	0		3	50	50	100	3
5	OEC 21XX75X	Open elective Course-II	Concerned Department	3	0	0		3	50	50	100	3
6	Project 21AIP76	Project work		Two contact hours /week for interaction between the faculty and students.				3	100	100	200	10
								Total	**350**	**350**	**700**	**24**

VIII SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department	Teaching Hours /Week: Theory Lecture (L)	Tutorial (T)	Practical/ Drawing (P)	Self -Study (S)	Examination: Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
1	Seminar 21AI81		Technical Seminar		One contact hour /week for interaction between the faculty and students.				--	100	--	100	01
2	INT 21INT82		Research Internship/ Industry Internship		Two contact hours /week for interaction between the faculty and students.				03 (Batch wise)	100	100	200	15
3	NCMC	21NS83	National Service Scheme (NSS)	NSS	Completed during the intervening period of III semester to VIII semester.				--	50	50	100	0
		21PE83	Physical Education (PE) (Sports and Athletics)	PE									
		21YO83	Yoga	Yoga									
									Total	**250**	**150**	**400**	**16**

Professional Elective - II

21AI731	Social Network Analysis	21CS734	Blockchain Technology
21CS732	Digital Image Processing	21CS735	Internet of Things
21AI733	Fullstack Development		

Professional Elective - III

21AI741	Augmented Reality	21CS744	Robotic Process Automation Design and Development
21CS742	Multiagent Systems	21CS745	NoSQL Data Base
21AI743	Predictive Analytics		

Open Electives - II offered by the Department to other Department students			
21CS751	Programming in Python	21CS754	Introduction to Data Science
21CS752	Introduction to AI and ML	21CS755	
21CS753	Introduction to Big Data		

Note: PCC: Professional Core Course, **PEC:** Professional Elective Courses, **OEC**–Open Elective Course, **AEC** –Ability Enhancement Courses.
L –Lecture, T – Tutorial, P- Practical / Drawing, S – Self Study Component, CIE: Continuous Internal Evaluation, SEE: Semester End Examination.

Note: VII and VIII semesters of IV year of the programme

(1) Institutions can swap VII and VIII Semester Scheme of Teaching and Examinations to accommodate research internship/ industry internship after the VI semester**.**

(2) Credits earned for the courses of VII and VIII Semester Scheme of Teaching and Examinations shall be counted against the corresponding semesters whether VII or VIII semester is completed during the beginning of IV year or later part of IV year of the programme.

PROJECT WORK (21XXP76): The objective of the Project work is

(i) To encourage independent learning and the innovative attitude of the students.
(ii) To develop interactive attitude, communication skills, organization, time management, and presentation skills.
(iii) To impart flexibility and adaptability.
(iv) To inspire team working.
(v) To expand intellectual capacity, credibility, judgment and intuition.
(vi) To adhere to punctuality, setting and meeting deadlines.
(vii) To instil responsibilities to oneself and others.
(viii) To train students to present the topic of project work in a seminar without any fear, face the audience confidently, enhance communication skills, involve in group discussion to present and exchange ideas.

CIE procedure for Project Work:

(1) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide.

The CIE marks awarded for the project work, shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

(2) Interdisciplinary: Continuous Internal Evaluation shall be group-wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable. The CIE marks awarded for the project work, shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

SEE procedure for Project Work: SEE for project work will be conducted by the two examiners appointed by the University. The SEE marks awarded for the project work, shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25.

TECHNICAL SEMINAR (21XXS81): The objective of the seminar is to inculcate self-learning, present the seminar topic confidently, enhance communication skill, involve in group discussion for exchange of ideas. Each student, under the guidance of a Faculty, shall choose, preferably, a recent topic of his/her interest relevant to the programme of Specialization.

(i) Carry out literature survey, systematically organize the content.
(ii) Prepare the report with own sentences, avoiding a cut and paste act.
(iii) Type the matter to acquaint with the use of Micro-soft equation and drawing tools or any such facilities.
(iv) Present the seminar topic orally and/or through PowerPoint slides.
(v) Answer the queries and involve in debate/discussion.
(**vi)** Submit a typed report with a list of references.

The participants shall take part in the discussion to foster a friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident.

Evaluation Procedure:

The CIE marks for the seminar shall be awarded (based on the relevance of the topic, presentation skill, participation in the question and answer session, and quality of report) by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three teachers from the department with the senior-most acting as the Chairman.

Marks distribution for CIE of the course:

Seminar Report:50 marks
Presentation skill:25 marks
Question and Answer: 25 marks. ■ No SEE component for Technical Seminar

Non – credit mandatory courses (NCMC):

National Service Scheme/Physical Education (Sport and Athletics)/ Yoga:

(1) Securing 40 % or more in CIE,35 % or more marks in SEE and 40 % or more in the sum total of CIE + SEE leads to successful completion of the registered course.

(2) In case, students fail to secure 35 % marks in SEE, they has to appear for SEE during the subsequent examinations conducted by the University.

(3) In case, any student fails to register for NSS, PE or Yoga/fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have not completed the requirements of the course. In such a case, the student has to fulfill the course requirements during subsequently to earn the qualifying CIE marks subject to the maximum programme period.

(4) Successful completion of the course shall be indicated as satisfactory in the grade card. Non-completion of the course shall be indicated as Unsatisfactory.

(5) These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses shall be mandatory for the award of degree.

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III SEMESTER

Sl. No	Course and Course Code	Course title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
				Theory Lecture L	Tutorial T	Practical/ Drawing P	Self -Study S	Duration in hours	CIE Marks	SEE Marks	Total Marks	
1	BSC 21MAT31	Mathematics course (common to all)	TD- Maths PSB-Maths	2	2	0	0	03	50	50	100	3
2	IPCC 21BT32	Unit operations + lab	TD: BT PSB: BT	3	1	2	0	03	50	50	100	4
3	IPCC 21BT33	Biochemistry + lab	TD: BT PSB: BT	3	0	2	0	03	50	50	100	4
4	PCC 21BT34	Microbiology	TD: BT PSB: BT	2	2	0	0	03	50	50	100	3
5	PCC 21BTL35	Microbiology lab	TD: BT PSB: BT	0	0	2	0	03	50	50	100	1
6	UHV 21UH36	Social Connect and Responsibility	Any Department	0	0	2	0	01	50	50	100	1
7	HSMC 21KSK37/47	Samskrutika kannada	TD and PSB HSMC	1	0	0	0	01	50	50	100	1
	HSMC 21KBK37/47	Balake kannada										
	OR											
	HSMC 21CIP37/47	Constitution of India and Professional Ethics										
8	AEC21BT38X	Ability Enhancement Course - III	TD: BT PSB: BT	If offered as Theory Course				01	50	50	100	1
				1	0	0	1					
				If offered as lab. course				02				
				0	0	2	0					
								Total	**400**	**400**	**800**	**18**

Sl. No		Course Code	Course title		
9	**Scheduled activities for III to VIII semesters**	NMDC 21NS83	National Service Scheme (NSS)	NSS	All students have to register for any one of the course namely National Service Scheme, Physical Education (PE)(Sports and Athletics) and Yoga with the concerned coordinator of the course during the first week of III semester. The activities shall be carried out between III semester to VIII semester (for 5 semesters). SEE in the above courses shall be conducted during VIII semester examinations and the accumulated CIE marks shall be added to the SEE marks. Successful completion of the registered course is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE and Yoga activities.
		NMDC 21PE83	Physical Education (PE)(Sports and Athletics)	PE	
		NMDC 21YO83	Yoga	YOGA	

Course prescribed to lateral entry Diploma holders admitted to III semester B.E./B.Tech programs

Sl. No	Course Code	Course title	TD	L	T	P	S	Duration	CIE	SEE	Total	Credits
1	NCMC 21MATDIP31	Additional Mathematics - I	Maths	02	02	--	--	---	100	---	100	0

Note: BSC: Basic Science Course, **IPCC:** Integrated Professional Core Course, **PCC:** Professional Core Course, **INT** –Internship, **HSMC:** Humanity and Social Science & Management Courses, **AEC**–Ability Enhancement Courses. **UHV:** Universal Human Value Course.
L –Lecture, **T –** Tutorial, P- Practical/ Drawing, **S –** Self Study Component, **CIE:** Continuous Internal Evaluation, **SEE:** Semester End Examination.**TD-** Teaching Department, **PSB**: Paper Setting department

21KSK37/47 Samskrutika Kannada is for students who speak, read and write Kannada and **21KBK37/47** Balake Kannada is for non-Kannada speaking, reading, and writing students.

Integrated Professional Core Course (IPCC): Refers to Professional Theory Core Course Integrated with practical of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (B.E./B.Tech.) 2021-22 may be referred.

21INT49Inter/Intra Institutional Internship: All the students admitted to engineering programs under the lateral entry category shall have to undergo a mandatory 21INT49 Inter/Intra Institutional Internship of 03 weeks during the intervening period of III and IV semesters. The internship shall be slated for CIE only and will not have SEE. The letter grade earned through CIE shall be included in the IV semester grade card.The internship shall be considered as a head of passing and shall be considered for vertical progression and for the award of degree. Those, who do not take up / complete the internship shall be declared fail and shall have to complete during subsequently after satisfying the internship requirements. The faculty coordinator or mentor shall monitor the students' internship progress and interact with them for the successful completion of the internship.

Non–credit mandatory courses (NCMC):
(A)Additional Mathematics I and II:
(1) These courses are prescribed for III and IV semesters respectively to lateral entry Diploma holders admitted to III semester of B.E./B.Tech., programs. They shall attend the classes during the respective semesters to complete all the formalities of the course and appear for the Continuous Internal Evaluation (CIE). In case, any student fails to register for the said course/fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have secured an F grade. In such a case, the student has to fulfill the course requirements during subsequent semester/s to earn the qualifying CIE marks. These courses are slated for CIE only and have no SEE.
(2) Additional Mathematics I and II shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses shall be mandatory for the award of degree.
(3) Successful completion of the courses Additional Mathematics I and II shall be indicated as satisfactory in the grade card. Non-completion of the courses Additional Mathematics I and II shall be indicated as Unsatisfactory.
(B) National Service Scheme/Physical Education (Sport and Athletics)/ Yoga:
(1) Securing 40 % or more in CIE,35 % or more marks in SEE and 40 % or more in the sum total of CIE + SEE leads to successful completion of the registered course.
(2) In case, students fail to secure 35 % marks in SEE, they has to appear for SEE during the subsequent examinations conducted by the University.
(3) In case, any student fails to register for NSS, PE or Yoga/fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have not completed the requirements of the course. In such a case, the student has to fulfill the course requirements during subsequent semester/s to earn the qualifying CIE marks.
(4) Successful completion of the course shall be indicated as satisfactory in the grade card. Non-completion of the course shall be indicated as Unsatisfactory.
(5) These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses shall be mandatory for the award of degree.

ABILITY ENHANCEMENT COURSE – III			
21BT381	Data presentation, Error Analysis and Inferences	21BT383	Biodiversity and Conservation Law
21BT382	Bio-Lab Management and Risk Assessment	21BT384	Linux programming for Biologists

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IV SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	BSC	21BT41	Biostatistics and Design of experiments	TD, PSB- Maths	3	0	0	0	03	50	50	100	3
2	IPCC	21BT42	Python programming + lab	TD: BT PSB: BT	3	0	2	0	03	50	50	100	4
3	IPCC	21BT43	Cell biology &Cell culture techniques + lab	TD: BT PSB: BT	3	0	2	0	03	50	50	100	4
4	PCC	21BT44	Molecular biology &Genetic engineering	TD: BT PSB: BT	2	2	0	0	03	50	50	100	3
5	AEC	21BE45	Biology for engineers	BT, CHE, PHY	1	2	0	0	02	50	50	100	2
6	PCC	21BTL46	Molecular biology &Genetic engineering lab	TD: BT PSB: BT	0	0	2	0	03	50	50	100	1
7	HSMC	21KSK37/47	Samskrutika Kannada	HSMC	1	0	0	0	01	50	50	100	1
	HSMC	21KBK37/47	Balake Kannada										
	OR												
	HSMC	21CIP37/47	Constitution of India & Professional Ethics										
8	AEC21BT48X		Ability Enhancement Course- IV	TD: BT PSB: BT	If offered as theory Course				01	50	50	100	1
					1	0	0	1					
					If offered as lab. course				02				
					0	0	2	0					
9	UHV21UH49		Universal Human Values	Any Department	1	0	0	0	01	50	50	100	1
10	INT21INT49		Inter/Intra Institutional Internship	Evaluation By the appropriate authorities	Completed during the intervening period of II and III semesters by students admitted to first year of BE./B.Tech and during the intervening period of III and IV semesters by Lateral entry students admitted to III semester.				3	100	--	100	2
									Total	**550**	**450**	**1000**	**22**
	Course prescribed to lateral entry Diploma holders admitted to III semester of Engineering programs												
1	NCMC	21MATDIP41	Additional Mathematics - II	Maths	02	02	--	--	--	100	--	100	0

Note: BSC: Basic Science Course, IPCC: Integrated Professional Core Course, PCC: Professional Core Course, AEC –Ability Enhancement Courses, HSMC: Humanity and Social Science and Management Courses, UHV- Universal Human Value Courses.
L –Lecture, T – Tutorial, P- Practical/ Drawing, S – Self Study Component, CIE: Continuous Internal Evaluation, SEE: Semester End Examination.

21KSK37/47 Samskrutika Kannada is for students who speak, read and write Kannada and 21KBK37/47 Balake Kannada is for non-Kannada speaking, reading, and writing students.

Integrated Professional Core Course (IPCC): Refers to Professional Theory Core Course Integrated with Practicals of the same course. Credit for IPCC can be 04 and its Teaching – Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from practical part of IPCC shall be included in the SEE question paper. For more details the regulation governing the Degree of Bachelor of Engineering /Technology (BE/B.Tech.) 2021-22 may be referred.

Non – credit mandatory course (NCMC):
Additional Mathematics - II:
(1) Lateral entry Diploma holders admitted to III semester of B.E./B.Tech., shall attend the classes during the IV semester to complete all the formalities of the course and appear for the Continuous Internal Evaluation (CIE). In case, any student fails to register for the said course/fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have secured an F grade. In such a case, the student has to fulfill the course requirements during subsequent semester/s to earn the qualifying CIE marks. These courses are slated for CIE only and have no SEE.

(2) Additional Mathematics I and II shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses shall be mandatory for the award of degree.
(3) Successful completion of the course Additional Mathematics II shall be indicated as satisfactory in the grade card. Non-completion of the courses Additional Mathematics II shall be indicated as Unsatisfactory.

Ability Enhancement Course – IV			
21BT481	Hydroponics, Aquaponics and Aeroponics	21BT483	Biopesticides and Biofertilizers
21BT482	Quality Control and Quality Assurance	21BT484	R Programming for Biologists

Internship of 04 weeks during the intervening period of IV and V semesters; 21INT68Innovation/ Entrepreneurship/ Societal based Internship.
(1) All the students shall have to undergo a mandatory internship of 04 weeks during the intervening period of IV and V semesters. The internship shall be slated for CIE only and will not have SEE. The letter grade earned through CIE shall be included in the VI semester grade card. The internship shall be considered as a head of passing and shall be considered for vertical progression and for the award of degree. Those, who do not take up / complete the internship shall be considered under F (fail) grade and shall have to complete during subsequently after satisfying the internship requirements.
(2) Innovation/ Entrepreneurship Internship shall be carried out at industry, State and Central Government /Non-government organizations (NGOs), micro, small and medium enterprise (MSME), Innovation centres or Incubation centres. Innovation need not be a single major breakthrough; it can also be a series of small or incremental changes. Innovation of any kind can also happen outside of the business world.
Entrepreneurship internships offers a chance to gain hands on experience in the world of entrepreneurship and helps to learn what it takes to run a small entrepreneurial business by performing intern duties with an established company. This experience can then be applied to future business endeavours. Start-ups and small companies are a preferred place to learn the business tactics for future entrepreneurs as learning how a small business operates will serve the intern well when he/she manages his/her own company. Entrepreneurship acts as a catalyst to open the minds to creativity and innovation. Entrepreneurship internship can be from several sectors, including technology, small and medium-sized, and the service sector.
(3) Societal or social internship.
Urbanization is increasing on a global scale; and yet, half the world's population still resides in rural areas and is devoid of many things that urban population enjoy. Rural internship is a work-based activity in which students will have a chance to solve/reduce the problems of the rural place for better living.
As proposed under the AICTE rural internship programme, activities under Societal or social internship, particularly in rural areas, shall be considered for 40 points under AICTE activity point programme.

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V SEMESTER

Sl. No	Course and Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
				Theory Lecture	Tutorial	Practical / Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
				L	T	P	S					
1	PCC21BT51	Biokinetics &Bioreaction engineering	TD: BT PSB: BT	2	2	0	0	03	50	50	100	3
2	IPCC21BT52	Immunotechnology+lab	TD: BT PSB: BT	3	0	2	0	03	50	50	100	4
3	PCC21BT53	Structural biology &Analytical techniques	TD: BT PSB: BT	2	2	0	0	03	50	50	100	3
4	PCC21BT54	Genomics, Proteomics &Bioinformatics	TD: BT PSB: BT	3	0	0	0	03	50	50	100	3
5	PCC21BTL55	Bioinformatics lab	TD: BT PSB: BT	0	0	2	0	03	50	50	100	1
6	AEC21BT56	Research methodology & Intellectual property rights	TD: Any Department PSB: As identified by University	2	0	0	0	02	50	50	100	2
7	HSMC21CIV57	Environmental Studies	TD: Civil/ Environmental /Chemistry/ Biotech. PSB: Civil Engg	1	0	0	0	1	50	50	100	1
8	AEC21BT58X	Ability Enhancement Course-V	TD: BT PSB: BT	If offered as Theory courses				01	50	50	100	1
				1	0	0	1					
				If offered as lab. courses				02				
				0	0	2	0					
								Total	**400**	**400**	**800**	**18**

Ability Enhancement Course - V

21BT581	Bio-Innovation and Start-ups	21BT583	Modelling and Simulations in Biology
21BT582	Extraction Methods and Herbal products	21BT584	Good Manufacturing and Laboratory Practices

Note: BSC: Basic Science Course, PCC: Professional Core Course, IPCC: Integrated Professional Core Course, AEC –Ability Enhancement Course INT – Internship, HSMC: Humanity and Social Science & Management Courses.
L –Lecture, T – Tutorial, P- Practical/ Drawing, S – Self Study Component, CIE: Continuous Internal Evaluation, SEE: Semester End Examination.

Integrated Professional Core Course (IPCC): refers to Professional Theory Core Course Integrated with Practical of the same course. Credit for IPCC can be 04 and its Teaching – Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). Theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by CIE only and there shall be no SEE. For more details the regulation governing the Degree of Bachelor of Engineering /Technology (BE/B.Tech.) 2021-22 may be referred.

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VI SEMESTER

Sl. No	Course and Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
				Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
				L	T	P	S					
1	HSMC21BT61	Biobusiness Management and Entrepreneurship	Any Department	3	0	0	1	03	50	50	100	3
2	IPCC21BT62	Bioprocess Principles, Control &Automation + Lab	TD: BT PSB: BT	3	0	2	0	03	50	50	100	4
3	PCC21BT63	Enzyme Technology	TD: BT PSB: BT	3	0	0	0	03	50	50	100	3
4	PEC21BT64x	Professional elective course-I	TD: BT PSB: BT	3	0	0	1	03	50	50	100	3
5	OEC21BT65x	Open elective course-I	TD: BT PSB: BT	3	0	0	1	03	50	50	100	3
6	PCC21BTL66	Enzyme Technology lab	TD: BT PSB: BT	0	0	2	0	03	50	50	100	1
7	MP21BTMP67	Mini project	BT	Two contact hours /week for interaction between the faculty and students.				--	100	--	100	2
8	INT21INT68	Innovation/Entrepreneurship /Societal Internship	Completed during the intervening period of IV and V semesters.					--	100	--	100	3
								Total	**500**	**300**	**800**	**22**

Professional Elective Course - I

21BT641	Human Anatomy and Physiology	21BT643	Biological Data Management and Analysis
21BT642	Biochemical Thermodynamics and Bioenergetics	21BT644	Stem Cell Technology

Open Elective course – I

21BT651	Ecology and Ecosystem	21BT653	Forensic Science
21BT652	Food, Nutrition and Health	21BT654	Robotics in Healthcare and Agri Tech

Note: HSMC: Humanity and Social Science & Management Courses, **IPCC:** Integrated Professional Core Course, **PCC:** Professional Core Course, **PEC:** Professional Elective Courses, OEC–Open Elective Course, **MP** –Mini Project, INT –Internship.
L –Lecture, **T** – Tutorial, **P** - Practical / Drawing, **S** – Self Study Component, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Examination.

Integrated Professional Core Course (IPCC): Refers to Professional Theory Core Course Integrated with Practical of the same course. Credit for IPCC can be 04 and its Teaching – Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by CIE only and there shall be no SEE. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (BE/B.Tech) 2021-22 may be referred.

Professional Elective Courses(PEC):
A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an option to select one course out of five courses. The minimum students' strength for offering professional electives is 10. However, this conditional shall not be applicable to cases where the admission to the programme is less than 10.

Open Elective Courses:
Students belonging to a particular stream of Engineering and Technology are not entitled for the open electives offered by their parent Department. However, they can opt an elective offered by other Departments, provided they satisfy the prerequisite condition if any. Registration to open electives shall be documented under the guidance of the Program Coordinator/ Advisor/Mentor.
Selection of an open elective shall **not be allowed** if,
(i) The candidate has studied the same course during the previous semesters of the program.
(ii) The syllabus content of open electives is similar to that of the Departmental core courses or professional electives.
(iii) A similar course, under any category, is prescribed in the higher semesters of the program.
In case, any college is desirous of offering a course (not included in the Open Elective List of the University) from streams such as Law, Business (MBA), Medicine, Arts, Commerce, etc., can seek permission, at least one month before the commencement of the semester, from the University by submitting a copy of the syllabus along with the details of expertise available to teach the same in the college.

The minimum students' strength for offering open electives is 10. However, this conditional shall not be applicable to cases where the admission to the programme is less than 10.

Mini-project work: Mini Project is a laboratory-oriented course which will provide a platform to students to enhance their practical knowledge and skills by the development of small systems/applications.

Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary Mini- project can be assigned to an individual student or to a group having not more than 4 students.

CIE procedure for Mini-project:

(i) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two faculty members of the Department, one of them being the Guide. The CIE marks awarded for the Mini-project work shall be based on the evaluation of project report, project presentation skill, and question and answer session in the ratio of 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

(ii) Interdisciplinary: Continuous Internal Evaluation shall be group-wise at the college level with the participation of all the guides of the project.

The CIE marks awarded for the Mini-project, shall be based on the evaluation of project report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

No SEE component for Mini-Project.

Internship of 04 weeks during the intervening period of IV and V semesters; 21INT68Innovation/ Entrepreneurship/ Societalbased Internship.

(1) All the students shall have to undergo a mandatory internship of 04 weeks during the intervening period of IV and V semesters. The internship shall be slated for CIE only and will not have SEE. The letter grade earned through CIE shall be included in the VI semester grade card.The internship shall be considered as a head of passing and shall be considered for vertical progression and for the award of degree. Those, who do not take up / complete the internship shall be considered under F (fail) grade and shall have to complete during subsequently after satisfying the internship requirements.

(2) Innovation/ Entrepreneurship Internship shall be carried out at industry, State and Central Government /Non-government organizations (NGOs), micro, small and medium enterprise (MSME), Innovation centres or Incubation centres. Innovation need not be a single major breakthrough; it can also be a series of small or incremental changes. Innovation of any kind can also happen outside of the business world.

Entrepreneurship internships offers a chance to gain hands on experience in the world of entrepreneurship and helps to learn what it takes to run a small entrepreneurial business by performing intern duties with an established company. This experience can then be applied to future business endeavours. Start-ups and small companies are a preferred place to learn the business tack ticks for future entrepreneurs as learning how a small business operates will serve the intern well when he/she manages his/her own company. Entrepreneurship acts as a catalyst to open the minds to creativity and innovation. Entrepreneurship internship can be from several sectors, including technology, small and medium-sized, and the service sector.

(3) Societal or social internship.

Urbanization is increasing on a global scale; and yet, half the world's population still resides in rural areas and is devoid of many things that urban population enjoy. Rural internship is a work-based activity in which students will have a chance to solve/reduce the problems of the rural place for better living.

As proposed under the AICTE rural internship programme, activities under Societal or social internship, particularly in rural areas, shall be considered for 40 points under AICTE activity point programme.

VII semester Class work and Research Internship /Industry Internship (21INT82)

Swapping Facility

Institutions can swap VII and VIII Semester Scheme of Teaching and Examinations to accommodate research internship/ industry internship after the VI semester**.**

(2) Credits earned for the courses of VII and VIII Semester Scheme of Teaching and Examinations shall be counted against the corresponding semesters whether VII or VIII semester is completed during the beginning of IV year or later part of IV year of the program.

Elucidation:

At the beginning of IV year of the programme i.e., after VI semester, VII semester classwork and VIII semester Research Internship /Industrial Internship shall be permitted to be operated simultaneously by the University so that students have ample opportunity for internship. In other words, a good percentage of the class shall attend VII semester classwork and similar percentage of others shall attend to Research Internship or Industrial Internship.

Research/Industrial Internship shall be carried out at an Industry, NGO, MSME, Innovation centre, Incubation centre, Start-up, Centers of Excellence (CoE), Study Centre established in the parent institute and /or at reputed research organizations / institutes. The internship can also be rural internship.

The mandatory Research internship /Industry internship is for 24 weeks. The internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take up/complete the internship shall be declared fail and shall have to complete during the subsequent University examination after satisfying the internship requirements.

INT21INT82Research Internship/ Industry Internship/Rural Internship

Research internship: A research internship is intended to offer the flavour of current research going on in the research field. It helps students get familiarized with the field and imparts the skill required for carrying out research.

Industry internship: Is an extended period of work experience undertaken by students to supplement their degree for professional development. It also helps them learn to overcome unexpected obstacles and successfully navigate organizations, perspectives, and cultures. Dealing with contingencies helps students recognize, appreciate, and adapt to organizational realities by tempering their knowledge with practical constraints.

Rural Internship: A long-term goal, as proposed under the AICTE rural internship programme, shall be counted as rural internship activity.

The student can take up Interdisciplinary Research Internship or Industry Internship.

The faculty coordinator or mentor has to monitor the students' internship progress and interact with them to guide for the successful completion of the internship.

The students are permitted to carry out the internship anywhere in India or abroad. University shall not bear any expenses incurred in respect of internship.

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Swappable VII and VIII SEMESTER

VII SEMESTER

Sl. No	Course and Course Code	Course title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week: Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Examination: Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
				L	T	P	S					
1	PCC21BT71	Upstream &Downstream Bioprocess Technology	TD: BT PSB: BT	3	0	0	1	3	50	50	100	3
2	PCC21BT72	Bioethics and Biosafety	TD: BT PSB: BT	2	0	0	1	2	50	50	100	2
3	21BT73X	Professional elective course-II	TD: BT PSB: BT	3	0	0	1	3	50	50	100	3
4	21BT74X	Professional elective course-III	TD: BT PSB: BT	3	0	0	1	3	50	50	100	3
5	21BT75X	Open elective course-II	TD: BT PSB: BT	3	0	0	1	3	50	50	100	3
6	Proj21BT76	Project work	BT	Two contact hours /week for interaction between the faculty and students.				3	100	100	200	10
								Total	**350**	**350**	**700**	**24**

VIII SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department	Teaching Hours /Week: Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Examination: Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
					L	T	P	S					
1	Seminar21BT81		Technical seminar	BT	One contact hour /week for interaction between the faculty and students.				--	100	--	100	01
2	INT21INT82		Research internship/ industry internship	BT	Two contact hours /week for interaction between the faculty and students.				03 (Batch wise)	100	100	200	15
3	NCMC	21NS83	National Service Scheme (NSS)	NSS	Completed during the intervening period of III semester to VIII semester.				--	50	50	100	0
		21PE83	Physical Education (PE) (Sports and Athletics)	PE									
		21YO83	Yoga	Yoga									
									Total	**250**	**150**	**400**	**16**

Professional Elective Course - II

21BT731	Medicinal Chemistry and Chemoinformatics	21BT734	Metabolic Engineering and Functional Genomics
21BT732	Bioreactor Design and Scale up	21BT735	Nanobiotechnology
21BT733	Biomedical Imaging and Health Informatics		

Professional Elective Course - III

21BT741	Systems Biology & Rational Drug Design	21BT744	Agricultural Biotechnology and Crop Improvement
21BT742	Food Processing and Nutraceuticals	21BT745	Synthetic Biology and Tissue Engineering
21BT743	Pharmaceutical BT and Clinical Research		

Open Elective Course - II			
21BT751	Biomaterials and Medical Implants	21BT754	Biofuels and Bioenergy
21BT752	Biosensors and Applications	21BT755	Bioterrorism and National Security
21BT753	Bioremediation Techniques		

Note: PCC: Professional Core Course, **PEC:** Professional Elective Courses, **OEC**–Open Elective Course, **AEC** –Ability Enhancement Courses.
L –Lecture, T – Tutorial, P- Practical / Drawing, S – Self Study Component, CIE: Continuous Internal Evaluation, SEE: Semester End Examination.

Note: VII and VIII semesters of IV year of the programme
(1) Institutions can swap VII and VIII Semester Scheme of Teaching and Examinations to accommodate research internship/ industry internship after the VI semester**.**
(2) Credits earned for the courses of VII and VIII Semester Scheme of Teaching and Examinations shall be counted against the corresponding semesters whether VII or VIII semester is completed during the beginning of IV year or later part of IV year of the programme.

VII semester Class work and Research Internship /Industry Internship (21INT82)

Elucidation:
At the beginning of IV year of the programme i.e., after VI semester, VII semester classwork and VIII semester Research Internship /Industrial Internship shall be permitted to be operated simultaneously by the University so that students have ample opportunity for internship. In other words, a good percentage of the class shall attend VII semester classwork and similar percentage of others shall attend to Research Internship or Industrial Internship.
Research/Industrial Internship shall be carried out at an Industry, NGO, MSME, Innovation centre, Incubation centre, Start-up, Centers of Excellence (CoE), Study Centre established in the parent institute and /or at reputed research organizations / institutes. The internship can also be rural internship.
The mandatory Research internship /Industry internship is for 24 weeks. The internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take up/complete the internship shall be declared fail and shall have to complete during the subsequent University examination after satisfying the internship requirements.

INT21INT82Research Internship/ Industry Internship/Rural Internship
Research internship: A research internship is intended to offer the flavour of current research going on in the research field. It helps students get familiarized with the field and imparts the skill required for carrying out research.
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Rural Internship: A long-term goal, as proposed under the AICTE rural internship programme, shall be counted as rural internship activity.
The student can take up Interdisciplinary Research Internship or Industry Internship.
The faculty coordinator or mentor has to monitor the students' internship progress and interact with them to guide for the successful completion of the internship.
The students are permitted to carry out the internship anywhere in India or abroad. University shall not bear any expenses incurred in respect of internship.

PROJECT WORK (21BTP75): The objective of the Project work is
- **(i)** To encourage independent learning and the innovative attitude of the students.
- **(ii)** To develop interactive attitude, communication skills, organization, time management, and presentation skills.
- **(iii)** To impart flexibility and adaptability.
- **(iv)** To inspire team working.
- **(v)** To expand intellectual capacity, credibility, judgment and intuition.
- **(vi)** To adhere to punctuality, setting and meeting deadlines.
- **(vii)** To install responsibilities to oneself and others.
- **(viii)**To train students to present the topic of project work in a seminar without any fear, face the audience confidently, enhance communication skills, involve in group discussion to present and exchange ideas.

CIE procedure for Project Work:
(1) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide.
The CIE marks awarded for the project work, shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.
(2) Interdisciplinary: Continuous Internal Evaluation shall be group-wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable. The CIE marks awarded for the project work, shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.
SEE procedure for Project Work: SEE for project work will be conducted by the two examiners appointed by the University. The SEE marks awarded for the project work shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25.

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III SEMESTER

Sl. No	Course and Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
				Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
				L	T	P	S					
1	BSC 21MAT31	Transform Calculus, Fourier Series and Numerical Techniques (Common to all)	TD- Maths PSB-Maths					03	50	50	100	3
2	IPCC 21CV32	Geodetic Engineering	TD: Civil Engg PSB: Civil Engg	2	2	2		03	50	50	100	4
3	IPCC 21CV33	Strength of Materials	TD: Civil Engg PSB: Civil Engg	2	2	2		03	50	50	100	4
4	PCC 21CV34	Earth Resources and Engineering	TD: Geology PSB: Geology	3	0	0		03	50	50	100	3
5	PCC 21CVL35	Computer-Aided Building Planning and Drawing	TD: Civil Engg PSB: Civil Engg	0	0	2		03	50	50	100	1
6	UHV **21SCR36**	Social Connect and Responsibility	Any Department	0	0	1		01	50	50	100	1
7	HSMC 21KSK37/47	Samskrutika Kannada	TD and PSB HSMC	0	2	0		01	50	50	100	1
	HSMC 21KBK37/47	Balake Kannada										
	OR											
	HSMC 21CIP37/47	Constitution of India and Professional Ethics										
8	AEC 21CV38X	Ability Enhancement Course - III	TD: Concerned department PSB: Concerned Board	If offered as Theory Course				01	50	50	100	1
				0	2	0						
				If offered as lab. course				02				
				0	0	2						
								Total	**400**	**400**	**800**	**18**

9	Scheduled activities for III to VIII semesters	NCMC 21NS83	National Service Scheme (NSS)	NSS	All students have to register for any one of the courses namely National Service Scheme, Physical Education (PE)(Sports and Athletics), and Yoga with the concerned coordinator of the course during the first week of III semester. The activities shall be carried out between III semester to VIII semester (for 5 semesters). SEE in the above courses shall be conducted during VIII semester examinations and the accumulated CIE marks shall be added to the SEE marks. Successful completion of the registered course is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities.
		NCMC 21PE83	Physical Education (PE)(Sports and Athletics)	PE	
		NCMC 21YO83	Yoga	Yoga	

Course prescribed to lateral entry Diploma holders admitted to III semester B.E./B.Tech programs

1	NCMC 21MATDIP31	Additional Mathematics - I	Maths	02	02	--	--	---	100	---	100	0

Note: BSC: Basic Science Course, **IPCC:** Integrated Professional Core Course, **PCC:** Professional Core Course, **INT** –Internship, **HSMC:** Humanity and Social Science & Management Courses, **AEC**–Ability Enhancement Courses. **UHV:** Universal Human Value Course.

L –Lecture, **T –** Tutorial, P- Practical/ Drawing, **S –** Self Study Component, **CIE:** Continuous Internal Evaluation, **SEE:** Semester End Examination.**TD-** Teaching Department, **PSB**: Paper Setting department

21KSK37/47 Samskrutika Kannada is for students who speak, read and write Kannada and **21KBK37/47** Balake Kannada is for non-Kannada speaking, reading, and writing students.

Integrated Professional Core Course (IPCC): Refers to Professional Theory Core Course Integrated with practical of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (B.E./B.Tech.) 2021-22 may be referred.

21INT49Inter/Intra Institutional Internship: All the students admitted to engineering programs under the lateral entry category shall have to undergo a mandatory 21INT49 Inter/Intra Institutional Internship of 03 weeks during the intervening period of III and IV semesters. The internship shall be slated for CIE only and will not have SEE. The letter grade earned through CIE shall be included in the IV semester grade card. The internship shall be considered as a head of passing and shall be considered for vertical progression and for the award of degree. Those, who do not take up / complete the internship shall be declared fail and shall have to complete during subsequently after satisfying the internship requirements. The faculty coordinator or mentor shall monitor the students' internship progress and interact with them for the successful completion of the internship.

Non–credit mandatory courses (NCMC):

(A)Additional Mathematics I and II:

(1) These courses are prescribed for III and IV semesters respectively to lateral entry Diploma holders admitted to III semester of B.E./B.Tech., programs. They shall attend the classes during the respective semesters to complete all the formalities of the course and appear for the Continuous Internal Evaluation (CIE). In case, any student fails to register for the said course/fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have secured an F grade. In such a case, the student has to fulfill the course requirements during subsequent semester/s to earn the qualifying CIE marks. These courses are slated for CIE only and have no SEE.

(2) Additional Mathematics I and II shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses shall be mandatory for the award of degree.

(3) Successful completion of the courses Additional Mathematics I and II shall be indicated as satisfactory in the grade card. Non-completion of the courses Additional Mathematics I and II shall be indicated as Unsatisfactory.

(B) National Service Scheme/Physical Education (Sport and Athletics)/ Yoga:

(1) Securing 40 % or more in CIE,35 % or more marks in SEE, nd 40 % or more in the sum total of CIE + SEE leads to successful completion of the registered course.

(2) In case, students fail to secure 35 % marks in SEE, they have to appear for SEE during the subsequent examinations conducted by the University.

(3) In case, any student fails to register for NSS, PE or Yoga/fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have not completed the requirements of the course. In such a case, the student has to fulfill the course requirements during subsequent semester/s to earn the qualifying CIE marks.

(4) Successful completion of the course shall be indicated as satisfactory in the grade card. Non-completion of the course shall be indicated as Unsatisfactory.

(5) These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses shall be mandatory for the award of degree.

Ability Enhancement Course - III			
21CV381	Problem Solving using Python	21CV384	Infrastructure Finance
21CV382	Microsoft Excel and Visual Basic for Application	21CV385	Fire Safety in Buildings
21CV383	Personality Development and Soft Skills		

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IV SEMESTER

Sl. No	Course and Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week: Theory Lecture (L)	Tutorial (T)	Practical/ Drawing (P)	Self -Study (S)	Examination: Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
1	BSC **21MAT41**	Complex Analysis, Probability and Statistical Methods.	TD, PSB-Maths					03	50	50	100	3
2	IPCC 21CV42	Fluid Mechanics and Hydraulics	TD: Civil Engg PSB: Civil Engg	2	2	2		03	50	50	100	4
3	IPCC 21CV43	Public Health Engineering	TD: Civil Engg PSB: Civil Engg	2	2	2		03	50	50	100	4
4	PCC 21CV44	Analysis of Structures	TD: Civil Engg PSB: Civil Engg	2	2	0		03	50	50	100	3
5	AEC 21BE45	Biology for Engineers	BT, CHE, PHY	1	2	0		02	50	50	100	2
6	PCC 21CVL46	Earth Resources and Engineering Lab	TD: Geology PSB: Geology	0	0	2		03	50	50	100	1
7	HSMC 21KSK37/47 HSMC 21KBK37/47 OR HSMC 21CIP37/47	Samskrutika Kannada Balake Kannada Constitution of India & Professional Ethics	HSMC	0	2	0		01	50	50	100	1
8	AEC 21CV48X	Ability Enhancement Course- IV	TD and PSB: Concerned department	If offered as theory Course 0	2	0		01	50	50	100	1
				If offered as lab. course 0	0	2		02				
9	UHV 21UH49	Universal Human Values	Any Department	0	2	0		01	50	50	100	1
10	INT 21INT49	Inter/Intra Institutional Internship	Evaluation By the appropriate authorities	Completed during the intervening period of II and III semesters by students admitted to first year of BE./B.Tech and during the intervening period of III and IV semesters by Lateral entry students admitted to III semester.				3	100	--	100	2
								Total	**550**	**450**	**1000**	**22**

Course prescribed to lateral entry Diploma holders admitted to III semester of Engineering programs

Sl. No	Course and Course Code	Course Title	TD/PSB	L	T	P	S	Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
1	NCMC 21MATDIP41	Additional Mathematics - II	Maths	02	02	--	--	--	100	--	100	0

Note: BSC: Basic Science Course, IPCC: Integrated Professional Core Course, PCC: Professional Core Course, AEC –Ability Enhancement Courses, HSMC: Humanity and Social Science and Management Courses, UHV- Universal Human Value Courses.

L –Lecture, T – Tutorial, P- Practical/ Drawing, S – Self Study Component, CIE: Continuous Internal Evaluation, SEE: Semester End Examination.

21KSK37/47 Samskrutika Kannada is for students who speak, read and write Kannada and 21KBK37/47 Balake Kannada is for non-Kannada speaking, reading, and writing students.

Integrated Professional Core Course (IPCC): Refers to Professional Theory Core Course Integrated with Practical of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (BE/B.Tech.) 2021-22 may be referred.

Non – credit mandatory course (NCMC):
Additional Mathematics - II:
(1) Lateral entry Diploma holders admitted to III semester of B.E./B.Tech., shall attend the classes during the IV semester to complete all the formalities of the course and appear for the Continuous Internal Evaluation (CIE). In case, any student fails to register for the said course/fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have secured an F grade. In such a case, the student has to fulfill the course requirements during subsequent semester/s to earn the qualifying CIE marks. These courses are slated for CIE only and have no SEE.
(2) Additional Mathematics I and II shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses shall be mandatory for the award of degree.
(3) Successful completion of the course Additional Mathematics II shall be indicated as satisfactory in the grade card. Non-completion of the courses. Additional Mathematics II shall be indicated as Unsatisfactory.

Ability Enhancement Course - IV

21CV481	Data Cleaning and Preparation with Python Pandas	21CV484	Project Finance
21CV482	GIS with Quantum GIS	21CV485	Green Buildings
21CV483	Technical Writing Skills		

Internship of 04 weeks during the intervening period of IV and V semesters; 21INT68Innovation/ Entrepreneurship/ Societal Internship.
(1) All the students shall have to undergo a mandatory internship of 04 weeks during the intervening period of IV and V semesters. The internship shall be slated for CIE only and will not have SEE. The letter grade earned through CIE shall be included in the VI semester grade card.The internship shall be considered as a head of passing and shall be considered for vertical progression and for the award of degree. Those, who do not take up / complete the internship shall be considered under F (fail) grade and shall have to complete it subsequently after satisfying the internship requirements.
(2) Innovation/ Entrepreneurship Internship shall be carried out at industry, State and Central Government /Non-government organizations (NGOs), micro, small and medium enterprises (MSME), Innovation centres, or Incubation centers etc. Innovation need not be a single major breakthrough; it can also be a series of small or incremental changes. Innovation of any kind can also happen outside of the business world.
Entrepreneurship internships offer a chance to gain hands-on experience in the world of entrepreneurship and help to learn what it takes to run a small entrepreneurial business by performing intern duties with an established company. This experience can then be applied to future business endeavors. Start-ups and small companies are a preferred places to learn the business tactics for future entrepreneurs as earning how a small business operates will serve the intern well when he/she manages his/her own company. Entrepreneurship acts as a catalyst to open minds to creativity and innovation. Entrepreneurship internships can be from several sectors, including technology, small and medium-sized sector, and the service sector.
(3) **Societal or Social internship.** Urbanization is increasing on a global scale; and yet, half the world's population still resides in rural areas and is devoid of many things that urban population enjoys. The rural internship is a work-based activity in which students will have a chance to solve/reduce the problems of the rural place for better living.

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V SEMESTER

Sl. No	Course and Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week: Theory Lecture (L)	Tutorial (T)	Practical/ Drawing (P)	Self -Study (S)	Examination: Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
1	BSC 21CV51	Hydrology and Water Resources Engineering	TD: Civil Engg PSB: Civil Engg	3	0	0		03	50	50	100	3
2	IPCC 21CV52	Transportation Engineering	TD: Civil Engg PSB: Civil Engg	2	2	2		03	50	50	100	4
3	PCC 21CV53	Design of RC Structural Elements	TD: Civil Engg PSB: Civil Engg	2	2	0		03	50	50	100	3
4	PCC 21CV54	Geotechnical Engineering	TD: Civil Engg PSB: Civil Engg	2	2	0		03	50	50	100	3
5	PCC 21CVL55	Geotechnical Engineering Lab	TD: Civil Engg PSB: Civil Engg	0	0	2		03	50	50	100	1
6	AEC 21RMI56	Research Methodology & Intellectual Property Rights	TD: Any Department PSB: As identified by University	1	2	0		02	50	50	100	2
7	HSMC 21CIV57	Environmental Studies	TD: Civil/ Environmental /Chemistry/ Biotech. PSB: Civil Engg	0	2	0		1	50	50	100	1
8	AEC 21CV58X	Ability Enhancement Course-V	Concerned Board	If offered as Theory courses 0	 2	 0		01	50	50	100	1
				If offered as lab. courses 0	 0	 2		02				
								Total	**400**	**400**	**800**	**18**

Ability Enhancement Course - V

21CV581	Data Analysis with Python	21CV584	Quality Control and Quality Assurance
21CV582	Software Applications	21CV585	Offshore Structures
21CV583	Gender Sensitization		

Note: BSC: Basic Science Course, PCC: Professional Core Course, IPCC: Integrated Professional Core Course, AEC –Ability Enhancement Course INT – Internship, HSMC: Humanity and Social Science & Management Courses.
L –Lecture, T – Tutorial, P- Practical/ Drawing, S – Self Study Component, CIE: Continuous Internal Evaluation, SEE: Semester End Examination.

Integrated Professional Core Course (IPCC): refers to Professional Theory Core Course Integrated with Practical of the same course. Credit for IPCC can be 04 and its Teaching – Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by CIE only and there shall be no SEE. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (BE/B.Tech.) 2021-22 may be referred.

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VI SEMESTER

Sl. No	Course and Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination					Credits
				Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks		
				L	T	P	S						
1	HSMC 21CV61	Construction Management and Entreprenurship	TD: Civil Engg PSB: Civil Engg	3	0	0		03	50	50	100		3
2	IPCC 21CV62	Concrete Technology	TD: Civil Engg PSB: Civil Engg	2	2	2		03	50	50	100		4
3	PCC 21CV63	Design of Steel structure	TD: Civil Engg PSB: Civil Engg	2	2	0		03	50	50	100		3
4	PEC 21CV64x	Professional Elective Course-I	TD: Civil Engg PSB: Civil Engg					03	50	50	100		3
5	OEC 21CV65x	Open Elective Course-I	Concerned Department					03	50	50	100		3
6	PCC 21CVL66	Computer Aided Detailing of Structure	TD: Civil Engg PSB: Civil Engg	0	0	2		03	50	50	100		1
7	MP 21CVMP67	Mini Project	TD: Civil Engg PSB: Civil Engg	Two contact hours /week for interaction between the faculty and students.				--	100	--	100		2
8	INT 21INT68	Innovation/Entrepreneurship /Societal Internship	Completed during the intervening period of IV and V semesters.					--	100	--	100		3
								Total	500	300	800		22

Professional Elective - I

21CV641	Design of Prestressed Concrete Structures	21CV644	Design Concept in Building Services
21CV642	Applied Geotechnical Engineering	21CV645	Ground Water Hydraulics
21CV643	Railways, Harbors, Tunneling and Airports	21CV646	Alternative Building Materials

Open Electives – I offered by the Department to other Department students

21CV651	Remote Sensing and GIS	21CV653	Occupational Health and Safety
21CV652	Traffic Engineering	21CV654	Conservation of Natural Resources

Note: HSMC: Humanity and Social Science & Management Courses, **IPCC:** Integrated Professional Core Course, **PCC:** Professional Core Course, **PEC:** Professional Elective Courses, O**EC**–Open Elective Course, **MP** –Mini Project, INT –Internship.
L –Lecture, **T** – Tutorial, **P** - Practical / Drawing, **S** – Self Study Component, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Examination.

Integrated Professional Core Course (IPCC): Refers to Professional Theory Core Course Integrated with Practical of the same course. Credit for IPCC can be 04 and its Teaching – Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by CIE only and there shall be no SEE. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (BE/B.Tech) 2021-22 may be referred.

Professional Elective Courses(PEC):
A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an option to select one course. The minimum number of students' strengths for offering professional electives is 10. However, this conditional shall not be applicable to cases where the admission to the program is less than 10.

Open Elective Courses:
Students belonging to a particular stream of Engineering and Technology are not entitled to the open electives offered by their parent Department. However, they can opt for an elective offered by other Departments, provided they satisfy the prerequisite condition if any. Registration to open electives shall be documented under the guidance of the Program Coordinator/ Advisor/Mentor.
Selection of an open elective shall **not be allowed** if,

(i) The candidate has studied the same course during the previous semesters of the program.
(ii) The syllabus content of open electives is similar to that of the Departmental core courses or professional electives.
(iii) A similar course, under any category, is prescribed in the higher semesters of the program.

In case, any college is desirous of offering a course (not included in the Open Elective List of the University) from streams such as Law, Business (MBA), Medicine, Arts, Commerce, etc., can seek permission, at least one month before the commencement of the semester, from the University by submitting a copy of the syllabus along with the details of expertise available to teach the same in the college.
The minimum students' strength for offering open electives is 10. However, this conditional shall not be applicable to cases where the admission to the programme is less than 10.

Mini-project work: Mini Project is a laboratory-oriented course which will provide a platform to students to enhance their practical knowledge and skills by the development of small systems/applications.
Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary Mini- project can be assigned to an individual student or to a group having not more than 4 students.

CIE procedure for Mini-project:

(i) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two faculty members of the Department, one of them being the Guide. The CIE marks awarded for the Mini-project work shall be based on the evaluation of project report, project presentation skill, and question and answer session in the ratio of 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

(ii) Interdisciplinary: Continuous Internal Evaluation shall be group-wise at the college level with the participation of all the guides of the project.
The CIE marks awarded for the Mini-project, shall be based on the evaluation of project report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

No SEE component for Mini-Project.

VII semester Class work and Research Internship /Industry Internship (21INT82)

Swapping Facility

Institutions can swap VII and VIII Semester Scheme of Teaching and Examinations to accommodate research internship/ industry internship after the VI semester**.**

(2) Credits earned for the courses of VII and VIII Semester Scheme of Teaching and Examinations shall be counted against the corresponding semesters whether VII or VIII semester is completed during the beginning of IV year or later part of IV year of the program.

Elucidation:

At the beginning of IV years of the program i.e., after VI semester, VII semester classwork and VIII semester Research Internship /Industrial Internship shall be permitted to be operated simultaneously by the University so that students have ample opportunity for an internship. In other words, a good percentage of the class shall attend VII semester classwork and a similar percentage of others shall attend to Research Internship or Industrial Internship.
Research/Industrial Internship shall be carried out at an Industry, NGO, MSME, Innovation center, Incubation center, Start-up, center of Excellence (CoE), Study Centre established in the parent institute and /or at reputed research organizations/institutes.
The mandatory Research internship /Industry internship is for 24 weeks. The internship shall be considered as a head of passing and shall be considered for the award of a degree. Those, who do not take up/complete the internship shall be declared to fail and shall have to complete it during the subsequent University examination after satisfying the internship requirements.

INT21INT82 Research Internship/ Industry Internship/Rural Internship

Research internship: A research internship is intended to offer the flavor of current research going on in the research field. It helps students get familiarized with the field and imparts the skill required for carrying out research.

Industry internship: Is an extended period of work experience undertaken by students to supplement their degree for professional development. It also helps them learn to overcome unexpected obstacles and successfully navigate organizations, perspectives, and cultures. Dealing with contingencies helps students recognize, appreciate, and adapt to organizational realities by tempering their knowledge with practical constraints.
The faculty coordinator or mentor has to monitor the students' internship progress and interact with them to guide for the successful completion of the internship.
The students are permitted to carry out the internship anywhere in India or abroad. University shall not bear any expenses incurred in respect of internship.

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Swappable VII and VIII SEMESTER

VII SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	PCC	21CV71	Quantity Survey and Contract Management	TD: Civil Engg PSB: Civil Engg	2	2	0		3	50	50	100	3
2	PCC	21CV72	Construction Technology for Substructure and Super Structures	TD: Civil Engg PSB: Civil Engg	2	0	0		3	50	50	100	2
3	PEC	21CV73X	Professional elective Course-II	TD: Civil Engg PSB: Civil Engg					3	50	50	100	3
4	PEC	21CV74X	Professional elective Course-III	TD: Civil Engg PSB: Civil Engg					3	50	50	100	3
5	OEC	21CV75X	Open elective Course-II	Concerned Department					3	50	50	100	3
6	Project	21CVP76	Project work	TD: Civil Engg PSB: Civil Engg	Two contact hours /week for interaction between the faculty and students.				3	100	100	200	10
									Total	**350**	**350**	**700**	**24**

VIII SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	Seminar	21CV81	Technical Seminar	TD: Civil Engg PSB: Civil Engg	One contact hour /week for interaction between the faculty and students.				--	100	--	100	01
2	INT	21INT82	Research Internship/ Industry Internship	TD: Civil Engg PSB: Civil Engg	Two contact hours /week for interaction between the faculty and students.				03 (Batch wise)	100	100	200	15
3	NCMC	21NS83	National Service Scheme (NSS)	NSS	Completed during the intervening period of III semester toVIII semester.				--	50	50	100	0
		21PE83	Physical Education (PE) (Sports and Athletics)	PE									
		21YO83	Yoga	Yoga									
									Total	**250**	**150**	**400**	**16**

Professional Elective - II

21CV731	Advanced Design of RCC and Steel Structures	21CV734	Solid Waste Management
21CV732	Advanced Geotechnical Engineering	21CV735	Design of Hydraulic Structures
21CV733	Pavement Materials and Construction	21CV736	Repair, Retrofitting and Rehabilitation of Structures

Professional Elective - III

21CV741	Earthquake Engineering	21CV744	Air Pollution and Control
21CV742	Ground Improvement Techniques	21CV745	Open Channel Hydraulics
21CV743	Pavement Design	21CV746	Design of Masonry Structures

Open Electives - II offered by the Department to other Department students			
21CV751	Finite Element Method	21CV754	Intelligent Transportation Systems
21CV752	Numerical Methods and Applications		
21CV753	Environmental Protection and Management		

Note: PCC: Professional Core Course, **PEC:** Professional Elective Courses, **OEC**–Open Elective Course, **AEC** –Ability Enhancement Courses.
L –Lecture, T – Tutorial, P- Practical / Drawing, S – Self Study Component, CIE: Continuous Internal Evaluation, SEE: Semester End Examination.

Note: VII and VIII semesters of IV year of the programme
(1) Institutions can swap VII and VIII Semester Scheme of Teaching and Examinations to accommodate research internship/ industry internship after the VI semester**.**
(2) Credits earned for the courses of VII and VIII Semester Scheme of Teaching and Examinations shall be counted against the corresponding semesters whether VII or VIII semester is completed during the beginning of IV year or later part of IV year of the program.

PROJECT WORK (21XXP75): The objective of the Project work is
- **(i)** To encourage independent learning and the innovative attitude of the students.
- **(ii)** To develop interactive attitude, communication skills, organization, time management, and presentation skills.
- **(iii)** To impart flexibility and adaptability.
- **(iv)** To inspire team working.
- **(v)** To expand intellectual capacity, credibility, judgment and intuition.
- **(vi)** To adhere to punctuality, setting and meeting deadlines.
- **(vii)** To install responsibilities to oneself and others.
- **(viii)**To train students to present the topic of project work in a seminar without any fear, face the audience confidently, enhance communication skills, involve in group discussion to present and exchange ideas.

CIE procedure for Project Work:
(1) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide.
The CIE marks awarded for the project work, shall be based on the evaluation of the project work Report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.
(2) Interdisciplinary: Continuous Internal Evaluation shall be group-wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable. The CIE marks awarded for the project work, shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.
SEE procedure for Project Work: SEE for project work will be conducted by the two examiners appointed by the University. The SEE marks awarded for the project work shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25.

TECHNICAL SEMINAR (21XXS81): The objective of the seminar is to inculcate self-learning, present the seminar topic confidently, enhance communication skill, involve in group discussion for the exchange of ideas. Each student, under the guidance of a Faculty, shall choose, preferably, a recent topic of his/her interest relevant to the program of Specialization.

(i) Carry out a literature survey, and systematically organize the content. **(ii)** Prepare the report with your own sentences, avoiding a cut and paste act. **(iii)**Type the matter to acquaint with the use of Micro-soft equation and drawing tools or any such facilities. **(iv)** Present the seminar topic orally and/or through PowerPoint slides. **(v)** Answer the queries and involve in debate/discussion. (**vi)** Submit a typed report with a list of references.

The participants shall take part in the discussion to foster a friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident.
Evaluation Procedure:
The CIE marks for the seminar shall be awarded (based on the relevance of the topic, presentation skill, participation in the question and answer session, and quality of report) by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three teachers from the department with the senior-most acting as the Chairman.
Marks distribution for CIE of the course:
Seminar Report:50 marks
Presentation skill:25 marks
Question and Answer: 25 marks. ■No SEE component for Technical Seminar

Non–credit mandatory courses (NCMC):
National Service Scheme/Physical Education (Sport and Athletics)/ Yoga:
(1) Securing 40 % or more in CIE, 35 % or more marks in SEE, and 40 % or more in the sum total of CIE + SEE leads to successful completion of the registered course.
(2) In case, students fail to secure 35 % marks in SEE, they have to appear for SEE during the subsequent examinations conducted by the University.
(3) In case, any student fails to register for NSS, PE or Yoga/fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have not completed the requirements of the course. In such a case, the student has to fulfill the course requirements during subsequently to earn the qualifying CIE marks subject to the maximum program period.
(4) Successful completion of the course shall be indicated as satisfactory in the grade card. Non-completion of the course shall be indicated as Unsatisfactory.
(5) These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses shall be mandatory for the award of a degree.

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III SEMESTER

Sl. No	Course and Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week: Theory Lecture (L)	Tutorial (T)	Practical/ Drawing (P)	Self -Study (S)	Examination: Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
1	BSC 21MAT31	Transform Calculus, Fourier Series and Numerical Techniques	Maths	3	0	0		03	50	50	100	3
2	IPCC 21CS32	Data Structures and Applications	Any CS Board Department	3	0	2		03	50	50	100	4
3	IPCC 21CS33	Analog and Digital Electronics		3	0	2		03	50	50	100	4
4	PCC 21CS34	Computer Organization and Architecture		3	0	0		03	50	50	100	3
5	PCC 21CSL35	Object Oriented Programming with JAVA Laboratory		0	0	2		03	50	50	100	1
6	UHV 21UH36	Social Connect and Responsibility	Any Department	0	0	2		01	50	50	100	1
7	HSMC 21KSK37/47	Samskrutika Kannada	TD and PSB: HSMC	1	0	0		01	50	50	100	1
	HSMC 21KBK37/47	Balake Kannada										
	OR											
	HSMC 21CIP37/47	Constitution of India and Professional Ethics										
8	AEC 21CS38X/21 CSL38X	Ability Enhancement Course - III	TD: Concerned department PSB: Concerned Board	If offered as Theory Course: 1	0	0		01	50	50	100	1
				If offered as lab. course: 0	0	2		02				
								Total	**400**	**400**	**800**	**18**

Sl. No		Course Code	Course Title	TD	Details
9	Scheduled activities for III to VIII semesters	NMDC 21NS83	National Service Scheme (NSS)	NSS	All students have to register for any one of the course namely National Service Scheme, Physical Education (PE)(Sports and Athletics) and Yoga with the concerned coordinator of the course during the first week of III semester. The activities shall be carried out from (for 5 semesters) between III semester to VIII semester. SEE in the above courses shall be conducted during VIII semester examinations and the accumulated CIE marks shall be added to the SEE marks. Successful completion of the registered course is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the colander prepared for the NSS, PE and Yoga activities.
		NMDC 21PE83	Physical Education (PE)(Sports and Athletics)	PE	
		NMDC 21YO83	Yoga	Yoga	

Course prescribed to lateral entry Diploma holders admitted to III semester B.E./B.Tech programs

Sl. No	Course and Course Code	Course Title	TD/PSB	L	T	P	S	Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
1	NCMC 21MATDIP31	Additional Mathematics - I	Maths	02	02	--	--	---	100	---	100	0

Note:BSC: Basic Science Course, **IPCC:** Integrated Professional Core Course, **PCC:** Professional Core Course,**INT** –Internship, **HSMC:** Humanity and Social Science & Management Courses, **AEC**–Ability Enhancement Courses. **UHV:** Universal Human Value Course.
L –Lecture, **T –** Tutorial, P- Practical/ Drawing, **S –** Self Study Component, **CIE:** Continuous Internal Evaluation, **SEE:** Semester End Examination.**TD-** Teaching Department, **PSB**: Paper Setting department

21KSK37/47 Samskrutika Kannada is for students who speak, read and write Kannada and **21KBK37/47**Balake Kannada is for non-Kannada speaking, reading, and writing students.

Integrated Professional Core Course (IPCC): Refers to Professional Theory Core Course Integrated with Practical's of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper.For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (BE/B.Tech.) 2021-22 may be referred.

21INT49Inter/Intra Institutional Internship: All the students admitted to engineering programs under the lateral entry category shall have to undergo a mandatory 21INT49 Inter/Intra Institutional Internshipof 03 weeks during the intervening period of III and IV semesters. The internship shall be slated for CIE only and will not have SEE. The letter grade earned through CIE shall be included in the IV semester grade card.The internship shall be considered as a head of passing and shall be considered for vertical progression and for the award of degree. Those, who do not take up / complete the internship shall be declared fail and shall have to complete during subsequently after satisfying the internship requirements. The faculty coordinator or mentor shall monitor the students' internship progress and interact with them for the successful completion of the internship.

Non–credit mandatory courses (NCMC):

(A)Additional Mathematics I and II:

(1) These courses are prescribed for III and IV semesters respectively to lateral entry Diploma holders admitted to III semester of B.E./B.Tech., programs. They shall attend the classes during the respective semesters to complete all the formalities of the course and appear for the Continuous Internal Evaluation (CIE). In case, any student fails to register for the said course/fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have secured an F grade. In such a case, the student has to fulfill the course requirements during subsequent semester/s to earn the qualifying CIE marks. These courses are slated for CIE only and has no SEE.

(2) Additional Mathematics I and II shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses shall be mandatory for the award of degree.

(3) Successful completion of the coursesAdditional Mathematics I and IIshall be indicated as satisfactory in the grade card. Non-completion of the coursesAdditional Mathematics I and IIshall be indicated as Unsatisfactory.

(B) National Service Scheme/Physical Education (Sport and Athletics)/ Yoga:

(1) Securing 40 % or more in CIE,35 % or more marks in SEE and 40 % or more in the sum total of CIE + SEE leads to successful completion of the registered course.

(2) In case, students fail to secure 35 % marks in SEE, they have to appear for SEE during the subsequent examinations conducted by the University.

(3) In case, any student fails to register for NSS, PE or Yoga/fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have not completed the requirements of the course. In such a case, the student has to fulfill the course requirements during subsequent semester/s to earn the qualifying CIE marks.

(4) Successful completion of the course shall be indicated as satisfactory in the grade card. Non-completion of the course shall be indicated as Unsatisfactory.

(5) These coursesshall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses shall be mandatory for the award of degree.

Ability Enhancement Course - III

21CSL381	Mastering Office	21CS383	
21CS382	Programming IN c++	21CS384	

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IV SEMESTER

Sl. No	Course and Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week: Theory Lecture (L)	Tutorial (T)	Practical/ Drawing (P)	Self -Study (S)	Examination: Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
1	BSC 21CS41	Mathematical Foundations for Computing	Maths	2	2	0		03	50	50	100	3
2	IPCC 21CS42	Design and Analysis of Algorithms	Any CS Board Department	3	0	2		03	50	50	100	4
3	IPCC 21CS43	Microcontroller and Embedded SystemS		3	0	2		03	50	50	100	4
4	PCC 21CS44	Operating SystemS		2	2	0		03	50	50	100	3
5	AEC 21BE45	Biology For Engineers	BT, CHE, PHY	2	0	0		02	50	50	100	2
6	PCC 21CSL46	Python Programming Laboratory	Any CS Board Department	0	0	2		03	50	50	100	1
7	HSMC 21KSK37/47	Samskrutika Kannada	HSMC	1	0	0		01	50	50	100	1
	HSMC 21KBK37/47	Balake Kannada										
	OR											
	HSMC 21CIP37/47	Constitution of India & Professional Ethics										
8	AEC 21CS48X/21CSL48X	Ability Enhancement Course- IV	TD and PSB: Concerned department	If offered as theory Course				01	50	50	100	1
				1	0	0						
				If offered as lab. course				02				
				0	0	2						
9	UHV 21UH49	UniversalHumanValues	Any Department	1	0	0		01	50	50	100	1
10	INT 21INT49	Inter/Intra Institutional Internship	Evaluation By the appropriate authorities	Completed during the intervening period ofII and III semesters by students admitted to first year of BE./B.Tech and during the intervening period of III and IV semesters by Lateral entry students admitted to III semester.				3	100	--	100	2
								Total	**550**	**450**	**1000**	**22**

Course prescribed to lateral entry Diploma holders admitted to III semester of Engineering programs

Sl. No	Course and Course Code	Course Title	TD/PSB	L	T	P	S	Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
1	NCMC 21MATDIP41	Additional Mathematics - II	Maths	02	02	--	--	--	100	--	100	0

Note: BSC: Basic Science Course, IPCC: Integrated Professional Core Course, PCC: Professional Core Course, AEC –Ability Enhancement Courses, HSMC: Humanity and Social Science and Management Courses, UHV- Universal Human Value Courses.

L –Lecture, T – Tutorial, P- Practical/ Drawing, S – Self Study Component, CIE: Continuous Internal Evaluation, SEE: Semester End Examination.

21KSK37/47 Samskrutika Kannada is for students who speak, read and write Kannada and 21KBK37/47 Balake Kannada is for non-Kannada speaking, reading, and writing students.

Integrated Professional Core Course (IPCC): Refers to Professional Theory Core Course Integrated with Practical's of the same course. Credit for IPCC can be 04 and its Teaching – Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from practical part of IPCCshall be included in the SEE question paper.For more details the regulation governing the Degree of Bachelor of Engineering /Technology (BE/B.Tech.) 2021-22 may be referred.

Non – credit mandatory course (NCMC):

Additional Mathematics - II:

(1) Lateral entry Diploma holders admitted to III semester of B.E./B.Tech., shall attend the classes during the IV semester to complete all the formalities of the course and appear for the Continuous Internal Evaluation (CIE). In case, any student fails to register for the said course/fails to

secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have secured an F grade. In such a case, the student has to fulfil the course requirements during subsequent semester/s to earn the qualifying CIE marks. These courses are slated for CIE only and has no SEE.
(2) Additional Mathematics I and II shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses shall be mandatory for the award of degree.
(3) Successful completion of the course Additional Mathematics IIshall be indicated as satisfactory in the grade card. Non-completion of the coursesAdditional Mathematics IIshall be indicated as Unsatisfactory.

Ability Enhancement Course - IV			
21CSL481	Web Programming	21CSL483	R Programming
21CS482	Unix Shell Programming	21CS484	

Internship of 04 weeks during the intervening period of IV and V semesters; 21INT68Innovation/ Entrepreneurship/ Societalbased Internship.
(1) All the students shall have to undergo a mandatory internship of 04 weeks during the intervening period of IV and V semesters. The internship shall be slated for CIE only and will not have SEE. The letter grade earned through CIE shall be included in the VI semester grade card.The internship shall be considered as a head of passing and shall be considered for vertical progression and for the award of degree. Those, who do not take up / complete the internship shall be considered under F (fail) grade and shall have to complete during subsequently after satisfying the internship requirements.
(2) Innovation/ Entrepreneurship Internshipshall be carried out at industry, State and Central Government /Non-government organizations (NGOs), micro, small and medium enterprise (MSME), Innovation centers or Incubation centers. Innovation need not be a single major breakthrough; it can also be a series of small or incremental changes.Innovation of any kind can also happen outside of the business world.
Entrepreneurship internships offers a chance to gain hands on experience in the world of entrepreneurship and helps to learn what it takes to run a small entrepreneurial business by performing intern duties with an established company. This experience can then be applied to future business endeavours.Start-ups and small companies are a preferred place to learn the business tack ticks for future entrepreneurs as learning how a small business operates will serve the intern well when he/she manages his/her own company. Entrepreneurship acts as a catalyst to open the minds to creativity and innovation.Entrepreneurship internship can be from several sectors, including technology, small and medium-sized, and the service sector.
(3) Societal or social internship.
Urbanization is increasing on a global scale; and yet, half the world's population still resides in rural areas and is devoid of many things that urban population enjoy. Rural internship, is a work-based activity in which students will have a chance to solve/reduce the problems of the rural place for better living.
As proposed under the AICTE rural internship programme, activities under Societal or social internship, particularly in rural areas, shall be considered for 40 points under AICTE activity point programme.

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V SEMESTER

Sl. No	Course and Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
				Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
				L	T	P	S					
1	BSC 21CS51	Automata Theory and compiler Design	Any CS Board Department	3	0	0		03	50	50	100	3
2	IPCC 21CS52	Computer Networks		3	0	2		03	50	50	100	4
3	PCC 21CS53	Database Management Systems		3	0	0		03	50	50	100	3
4	PCC 21CS54	Artificial Intelligence and Machine Learning		3	0	0		03	50	50	100	3
5	PCC 21CSL55	Database Management Systems Laboratory with Mini Project		0	0	2		03	50	50	100	1
6	AEC 21XX56	Research Methodology & Intellectual Property Rights	TD: Any Department PSB: As identified by university	2	0	0		02	50	50	100	2
7	HSMC 21CIV57	Environmental Studies	TD: Civil/ Environmental /Chemistry/ Biotech. PSB: Civil Engg	1	0	0		1	50	50	100	1
8	AEC 21CS58X/21 CS58LX	Ability Enhancement Course-V	Concerned Board	If offered as Theory courses				01	50	50	100	1
				1	0	0						
				If offered as lab. courses				02				
				0	0	2						
								Total	**400**	**400**	**800**	**18**

Ability Enhancement Course - IV

21CSL581	Angular JS and Node JS	21CS583	
21CS582	C# and .Net Framework	21CS584	

Note: BSC: Basic Science Course, PCC: Professional Core Course, IPCC: Integrated Professional Core Course, AEC –Ability Enhancement Course INT –Internship, HSMC: Humanity and Social Science & Management Courses.
L –Lecture, T – Tutorial, P- Practical/ Drawing, S – Self Study Component, CIE: Continuous Internal Evaluation, SEE: Semester End Examination.

Integrated Professional Core Course (IPCC): refers to Professional Theory Core Course Integrated with Practical of the same course. Credit for IPCC can be 04 and its Teaching – Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). Theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by CIE only and there shall be no SEE. For more details the regulation governing the Degree of Bachelor of Engineering /Technology (BE/B.Tech.) 2021-22 may be referred.

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VI SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	HSMC	21CS61	Software Engineering & Project Management	Any CS Board Department	2	2	0		03	50	50	100	3
2	IPCC	21CS62	Fullstack Development		3	0	2		03	50	50	100	4
3	PCC	21CS63	Computer Graphics andFundamentals of Image Processing		3	0	0		03	50	50	100	3
4	PEC	21XX64x	Professional Elective Course-I		3	0	0		03	50	50	100	3
5	OEC	21XX65x	Open Elective Course-I	Concerned Department	3	0	0		03	50	50	100	3
6	PCC	21CSL66	Computer Graphics and Image Processing Laboratory	Any CS Board Department	0	0	2		03	50	50	100	1
7	MP	21CSMP67	Mini Project		Two contact hours /week for interaction between the faculty and students.				--	100	--	100	2
8	INT	21INT68	Innovation/Entrepreneurship /Societal Internship	Completed during the intervening period of IV and V semesters.					--	100	--	100	3
									Total	**500**	**300**	**800**	**22**

Professional Elective - I

21CS641	Agile Technology	21CS643	Advanced Computer Architecture
21CS642	Advanced JAVA Programming	21CS644	Data science and Visualization

Open Electives – I offered by the Department to other Department students

21CS651	Introduction to Data Structures	21CS653	Introduction to Cyber Security
21CS652	Introduction to Database Management Systems	21CS654	Programming in JAVA

Note:HSMC: Humanity and Social Science & Management Courses, **IPCC:** Integrated Professional Core Course, **PCC:** Professional Core Course, **PEC:** Professional Elective Courses, OEC–Open Elective Course, **MP** –Mini Project, INT –Internship.
L –Lecture, T – Tutorial, P - Practical / Drawing, S – Self Study Component, CIE: Continuous Internal Evaluation, SEE: Semester End Examination.

Integrated Professional Core Course (IPCC): Refers to Professional Theory Core Course Integrated with Practical of the same course. Credit for IPCC can be 04 and its Teaching – Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by CIE only and there shall be no SEE. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (BE/B.Tech) 2021-22 may be referred.

Professional Elective Courses (PEC):
A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an option to select one course out of five courses. The minimum students' strength for offering professional electives is 10. However, this conditional shall not be applicable to cases where the admission to the programme is less than 10.

Open Elective Courses:
Students belonging to a particular stream of Engineering and Technology are not entitled for the open electives offered by their parent Department. However, they can opt an elective offered by other Departments, provided they satisfy the prerequisite condition if any. Registration to open electives shall be documented under the guidance of the Program Coordinator/ Advisor/Mentor.
Selection of an open elective shall **not be allowed** if,
- **(i)** The candidate has studied the same course during the previous semesters of the program.
- **(ii)** The syllabus content of open electives is similar to that of the Departmental core courses or professional electives.
- **(iii)** A similar course, under any category, is prescribed in the higher semesters of the program.

In case, any college is desirous of offering a course (not included in the Open Elective List of the University) from streams such as Law, Business (MBA), Medicine, Arts, Commerce, etc., can seek permission, at least one month before the commencement of the semester, from the University by submitting a copy of the syllabus along with the details of expertise available to teach the same in the college.
The minimum students' strength for offering open electives is 10. However, this conditional shall not be applicable to cases where the admission to the programme is less than 10.

Mini-project work: Mini Project is a laboratory-oriented course which will provide a platform to students to enhance their practical knowledge and skills by the development of small systems/applications.
Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary Mini- project can be assigned to an individual student or to a group having not more than 4 students.
CIE procedure for Mini-project:
(i) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two faculty members of the Department, one of them being the Guide. The CIE marks awarded for the Mini-project work shall be based on the evaluation of project report, project presentation skill, and question and answer session in the ratio of 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.
(ii) Interdisciplinary: Continuous Internal Evaluation shall be group-wise at the college level with the participation of all the guides of the project.
The CIE marks awarded for the Mini-project, shall be based on the evaluation of project report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.
No SEE component for Mini-Project.

VII semester Classwork and Research Internship /Industry Internship (21INT82)

Swapping Facility
Institutions can swap VII and VIII Semester Scheme of Teaching and Examinations to accommodate research internship/ industry internship after the VI semester**.**
(2) Credits earned for the courses of VII and VIII Semester Scheme of Teaching and Examinations shall be counted against the corresponding semesters whether VII or VIII semester is completed during the beginning of IV year or later part of IV year of the program.
Elucidation:
At the beginning of IV year of the programme i.e., after VI semester, VII semester classwork and VIII semester Research Internship /Industrial Internship shall be permitted to be operated simultaneously by the University so that students have ample opportunity for internship. In other words, a good percentage of the class shall attend VII semester classwork and similar percentage of others shall attend to Research Internship or Industrial Internship.
Research/Industrial Internship shall be carried out at an Industry, NGO, MSME, Innovation centre, Incubation centre, Start-up, Centers of Excellence (CoE), Study Centre established in the parent institute and /or at reputed research organizations / institutes. The internship can also be rural internship.
The mandatory Research internship /Industry internship is for 24 weeks. The internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take up/complete the internship shall be declared fail and shall have to complete during the subsequent University examination after satisfying the internship requirements.

INT21INT82Research Internship/ Industry Internship/Rural Internship
Research internship:A research internship is intended to offer the flavour of current research going on in the research field. It helps students get familiarized with the field and imparts the skill required for carrying out research.
Industry internship: Is an extended period of work experience undertaken by students to supplement their degree for professional development. It also helps them learn to overcome unexpected obstacles and successfully navigate organizations, perspectives, and cultures. Dealing with contingencies helps students recognize, appreciate, and adapt to organizational realities by tempering their knowledge with practical constraints.
Rural internship:A long-term goal, as proposed under the AICTE rural internship programme, shall be counted as rural internship activity.
The student can take up Interdisciplinary Research Internship or Industry Internship.
The faculty coordinator or mentor has to monitor the students' internship progress and interact with them to guide for the successful completion of the internship.
The students are permitted to carry out the internship anywhere in India or abroad. University shall not bear any expenses incurred in respect of internship.

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Swappable VII and VIII SEMESTER

VII SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	PCC	21CS71	Big Data Analytics	Any CS Board Department	3	0	0		3	50	50	100	3
2	PCC	21CS72	Cloud Computing		2	0	0		3	50	50	100	2
3	PEC	21XX73X	Professional elective Course-II		3	0	0		3	50	50	100	3
4	PEC	21XX74X	Professional elective Course-III		3	0	0		3	50	50	100	3
5	OEC	21XX75X	Open elective Course-II	Concerned Department	3	0	0		3	50	50	100	3
6	Project	21CSP76	Project work		Two contact hours /week for interaction between the faculty and students.				3	100	100	200	10
									Total	**350**	**350**	**700**	**24**

VIII SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	Seminar	21CS81	Technical Seminar		One contact hour /week for interaction between the faculty and students.				--	100	--	100	01
2	INT	21INT82	Research Internship/ Industry Internship		Two contact hours /week for interaction between the faculty and students.				03 (Batch wise)	100	100	200	15
3	NCMC	21NS83	National Service Scheme (NSS)	NSS	Completed during the intervening period of III semester toVIII semester.				--	50	50	100	0
	NCMC	21PE83	Physical Education (PE) (Sports and Athletics)	PE									
	NCMC	21YO83	Yoga	Yoga									
									Total	**250**	**150**	**400**	**16**

Professional Elective - II

21CS731	Object oriented Modelling and Design	21CS734	Blockchain Technology
21CS732	Digital Image Processing	21CS735	Internet of Things
21CS733	Cryptography and Network Security		

Professional Elective - III

21CS741	Software Architecture and Design Patterns	21CS744	Robotic Process Automation Design and Development
21CS742	Multiagent Systems	21CS745	NoSQL Data Base
21CS743	Deep Learning		

Open Electives - II offered by the Department to other Department students			
21CS751	Programming in Python	21CS754	Introduction to Data Science
21CS752	Introduction to AI and ML	21CS755	
21CS753	Introduction to Big Data		

Note: PCC: Professional Core Course, **PEC:** Professional Elective Courses, **OEC**–Open Elective Course, **AEC** –Ability Enhancement Courses.
L –Lecture, T – Tutorial, P- Practical / Drawing, S – Self Study Component, CIE: Continuous Internal Evaluation, SEE: Semester End Examination.

Note: VII and VIII semesters of IV year of the programme

(1) Institutions can swap VII and VIII Semester Scheme of Teaching and Examinations to accommodate research internship/ industry internship after the VI semester**.**

(2) Credits earned for the courses of VII and VIII Semester Scheme of Teaching and Examinations shall be counted against the corresponding semesters whether VII or VIII semester is completed during the beginning of IV year or later part of IV year of the programme.

PROJECT WORK (21XXP76): The objective of the Project work is

- **(i)** To encourage independent learning and the innovative attitude of the students.
- **(ii)** To develop interactive attitude, communication skills, organization, time management, and presentation skills.
- **(iii)** To impart flexibility and adaptability.
- **(iv)** To inspire team working.
- **(v)** To expand intellectual capacity, credibility, judgment and intuition.
- **(vi)** To adhere to punctuality, setting and meeting deadlines.
- **(vii)** To instil responsibilities to oneself and others.
- **(viii)**To train students to present the topic of project work in a seminar without any fear, face the audience confidently, enhance communication skills, involve in group discussion to present and exchange ideas.

CIE procedure for Project Work:

(1) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide.

The CIE marks awarded for the project work, shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

(2) Interdisciplinary: Continuous Internal Evaluation shall be group-wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable. The CIE marks awarded for the project work, shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

SEE procedure for Project Work: SEE for project work will be conducted by the two examiners appointed by the University. The SEE marks awarded for the project work, shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25.

TECHNICAL SEMINAR (21XXS81): The objective of the seminar is to inculcate self-learning, present the seminar topic confidently, enhance communication skill, involve in group discussion for exchange of ideas. Each student, under the guidance of a Faculty, shall choose, preferably, a recent topic of his/her interest relevant to the programme of Specialization.

- **(i)** Carry out literature survey, systematically organize the content.
- **(ii)** Prepare the report with own sentences, avoiding a cut and paste act.
- **(iii)**Type the matter to acquaint with the use of Micro-soft equation and drawing tools or any such facilities.
- **(iv)** Present the seminar topic orally and/or through PowerPoint slides.
- **(v)** Answer the queries and involve in debate/discussion.
- (**vi)** Submit a typed report with a list of references.

The participants shall take part in the discussion to foster a friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident.

Evaluation Procedure:

The CIE marks for the seminar shall be awarded (based on the relevance of the topic, presentation skill, participation in the question and answer session, and quality of report) by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three teachers from the department with the senior-most acting as the Chairman.

Marks distribution for CIE of the course:

Seminar Report:50 marks
Presentation skill:25 marks
Question and Answer: 25 marks.■No SEE component for Technical Seminar

Non – credit mandatory courses (NCMC):

National Service Scheme/Physical Education (Sport and Athletics)/ Yoga:

(1) Securing 40 % or more in CIE,35 % or more marks in SEE and 40 % or more in the sum total of CIE + SEE leads to successful completion of the registered course.

(2) In case, students fail to secure 35 % marks in SEE, they has to appear for SEE during the subsequent examinations conducted by the University.

(3) In case, any student fails to register for NSS, PE or Yoga/fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have not completed the requirements of the course. In such a case, the student has to fulfill the course requirements during subsequently to earn the qualifying CIE marks subject to the maximum programme period.

(4) Successful completion of the course shall be indicated as satisfactory in the grade card. Non-completion of the course shall be indicated as Unsatisfactory.

(5) Thesecourses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses shall be mandatory for the award of degree.

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III SEMESTER

Sl. No	Course and Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week: Theory Lecture (L)	Tutorial (T)	Practical/ Drawing (P)	Self -Study (S)	Examination: Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
1	BSC 21MAT31	Mathematics Course (Common to all)	TD- Maths PSB-Maths					03	50	50	100	3
2	IPCC 21EC32	Digital System Design using Verilog	TD: ECE PSB: ECE	3	0	2		03	50	50	100	4
3	IPCC 21EC33	Basic Signal Processing	TD: ECE PSB: ECE	3	0	2		03	50	50	100	4
4	PCC 21EC34	Analog Electronic Circuits	TD: ECE PSB: ECE	3	0	0	1	03	50	50	100	3
5	PCC 21ECL35	Analog and Digital Electronics Lab	TD: ECE PSB: ECE	0	0	2		03	50	50	100	1
6	UHV 21UH36	Social Connect and Responsibility	Any Department	0	0	1		01	50	50	100	1
7	HSMC 21KSK37/47	Samskrutika Kannada	TD and PSB HSMC	1	0	0		01	50	50	100	1
	HSMC 21KBK37/47	Balake Kannada										
	OR											
	HSMC 21CIP37/47	Constitution of India and Professional Ethics										
8	AEC 21EC38X	Ability Enhancement Course - III	TD: Concerned department PSB: Concerned Board	If offered as Theory Course					50	50	100	1
				1	0	0		01				
				If offered as lab. course								
				0	0	2		02				
								Total	**400**	**400**	**800**	**18**

Sl. No	Scheduled activities for III to VIII semesters	Course Title		
9	NMDC 21NS83	National Service Scheme (NSS)	NSS	All students have to register for any one of the course namely National Service Scheme, Physical Education (PE)(Sports and Athletics) and Yoga with the concerned coordinator of the course during the first week of III semester. The activities shall be carried out between III semester to VIII semester (for 5 semesters). SEE in the above courses shall be conducted during VIII semester examinations and the accumulated CIE marks shall be added to the SEE marks. Successful completion of the registered course is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE and Yoga activities.
	NMDC 21PE83	Physical Education (PE)(Sports and Athletics)	PE	
	NMDC 21YO83	Yoga	Yoga	

Course prescribed to lateral entry Diploma holders admitted to III semester B.E./B.Tech programs

Sl. No	Course and Course Code	Course Title	TD/PSB	L	T	P	S	Duration	CIE	SEE	Total	Credits
1	NCMC 21MATDIP31	Additional Mathematics - I	Maths	02	02	--	--	---	100	---	100	0

Note: BSC: Basic Science Course, **IPCC:** Integrated Professional Core Course, **PCC:** Professional Core Course, **INT** –Internship, **HSMC:** Humanity and Social Science & Management Courses, **AEC**–Ability Enhancement Courses. **UHV:** Universal Human Value Course.

L –Lecture, **T** – Tutorial, P- Practical/ Drawing, **S** – Self Study Component, **CIE:** Continuous Internal Evaluation, **SEE:** Semester End Examination.**TD-** Teaching Department, **PSB**: Paper Setting department

21KSK37/47 Samskrutika Kannada is for students who speak, read and write Kannada and **21KBK37/47** Balake Kannada is for non-Kannada speaking, reading, and writing students.

Integrated Professional Core Course (IPCC): Refers to Professional Theory Core Course Integrated with practical of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (B.E./B.Tech.) 2021-22 may be referred.

21INT49Inter/Intra Institutional Internship: All the students admitted to engineering programs under the lateral entry category shall have to undergo a mandatory 21INT49 Inter/Intra Institutional Internship of 03 weeks during the intervening period of III and IV semesters. The internship shall be slated for CIE only and will not have SEE. The letter grade earned through CIE shall be included in the IV semester grade card. The internship shall be considered as a head of passing and shall be considered for vertical progression and for the award of degree. Those, who do not take up / complete the internship shall be declared fail and shall have to complete during subsequently after satisfying the internship requirements. The faculty coordinator or mentor shall monitor the students' internship progress and interact with them for the successful completion of the internship.

Non–credit mandatory courses (NCMC):
(A) Additional Mathematics I and II:
(1) These courses are prescribed for III and IV semesters respectively to lateral entry Diploma holders admitted to III semester of B.E./B.Tech., programs. They shall attend the classes during the respective semesters to complete all the formalities of the course and appear for the Continuous Internal Evaluation (CIE). In case, any student fails to register for the said course/fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have secured an F grade. In such a case, the student has to fulfill the course requirements during subsequent semester/s to earn the qualifying CIE marks. These courses are slated for CIE only and have no SEE.
(2) Additional Mathematics I and II shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses shall be mandatory for the award of degree.
(3) Successful completion of the courses Additional Mathematics I and II shall be indicated as satisfactory in the grade card. Non-completion of the courses Additional Mathematics I and II shall be indicated as Unsatisfactory.
(B) National Service Scheme/Physical Education (Sport and Athletics)/ Yoga:
(1) Securing 40 % or more in CIE,35 % or more marks in SEE and 40 % or more in the sum total of CIE + SEE leads to successful completion of the registered course.
(2) In case, students fail to secure 35 % marks in SEE, they have to appear for SEE during the subsequent examinations conducted by the University.
(3) In case, any student fails to register for NSS, PE or Yoga/fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have not completed the requirements of the course. In such a case, the student has to fulfill the course requirements during subsequent semester/s to earn the qualifying CIE marks.
(4) Successful completion of the course shall be indicated as satisfactory in the grade card. Non-completion of the course shall be indicated as Unsatisfactory.
(5) These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses shall be mandatory for the award of degree.

Ability Enhancement Course - III			
21EC381	LD (Logic Design) Lab using Pspice / MultiSIM	21EC383	LIC (Linear Integrated Circuits) Lab using Pspice / MultiSIM
21EC382	AEC (Analog Electronic Circuits) Lab	21EC384	LabVIEW Programming Basics

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IV SEMESTER

Sl. No	Course and Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week: Theory Lecture L	Tutorial T	Practical/ Drawing P	Self -Study S	Examination: Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
1	BSC **21EC41**	Maths for Communication Engineers	TD, PSB-Maths					03	50	50	100	3
2	IPCC 21EC42	Digital Signal Processing	TD: ECE PSB: ECE	3	0	2		03	50	50	100	4
3	IPCC 21EC43	Circuits & Controls	TD: ECE PSB: ECE	3	0	2		03	50	50	100	4
4	PCC 21EC44	Communication Theory	TD: ECE PSB: ECE	3	0	0	1	03	50	50	100	3
5	AEC 21BE45	Biology For Engineers	BT, CHE, PHY	2	0	0		02	50	50	100	2
6	PCC 21ECL46	Communication Laboratory I	TD: ECE PSB: ECE	0	0	2		03	50	50	100	1
7	HSMC 21KSK37/47	Samskrutika Kannada	HSMC	1	0	0		01	50	50	100	1
	HSMC 21KBK37/47	Balake Kannada										
	OR											
	HSMC 21CIP37/47	Constitution of India & Professional Ethics										
8	AEC 21EC48X	Ability Enhancement Course- IV	TD and PSB: Concerned department	If offered as theory Course: 1	0	0		01	50	50	100	1
				If offered as lab. course: 0	0	2		02				
9	UHV 21UH49	Universal Human Values	Any Department	1	0	0		01	50	50	100	1
10	INT 21INT49	Inter/Intra Institutional Internship	Evaluation By the appropriate authorities	Completed during the intervening period ofII and III semesters by students admitted to first year of BE./B.Tech and during the intervening period of III and IV semesters by Lateral entry students admitted to III semester.				3	100	--	100	2
								Total	**550**	**450**	**1000**	**22**

Course prescribed to lateral entry Diploma holders admitted to III semester of Engineering programs

Sl. No	Course and Course Code	Course Title	TD/PSB	L	T	P	S	Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
1	NCMC 21MATDIP41	Additional Mathematics - II	Maths	02	02	--	--	--	100	--	100	0

Note: BSC: Basic Science Course, IPCC: Integrated Professional Core Course, PCC: Professional Core Course, AEC –Ability Enhancement Courses, HSMC: Humanity and Social Science and Management Courses, UHV- Universal Human Value Courses.
L –Lecture, T – Tutorial, P- Practical/ Drawing, S – Self Study Component, CIE: Continuous Internal Evaluation, SEE: Semester End Examination.

21KSK37/47 Samskrutika Kannada is for students who speak, read and write Kannada and 21KBK37/47 Balake Kannada is for non-Kannada speaking, reading, and writing students.

Integrated Professional Core Course (IPCC): Refers to Professional Theory Core Course Integrated with Practicals of the same course. Credit for IPCC can be 04 and its Teaching – Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from practical part of IPCCshall be included in the SEE question paper.For more details the regulation governing the Degree of Bachelor of Engineering /Technology (BE/B.Tech.) 2021-22 may be referred.

Non – credit mandatory course (NCMC):

Additional Mathematics - II:

(1) Lateral entry Diploma holders admitted to III semester of B.E./B.Tech., shall attend the classes during the IV semester to complete all the formalities of the course and appear for the Continuous Internal Evaluation (CIE). In case, any student fails to register for the said course/fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have secured an F grade. In such a case, the student has to fulfill the course requirements during subsequent semester/s to earn the qualifying CIE marks. These courses are slated for CIE only and have no SEE.

(2) Additional Mathematics I and II shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses shall be mandatory for the award of degree.

(3) Successful completion of the course Additional Mathematics II shall be indicated as satisfactory in the grade card. Non-completion of the courses Additional Mathematics II shall be indicated as Unsatisfactory.

Ability Enhancement Course - IV			
21EC481	Embedded C Basics	21EC483	Octave / Scilab for Signals
21EC482	C++ Basics	21EC484	DAQ using LabVIEW

Internship of 04 weeks during the intervening period of IV and V semesters; 21INT68Innovation/ Entrepreneurship/ Societal based Internship.

(1) All the students shall have to undergo a mandatory internship of 04 weeks during the intervening period of IV and V semesters. The internship shall be slated for CIE only and will not have SEE. The letter grade earned through CIE shall be included in the VI semester grade card.The internship shall be considered as a head of passing and shall be considered for vertical progression and for the award of degree. Those, who do not take up / complete the internship shall be considered under F (fail) grade and shall have to complete during subsequently after satisfying the internship requirements.

(2) Innovation/ Entrepreneurship Internship shall be carried out at industry, State and Central Government /Non-government organizations (NGOs), micro, small and medium enterprise (MSME), Innovation centres or Incubation centres. Innovation need not be a single major breakthrough; it can also be a series of small or incremental changes. Innovation of any kind can also happen outside of the business world.

Entrepreneurship internships offers a chance to gain hands on experience in the world of entrepreneurship and helps to learn what it takes to run a small entrepreneurial business by performing intern duties with an established company. This experience can then be applied to future business endeavours. Start-ups and small companies are a preferred place to learn the business tack ticks for future entrepreneurs as learning how a small business operates will serve the intern well when he/she manages his/her own company. Entrepreneurship acts as a catalyst to open the minds to creativity and innovation. Entrepreneurship internship can be from several sectors, including technology, small and medium-sized, and the service sector.

(3) Societal or social internship.

Urbanization is increasing on a global scale; and yet, half the world's population still resides in rural areas and is devoid of many things that urban population enjoy. Rural internship is a work-based activity in which students will have a chance to solve/reduce the problems of the rural place for better living.

As proposed under the AICTE rural internship programme, activities under Societal or social internship, particularly in rural areas, shall be considered for 40 points under AICTE activity point programme.

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V SEMESTER

Sl. No	Course and Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
				Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
				L	T	P	S					
1	BSC 21EC51	Digital Communication	TD: ECE PSB: ECE	3	0	0	1	03	50	50	100	3
2	IPCC 21EC52	Computer Organization & ARM Microcontroller	TD: ECE, CSE PSB: ECE	3	0	2		03	50	50	100	4
3	PCC 21EC53	Computer Communication Networks	TD: ECE PSB: ECE	3	0	0	1	03	50	50	100	3
4	PCC 21EC54	Electromagnetics Waves	TD: ECE PSB: ECE	3	0	0		03	50	50	100	3
5	PCC 21ECL55	Communication Lab II		0	0	2		03	50	50	100	1
6	AEC 21EC56	Research Methodology & Intellectual Property Rights	TD: Any Department PSB: As identified by University	2	0	0		02	50	50	100	2
7	HSMC 21CIV57	Environmental Studies	TD: Civil/ Environmental /Chemistry/ Biotech. PSB: Civil Engg	1	0	0		1	50	50	100	1
8	AEC 21EC58X	Ability Enhancement Course-V	Concerned Board	If offered as Theory courses				01	50	50	100	1
				1	0	0						
				If offered as lab. courses				02				
				0	0	2						
								Total	**400**	**400**	**800**	**18**

Ability Enhancement Course - V

21EC581	IoT (Internet of Things) Lab	21EC583	Java Programming
21EC582	Communication Simulink Toolbox	21EC584	Data Structures Using C++

Note: BSC: Basic Science Course, PCC: Professional Core Course, IPCC: Integrated Professional Core Course, AEC –Ability Enhancement Course INT – Internship, HSMC: Humanity and Social Science & Management Courses.
L –Lecture, T – Tutorial, P- Practical/ Drawing, S – Self Study Component, CIE: Continuous Internal Evaluation, SEE: Semester End Examination.

Integrated Professional Core Course (IPCC): refers to Professional Theory Core Course Integrated with Practical of the same course. Credit for IPCC can be 04 and its Teaching – Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). Theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by CIE only and there shall be no SEE. For more details the regulation governing the Degree of Bachelor of Engineering /Technology (BE/B.Tech.) 2021-22 may be referred.

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VI SEMESTER

Sl. No	Course and Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination					Credits
				Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks		
				L	T	P	S						
1	HSMC 21EC61	Technological Innovation Management and Entrepreneurship	Any Department	3	0	0	0	03	50	50	100		3
2	IPCC 21EC62	Microwave Theory & Antennas	TD: ECE PSB: ECE	3	0	2		03	50	50	100		4
3	PCC 21EC63	VLSI Design & Testing	TD: ECE PSB: ECE	3	0	0		03	50	50	100		3
4	PEC 21EC64x	Professional Elective Course-I	TD: ECE PSB: ECE					03	50	50	100		3
5	OEC 21EC65x	Open Elective Course-I	Concerned Department					03	50	50	100		3
6	PCC 21ECL66	VLSI Laboratory		0	0	2		03	50	50	100		1
7	MP 21ECMP67	Mini Project		Two contact hours /week for interaction between the faculty and students.				--	100	--	100		2
8	INT 21INT68	Innovation/Entrepreneurship /Societal Internship	Completed during the intervening period of IV and V semesters.					--	100	--	100		3
								Total	500	300	800		22

Professional Elective – I

21EC641	Artificial Neural Networks (L:T:P :: 2:2:0)	21EC643	Python Programming (L:T:P :: 2:0:2)
21EC642	Cryptography (L:T:P :: 2:2:0)	21EC644	Micro Electro Mechanical Systems (L:T:P :: 3:0:0)

Open Electives – I offered by the Department to other Department students

21EC651	Communication Engineering (L:T:P :: 3:0:0)	21EC653	Basic VLSI Design (L:T:P :: 3:0:0)
21EC652	Microcontrollers (L:T:P :: 3:0:0)	21EC654	Electronic Circuits with Verilog (L:T:P :: 2:0:2)
21EC655	Sensors & Actuators (L:T:P :: 3:0:0)		

Note: HSMC: Humanity and Social Science & Management Courses, **IPCC:** Integrated Professional Core Course, **PCC:** Professional Core Course, **PEC:** Professional Elective Courses, OEC–Open Elective Course, **MP** –Mini Project, INT –Internship.
L –Lecture, **T** – Tutorial, **P** - Practical / Drawing, **S** – Self Study Component, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Examination.

Integrated Professional Core Course (IPCC): Refers to Professional Theory Core Course Integrated with Practical of the same course. Credit for IPCC can be 04 and its Teaching – Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by CIE only and there shall be no SEE. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (BE/B.Tech) 2021-22 may be referred.

Professional Elective Courses(PEC):
A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an option to select one course out of five courses. The minimum students' strength for offering professional electives is 10. However, this conditional shall not be applicable to cases where the admission to the programme is less than 10.

Open Elective Courses:
Students belonging to a particular stream of Engineering and Technology are not entitled for the open electives offered by their parent Department. However, they can opt an elective offered by other Departments, provided they satisfy the prerequisite condition if any. Registration to open electives shall be documented under the guidance of the Program Coordinator/ Advisor/Mentor.
Selection of an open elective shall **not be allowed** if,

(i) The candidate has studied the same course during the previous semesters of the program.
(ii) The syllabus content of open electives is similar to that of the Departmental core courses or professional electives.
(iii) A similar course, under any category, is prescribed in the higher semesters of the program.

In case, any college is desirous of offering a course (not included in the Open Elective List of the University) from streams such as Law, Business

(MBA), Medicine, Arts, Commerce, etc., can seek permission, at least one month before the commencement of the semester, from the University by submitting a copy of the syllabus along with the details of expertise available to teach the same in the college.
The minimum students' strength for offering open electives is 10. However, this conditional shall not be applicable to cases where the admission to the programme is less than 10.

Mini-project work: Mini Project is a laboratory-oriented course which will provide a platform to students to enhance their practical knowledge and skills by the development of small systems/applications.
Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary Mini- project can be assigned to an individual student or to a group having not more than 4 students.

CIE procedure for Mini-project:

(i) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two faculty members of the Department, one of them being the Guide. The CIE marks awarded for the Mini-project work shall be based on the evaluation of project report, project presentation skill, and question and answer session in the ratio of 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

(ii) Interdisciplinary: Continuous Internal Evaluation shall be group-wise at the college level with the participation of all the guides of the project.
The CIE marks awarded for the Mini-project, shall be based on the evaluation of project report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

No SEE component for Mini-Project.

VII semester Class work and Research Internship /Industry Internship (21INT82)

Swapping Facility

Institutions can swap VII and VIII Semester Scheme of Teaching and Examinations to accommodate research internship/ industry internship after the VI semester**.**

(2) Credits earned for the courses of VII and VIII Semester Scheme of Teaching and Examinations shall be counted against the corresponding semesters whether VII or VIII semester is completed during the beginning of IV year or later part of IV year of the program.

Elucidation:

At the beginning of IV year of the programme i.e., after VI semester, VII semester classwork and VIII semester Research Internship /Industrial Internship shall be permitted to be operated simultaneously by the University so that students have ample opportunity for internship. In other words, a good percentage of the class shall attend VII semester classwork and similar percentage of others shall attend to Research Internship or Industrial Internship.

Research/Industrial Internship shall be carried out at an Industry, NGO, MSME, Innovation centre, Incubation centre, Start-up, Centers of Excellence (CoE), Study Centre established in the parent institute and /or at reputed research organizations / institutes. The intership can also be rural internship.

The mandatory Research internship /Industry internship is for 24 weeks. The internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take up/complete the internship shall be declared fail and shall have to complete during the subsequent University examination after satisfying the internship requirements.

INT21INT82Research Internship/ Industry Internship/Rural Internship

Research internship: A research internship is intended to offer the flavour of current research going on in the research field. It helps students get familiarized with the field and imparts the skill required for carrying out research.

Industry internship: Is an extended period of work experience undertaken by students to supplement their degree for professional development. It also helps them learn to overcome unexpected obstacles and successfully navigate organizations, perspectives, and cultures. Dealing with contingencies helps students recognize, appreciate, and adapt to organizational realities by tempering their knowledge with practical constraints.

The faculty coordinator or mentor has to monitor the students' internship progress and interact with them to guide for the successful completion of the internship.

The students are permitted to carry out the internship anywhere in India or abroad. University shall not bear any expenses incurred in respect of internship.

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B.E. in Electronics and Communication Engineering (ECE)
Scheme of Teaching and Examinations 2021
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(Effective from the academic year 2021 - 22)

Swappable VII and VIII SEMESTER

VII SEMESTER

Sl. No	Course and Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week: Theory Lecture (L)	Tutorial (T)	Practical/ Drawing (P)	Self -Study (S)	Examination: Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
1	PCC 21EC71	Advanced VLSI	TD: ECE PSB: ECE	3	0	0		3	50	50	100	3
2	PCC 21EC72	Optical & Wireless Communication	TD: ECE PSB: ECE	2	0	0		3	50	50	100	2
3	PEC **21EC73X**	Professional elective Course-II	TD: ECE PSB: ECE					3	50	50	100	3
4	PEC **21EC74X**	Professional elective Course-III	TD: ECE PSB: ECE					3	50	50	100	3
5	OEC **21EC75X**	Open elective Course-II	Concerned Department					3	50	50	100	3
6	Project **21EC76**	Project work		Two contact hours /week for interaction between the faculty and students.				3	100	100	200	10
								Total	**350**	**350**	**700**	**24**

VIII SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department	Teaching Hours /Week: Theory Lecture (L)	Tutorial (T)	Practical/ Drawing (P)	Self -Study (S)	Examination: Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
1	Seminar 21EC81		Technical Seminar		One contact hour /week for interaction between the faculty and students.				--	100	--	100	01
2	INT 21INT82		Research Internship/ Industry Internship		Two contact hours /week for interaction between the faculty and students.				03 (Batch wise)	100	100	200	15
3	NCMC	21NS83	National Service Scheme (NSS)	NSS	Completed during the intervening period of III semester to VIII semester.				--	50	50	100	0
		21PE83	Physical Education (PE) (Sports and Athletics)	PE									
		21YO83	Yoga	Yoga									
									Total	**250**	**150**	**400**	**16**

Professional Elective - II

21EC731	Advanced Design Tools for VLSI (L:T:P :: 2:0:2)	**21EC734**	Biomedical Signal Processing (L:T:P :: 3:0:0)
21EC732	Digital Image Processing (L:T:P :: 2:0:2)	**21EC735**	Speech Signal Processing (L:T:P :: 3:0:0)
21EC733	DSP Algorithms & Architecture (L:T:P :: 3:0:0)		

Professional Elective - III

21EC741	IoT & Wireless Sensor Networks (L:T:P :: 3:0:0)	**21EC744**	Machine Learning with Python (L:T:P :: 2:0:2)
21EC742	Network Security (L:T:P :: 3:0:0)	**21EC745**	Multimedia Communication (L:T:P :: 2:0:2)
21EC743	Fabrication technology (L:T:P :: 3:0:0)		

Open Electives - II offered by the Department to other Department students			
21EC751	Optical & Satellite Communication (L:T:P :: 3:0:0)	21EC754	Basic Digital Signal Processing (L:T:P :: 2:0:2)
21EC752	ARM Embedded Systems (L:T:P :: 3:0:0)	21EC755	E-waste Management (L:T:P :: 3:0:0)
21EC753	Basic Digital Image Processing (L:T:P :: 2:0:2)		

Note: PCC: Professional Core Course, **PEC:** Professional Elective Courses, **OEC**–Open Elective Course, **AEC** –Ability Enhancement Courses.
L –Lecture, T – Tutorial, P- Practical / Drawing, S – Self Study Component, CIE: Continuous Internal Evaluation, SEE: Semester End Examination.

Note: VII and VIII semesters of IV year of the programme

(1) Institutions can swap VII and VIII Semester Scheme of Teaching and Examinations to accommodate research internship/ industry internship after the VI semester.

(2) Credits earned for the courses of VII and VIII Semester Scheme of Teaching and Examinations shall be counted against the corresponding semesters whether VII or VIII semester is completed during the beginning of IV year or later part of IV year of the programme.

PROJECT WORK (21XXP75): The objective of the Project work is

- **(i)** To encourage independent learning and the innovative attitude of the students.
- **(ii)** To develop interactive attitude, communication skills, organization, time management, and presentation skills.
- **(iii)** To impart flexibility and adaptability.
- **(iv)** To inspire team working.
- **(v)** To expand intellectual capacity, credibility, judgment and intuition.
- **(vi)** To adhere to punctuality, setting and meeting deadlines.
- **(vii)** To install responsibilities to oneself and others.
- **(viii)**To train students to present the topic of project work in a seminar without any fear, face the audience confidently, enhance communication skills, involve in group discussion to present and exchange ideas.

CIE procedure for Project Work:

(1) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide.

The CIE marks awarded for the project work, shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

(2) Interdisciplinary: Continuous Internal Evaluation shall be group-wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable. The CIE marks awarded for the project work, shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

SEE procedure for Project Work: SEE for project work will be conducted by the two examiners appointed by the University. The SEE marks awarded for the project work shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25.

TECHNICAL SEMINAR (21XXS81): The objective of the seminar is to inculcate self-learning, present the seminar topic confidently, enhance communication skill, involve in group discussion for exchange of ideas. Each student, under the guidance of a Faculty, shall choose, preferably, a recent topic of his/her interest relevant to the programme of Specialization.

- **(i)** Carry out literature survey, systematically organize the content.
- **(ii)** Prepare the report with own sentences, avoiding a cut and paste act.
- **(iii)**Type the matter to acquaint with the use of Micro-soft equation and drawing tools or any such facilities.
- **(iv)** Present the seminar topic orally and/or through PowerPoint slides.
- **(v)** Answer the queries and involve in debate/discussion.
- **(vi)** Submit a typed report with a list of references.

The participants shall take part in the discussion to foster a friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident.

Evaluation Procedure:

The CIE marks for the seminar shall be awarded (based on the relevance of the topic, presentation skill, participation in the question and answer session, and quality of report) by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three teachers from the department with the senior-most acting as the Chairman.

Marks distribution for CIE of the course:

Seminar Report:50 marks
Presentation skill:25 marks
Question and Answer: 25 marks. ■No SEE component for Technical Seminar

Non – credit mandatory courses (NCMC):

National Service Scheme/Physical Education (Sport and Athletics)/ Yoga:

(1) Securing 40 % or more in CIE,35 % or more marks in SEE and 40 % or more in the sum total of CIE + SEE leads to successful completion of the registered course.

(2) In case, students fail to secure 35 % marks in SEE, they has to appear for SEE during the subsequent examinations conducted by the University.

(3) In case, any student fails to register for NSS, PE or Yoga/fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have not completed the requirements of the course. In such a case, the student has to fulfill the course requirements during subsequently to earn the qualifying CIE marks subject to the maximum programme period.

(4) Successful completion of the course shall be indicated as satisfactory in the grade card. Non-completion of the course shall be indicated as Unsatisfactory.

(5) These course shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses shall be mandatory for the award of degree.

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III Semester

Digital System Design Using Verilog			
Course Code	**21EC32**	CIE Marks	50
Teaching Hours/Week (L: T: P: S)	(3:0:2:0)	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory + 13 Lab slots	Total Marks	100
Credits	04	Exam Hours	03

Course objectives: This course will enable students to:

1. To impart the concepts of simplifying Boolean expression using K-map techniques and Quine-McCluskey minimization techniques.
2. To impart the concepts of designing and analyzing combinational logic circuits.
3. To impart design methods and analysis of sequential logic circuits.
4. To impart the concepts of Verilog HDL-data flow and behavioral models for the design of digital systems.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

- Lecture method (L) does not mean only traditional lecture method, but different type of teaching methods may be adopted to develop the outcomes.
- Show Video/animation films to explain the different concepts of Linear Algebra & Signal Processing.
- Encourage collaborative (Group) Learning in the class .
- Ask at least three HOTS (Higher order Thinking) questions in the class, which promotes critical thinking.
- Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
- Topics will be introduced in a multiple representation.
- Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
- Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.
- Adopt Flipped class technique by sharing the materials / Sample Videos prior to the class and have discussions on the that topic in the succeeding classes.
- Give Programming Assignments.

Module-1

Principles of Combinational Logic: Definition of combinational logic, Canonical forms, Generation of switching equations from truth tables, Karnaugh maps- up to 4 variables, Quine-McCluskey Minimization Technique. Quine-McCluskey using Don't Care Terms. (Section 3.1 to 3.5 of Text 1).

Teaching-Learning Process	Chalk and Talk, YouTube videos **RBT Level:** L1, L2, L3

Module-2

Logic Design with MSI Components and Programmable Logic Devices: Binary Adders and Subtractors, Comparators, Decoders, Encoders, Multiplexers, Programmable Logic Devices (PLDs)
(Section 5.1 to 5.7 of Text 2)

Teaching-Learning Process	Chalk and Talk, YouTube videos **RBT Level:** L1, L2, L3

Module-3	
Flip-Flops and its Applications: The Master-Slave Flip-flops (Pulse-Triggered flip-flops): SR flip-flops, JK flip flops, Characteristic equations, Registers, Binary Ripple Counters, Synchronous Binary Counters, Counters based on Shift Registers, Design of Synchronous mod-n Counter using clocked T, JK, D and SR flip-flops. (Section 6.4, 6.6 to 6.9 (Excluding 6.9.3) of Text 2)	
Teaching-Learning Process	Chalk and Talk, YouTube videos **RBT Level:** L1, L2, L3
Module-4	
Introduction to Verilog: Structure of Verilog module, Operators, Data Types, Styles of Description. (Section 1.1 to 1.6.2, 1.6.4 (only Verilog), 2 of Text 3) **Verilog Data flow description:** Highlights of Data flow description, Structure of Data flow description. (Section 2.1 to 2.2 (only Verilog) of Text 3)	
Teaching-Learning Process	Chalk and Talk, YouTube videos, Programming assignments **RBT Level:** L1, L2, L3
Module-5	
Verilog Behavioral description: Structure, Variable Assignment Statement, Sequential Statements, Loop Statements, Verilog Behavioral Description of Multiplexers (2:1, 4:1, 8:1). (Section 3.1 to 3.4 (only Verilog) of Text 3) **Verilog Structural description**: Highlights of Structural description, Organization of structural description, Structural description of ripple carry adder. (Section 4.1 to 4.2 of Text 3)	
Teaching-Learning Process	Chalk and Talk, YouTube videos, Programming assignments **RBT Level:** L1, L2, L3
PRACTICAL COMPONENT OF IPCC Using suitable simulation software, demonstrate the operation of the following circuits:	

Sl.No	Experiments
1	To simplify the given Boolean expressions and realize using Verilog program.
2	To realize Adder/Subtractor (Full/half) circuits using Verilog data flow description.
3	To realize 4-bit ALU using Verilog program.
4	To realize the following Code converters using Verilog Behavioral description a) Gray to binary and vice versa b) Binary to excess3 and vice versa
5	To realize using Verilog Behavioral description: 8:1 mux, 8:3 encoder, Priority encoder
6	To realize using Verilog Behavioral description: 1:8 Demux, 3:8 decoder, 2-bit Comparator
7	To realize using Verilog Behavioral description: Flip-flops: a) JK type b) SR type c) T type and d) D type
8	To realize Counters - up/down (BCD and binary) using Verilog Behavioral description.
Demonstration Experiments (For CIE only – not to be included for SEE) Use FPGA/CPLD kits for downloading Verilog codes and check the output for interfacing experiments.	
9	Verilog Program to interface a Stepper motor to the FPGA/CPLD and rotate the motor in the specified direction (by N steps).
10	Verilog programs to interface a Relay or ADC to the FPGA/CPLD and demonstrate its working.
11	Verilog programs to interface DAC to the FPGA/CPLD for Waveform generation.
12	Verilog programs to interface Switches and LEDs to the FPGA/CPLD and demonstrate its working.

Course Outcomes

At the end of the course the student will be able to:

1. Simplify Boolean functions using K-map and Quine-McCluskey minimization technique.
2. Analyze and design for combinational logic circuits.
3. Analyze the concepts of Flip Flops (SR, D, T and JK) and to design the synchronous sequential circuits using Flip Flops.
4. Model Combinational circuits (adders, subtractors, multiplexers) and sequential circuits using Verilog descriptions.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

CIE for the theory component of IPCC

Two Tests each of **20 Marks (duration 01 hour**)

- First test at the end of 5th week of the semester
- Second test at the end of the 10th week of the semester

Two assignments each of **10 Marks**

- First assignment at the end of 4th week of the semester
- Second assignment at the end of 9th week of the semester

Scaled-down marks of two tests and two assignments added will be CIE marks for the theory component of IPCC for **30 marks**.

CIE for the practical component of IPCC

- On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The **15 marks** are for conducting the experiment and preparation of the laboratory record, the other **05 marks shall be for the test** conducted at the end of the semester.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to 15 marks.
- The laboratory test **(duration 03 hours)** at the end of the 15th week of the semester /after completion of all the experiments (whichever is early) shall be conducted for 50 marks and scaled down to 05 marks.

Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **20 marks**.

SEE for IPCC

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (duration 03 hours)

- The question paper will have ten questions. Each question is set for 20 marks.
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
- The students have to answer 5 full questions, selecting one full question from each module.

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component.

- The minimum marks to be secured in CIE to appear for SEE shall be the 12 (40% of maximum marks-30) in the theory component and 08 (40% of maximum marks -20) in the practical component. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included. The maximum of 04/05 questions to be set from the practical component of IPCC, the total marks of all questions should not be more than the 20 marks.

SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured out of 100 will be scaled down to 50 marks.

Suggested Learning Resources:

Text Books

1. Digital Logic Applications and Design by John M Yarbrough, Thomson Learning, 2001.
2. Digital Principles and Design by Donald D Givone, McGraw Hill, 2002.
3. HDL Programming VHDL and Verilog by Nazeih M Botros, 2009 reprint, Dreamtech press.

Reference Books:

1. Fundamentals of logic design, by Charles H Roth Jr., Cengage Learning
2. Logic Design, by Sudhakar Samuel, Pearson/ Sanguine, 2007
3. Fundamentals of HDL, by Cyril P R, Pearson/Sanguine 2010

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Programming Assignments / Mini Projects can be given to improve programming skills.

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III Semester

Basic Signal Processing			
Course Code	**21EC33**	CIE Marks	50
Teaching Hours/Week (L: T: P: S)	(3:0:2:0)	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory + 13 Lab slots	Total Marks	100
Credits	04	Exam Hours	03

Course objectives: This course will enable students to:

Preparation: To prepare students with fundamental knowledge/ overview in the field of Signal Processing with Familiarization with the concept of Vector spaces and orthogonality with a qualitative insight into applications in communications.

Core Competence: To equip students with a basic foundation of Signal Processing by delivering the basics of quantitative parameters for Matrices & Linear Transformations, the mathematical description of discrete time signals and systems, analyzing the signals in time domain using convolution sum, classifying signals into different categories based on their properties, analyzing Linear Time Invariant (LTI) systems in time and transform domains

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

- Lecture method (L) does not mean only traditional lecture method, but different type of teaching methods may be adopted to develop the outcomes.
- Show Video/animation films to explain the different concepts of Linear Algebra & Signal Processing.
- Encourage collaborative (Group) Learning in the class.
- Ask at least three HOTS (Higher order Thinking) questions in the class, which promotes critical thinking.
- Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
- Topics will be introduced in a multiple representation.
- Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
- Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.
- Adopt Flipped class technique by sharing the materials / Sample Videos prior to the class and have discussions on the that topic in the succeeding classes.
- Give Programming Assignments.

Module-1

Vector Spaces: Vector spaces and Null subspaces, Rank and Row reduced form, Independence, Basis and dimension, Dimensions of the four subspaces, Rank-Nullity Theorem, Linear Transformations Orthogonality: Orthogonal Vectors and Subspaces, Projections and Least squares, Orthogonal Bases and Gram-Schmidt Orthogonalization procedure

(Refer Chapters 2 and 3 of Text 1)

Teaching-Learning Process	Chalk and Talk, YouTube videos, Flipped Class Technique, Programming assignments **RBT Level:** L1, L2, L3

Module-2	
Eigen values and Eigen vectors: Review of Eigen values and Diagonalization of a Matrix, Special Matrices (Positive Definite, Symmetric) and their properties, Singular Value Decomposition. **(Refer Chapter 5, Text 1)**	
Teaching-Learning Process	Chalk and Talk, YouTube videos, Flipped Class Technique, Programming assignments **RBT Level:** L1, L2, L3
Module-3	
Introduction and Classification of signals: Definition of signal and systems with examples, Elementary signals/Functions: Exponential, sinusoidal, step, impulse and ramp functions **Basic Operations on signals:** Amplitude scaling, addition, multiplication, time scaling, time shift and time reversal. Expression of triangular, rectangular and other waveforms in terms of elementary signals **System Classification and properties:** Linear-nonlinear, Time variant -invariant, causal-noncausal, static-dynamic, stable-unstable, invertible. **(Text 2) [Only for Discrete Signals & Systems]**	
Teaching-Learning Process	Chalk and Talk, YouTube videos, Flipped Class Technique, Programming assignments **RBT Level:** L1, L2, L3
Module-4	
Time domain representation of LTI System: Impulse response, convolution sum. Computation of convolution sum using graphical method for unit step and unit step, unit step and exponential, exponential and exponential, unit step and rectangular, and rectangular and rectangular. **LTI system Properties in terms of impulse response:** System interconnection, Memory less, Causal, Stable, Invertible and Deconvolution and step response **(Text 2) [Only for Discrete Signals & Systems]**	
Teaching-Learning Process	Chalk and Talk, YouTube videos, Flipped Class Technique, Programming assignments **RBT Level:** L1, L2, L3
Module-5	
The Z-Transforms: Z transform, properties of the region of convergence, properties of the Z-transform, Inverse Z-transform by partial fraction, Causality and stability, Transform analysis of LTI systems. **(Text 2)**	
Teaching-Learning Process	Chalk and Talk, YouTube videos, Flipped Class Technique, Programming assignments **RBT Level:** L1, L2, L3

PRACTICAL COMPONENT OF IPCC

Sl.No	Experiments
1	a. Program to create and modify a vector (array). b. Program to create and modify a matrix.
2	Programs on basic operations on matrix.
3	Program to solve system of linear equations.
4	Program for Gram-Schmidt orthogonalization.
5	Program to find Eigen value and Eigen vector.
6	Program to find Singular value decomposition.

7	Program to generate discrete waveforms.
8	Program to perform basic operation on signals.
9	Program to perform convolution of two given sequences.
10	a. Program to perform verification of commutative property of convolution. b. Program to perform verification of distributive property of convolution. c. Program to perform verification of associative property of convolution.
11	Program to compute step response from the given impulse response.
12	Programs to find Z-transform and inverse Z-transform of a sequence.

Course outcomes (Course Skill Set)

At the end of the course the student will be able to :

1. Understand the basics of Linear Algebra
2. Analyse different types of signals and systems
3. Analyse the properties of discrete-time signals & systems
4. Analyse discrete time signals & systems using Z transforms

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

CIE for the theory component of IPCC

Two Tests each of **20 Marks (duration 01 hour**)

- First test at the end of 5th week of the semester
- Second test at the end of the 10th week of the semester

Two assignments each of **10 Marks**

- First assignment at the end of 4th week of the semester
- Programming assignment at the end of 9th week of the semester, which can be implemented using programming languages like C++/Python/Java/Scilab

Scaled-down marks of two tests and two assignments added will be CIE marks for the theory component of IPCC for **30 marks**.

CIE for the practical component of IPCC

- On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The **15 marks** are for conducting the experiment and preparation of the laboratory record, the other **05 marks shall be for the test** conducted at the end of the semester.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to 15 marks.
- The laboratory test **(duration 03 hours)** at the end of the 15th week of the semester /after completion of all the experiments (whichever is early) shall be conducted for 50 marks and scaled down to 05 marks.

Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **20 marks**.

SEE for IPCC

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (duration 03 hours)

- The question paper will have ten questions. Each question is set for 20 marks.
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
- The students have to answer 5 full questions, selecting one full question from each module.

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component.

- The minimum marks to be secured in CIE to appear for SEE shall be the 12 (40% of maximum marks-30) in the theory component and 08 (40% of maximum marks -20) in the practical component. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included**.** The maximum of 04/05 questions to be set from the practical component of IPCC, the total marks of all questions should not be more than the 20 marks.

SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured out of 100 will be scaled down to 50 marks.

Suggested Learning Resources:

Text Books

1. Gilbert Strang, "Linear Algebra and its Applications", Cengage Learning, 4^{th} Edition, 2006, ISBN 97809802327
2. Simon Haykin and Barry Van Veen, "Signals and Systems", 2^{nd} Edition, 2008, Wiley India. ISBN9971-51-239-4.

Reference Books:

1. **Michael Roberts,** "Fundamentals of Signals & Systems",2^{nd} edition, Tata McGraw-Hill, 2010, ISBN978-0-07-070221-9.
2. **Alan** V **Oppenheim, Alan** S **Willsky and** S **Hamid Nawab,** "Signals and Systems" Pearson Education Asia / PHI, 2"" edition, 1997. Indian Reprint 2002.
3. **H P Hsu, R Ranjan,** "Signals and Systems", Schaum's outlines, TMH, 2006.
4. **B P Lathi,** "Linear Systems and Signals", Oxford University Press, 2005.
5. **Ganesh Rao and Satish Tunga,** "Signals and Systems", Pearson/Sanguine.
6. **Seymour Lipschutz, Marc Lipson**, "Schaums Easy Outline of Linear Algebra", 2020.

Web links and Video Lectures (e-Resources):

Video lectures on Signals and Systems by Alan V Oppenheim

Lecture 1, Introduction | MIT RES.6.007 Signals and Systems, Spring 2011 - YouTube

Lecture 2, Signals and Systems: Part 1 | MIT RES.6.007 Signals and Systems, Spring 2011 - YouTube

NPTEL video lectures signals and system:

https://www.youtube.com/watch?v=7Z3LE5uM-6Y&list=PLbMVogVj5nJQQZbah2uRZIRZ_9kfoqZyx

Video lectures on Linear Algebra by Gilbert Strang

https://www.youtube.com/watch?v=ZK3O402wf1c&list=PL49CF3715CB9EF31D&index=1

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Programming Assignments / Mini Projects can be given to improve programming skills

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B.E: Electronics & Communication Engineering / B.E: Electronics & Telecommunication Engineering
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(Effective from the academic year 2021 – 22)

III Semester

Analog Electronic Circuits			
Course Code	**21EC34**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:1	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3

Course objectives: This course will enable students to

- Explain various BJT parameters, connections and configurations.
- Design and demonstrate the diode circuits and transistor amplifiers.
- Explain various types of FET biasing and demonstrate the use of FET amplifiers.
- Analyze Power amplifier circuits in different modes of operation.
- Construct Feedback and Oscillator circuits using FET.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1.Lecture method (L) does not mean only traditional lecture method, but different type of teaching methods may be adopted to develop the outcomes.
2.Show Video/animation films to explain evolution of communication technologies.
3. Encourage collaborative (Group) Learning in the class
4.Ask at least three HOTS (Higher order Thinking) questions in the class, which promotes critical thinking
5.Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6.Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
7.Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

BJT Biasing: Biasing in BJT amplifier circuits: The Classical Discrete circuit bias (Voltage-divider bias), Biasing using a collector to base feedback resistor.

Small signal operation and Models: Collector current and transconductance, Base current and input resistance, Emitter current and input resistance, voltage gain, Separating the signal and the DC quantities, The hybrid Π model, The T model.

MOSFETs: Biasing in MOS amplifier circuits: Fixing VGS, Fixing VG, Drain to Gate feedback resistor.

Small signal operation and modeling: The DC bias point, signal current in drain, voltage gain, small signal equivalent circuit models, transconductance, The T equivalent circuit model.

[Text 1: 3.5(3.5.1, 3.5.3), 3.6(3.6.1 to 3.6.7), 4.5(4.5.1, 4.5.2, 4.5.3), 4.6(4.6.1 to 4.6.7)]

Teaching-Learning Process	Chalk and talk method, Power Point Presentation. **Self-study topics:**Basic BJT Amplifier Configurations- Design of Common Emitter and Common collector amplifier circuits. **RBT Level:** L1, L2, L3

Module-2

MOSFET Amplifier configuration: Basic configurations, characterizing amplifiers, CS amplifier with and without source resistance RS, Source follower.

MOSFET internal capacitances and High frequency model: The gate capacitive effect, Junction capacitances, High frequency model.

Frequency response of the CS amplifier: The three frequency bands, high frequency response, Low frequency response.

Oscillators: FET based Phase shift oscillator, LC and Crystal Oscillators (no derivation) [Text 1: 4.7(4.7.1 to 4.7.4, 4.7.6) 4.8(4.8.1, 4.8.2, 4.8.3), 4.9, 12.2.2, 12.3.1, 12,3,2]	
Teaching-Learning Process	Chalk and talk method, Power Point Presentation. **Self-study topics:**Discrete Circuit MOS Amplifier – The common source amplifier and the source follower. **RBT Level:** L1, L2, L3
Module-3	
Feedback Amplifier: General feedback structure, Properties of negative feedback, The Four Basic Feedback Topologies, The series-shunt, series-series, shunt-shunt and shunt-series amplifiers (Qualitative Analysis). **Output Stages and Power Amplifiers:** Introduction, Classification of output stages, Class A output stage, Class B output stage: Transfer Characteristics, Power Dissipation, Power Conversion efficiency, Class AB output stage, Class C tuned Amplifier. [Text 1: 7.1, 7.2, 7.3, 7.4.1, 7.5.1, 7.6 (7.6.1 to 7.6.3), 13.1, 13.2, 13.3(13.3.1, 13.3.2, 13.3.3, 13.4, 13.7)]	
Teaching-Learning Process	Chalk and talk method, Power Point Presentation. **Self-study topics:**Class D power amplifier. **RBT Level:** L1, L2, L3
Module-4	
Op-Amp Circuits: Op-amp DC and AC Amplifiers, DAC - Weighted resistor and R-2R ladder, ADC-Successive approximation type, Small Signal half wave rectifier, Absolute value output circuit, Active Filters, First and second order low-pass and high-pass Butterworth filters, Band-pass filters, Band reject filters. **555 Timer and its applications:** Monostable and Astable Multivibrators. [Text 2: 6.2, 8.11(8.11.1a, 8.11.1b), 8.11.2a, 8.12.2,8.13 7.2, 7.3, 7.4, 7.5, 7.6, 7.8, 7.9, 9.4.1, 9.4.1(a), 9.4.3, 9.4.3(a)]	
Teaching-Learning Process	Chalk and talk method, Power Point Presentation. **Self-study topics:**Clippers and Clampers, Peak detector, Sample and hold circuit. **RBT Level:** L1, L2, L3
Module-5	
Overview of Power Electronic Systems: Power Electronic Systems, Power Electronic Converters and Applications. **Thyristors:** Static Anode-Cathode characteristics and Gate characteristics of SCR, Turn-ON methods, Turn-off Mechanism, Turn-OFF Methods: Natural and Forced Commutation – Class A without design consideration. **Gate Trigger Circuit:** Resistance Firing Circuit, Resistance capacitance firing circuit, Unijunction Transistor: Basic operation and UJT Firing Circuit. [Text 3: 1.3, 1.5,1.6, 2.2,2.3,2.4,2.6, 2.7,2.9, 2.10,3.2,3.5.1, 3.5.2, 3.6.1, 3.6.3,3.6.4]	
Teaching-Learning Process	Chalk and talk method, Power Point Presentation. **Self-study topics:** Basic Construction, working and applications of DIAC, TRIAC, IGBT, GTO. **RBT Level:** L1, L2, L3

Course Outcomes (Course Skill Set)

At the end of the course the student will be able to :

1. Understand the characteristics of BJTs and FETs for switching and amplifier circuits.
2. Design and analyze FET amplifiers and oscillatorswith different circuit configurations and biasing conditions.
3. Understand the feedback topologies and approximations in the design of amplifiers and oscillators.
4. Design of circuits using linear ICs for wide range applications such as ADC, DAC, filters and timers.
5. Understand the power electronic device components and its functions for basic power electronic circuits.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%.

The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored out of 100 shall be proportionally reduced to 50 marks.

Suggested Learning Resources:

Books

1. Microelectronic Circuits, Theory and Applications, Adel S Sedra, Kenneth C Smith, 6thEdition, Oxford, 2015.ISBN:978-0-19-808913-1
2. Op-Amps and Linear Integrated Circuits, Ramakant A Gayakwad, 4thEdition, Pearson Education, 2018. ISBN: 978-93-325-4991-3
3. **MD Singh and K B Khanchandani, Power Electronics, 2nd Edition, Tata Mc-Graw Hill, 2009, ISBN: 0070583897'**

Web links and Video Lectures (e-Resources):

- Integrated Electronics: Analog and Digital Circuits and Systems, Jacob Millman, Christos C. Halkias, McGraw-Hill, 2015.
- Electronic Devices and Circuit, Boylestad & Nashelsky, Eleventh Edition, Pearson, January 2015.

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III Semester

Analog and Digital Electronics Lab			
Course Code	**21ECL35**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0:0:2:0	SEE Marks	50
Credits	1	Exam Hours	3

Course objectives:

This laboratory course enables students to

- Understand the electronic circuit schematic and its working
- Realize and test amplifier and oscillator circuits for the given specifications
- Realize the opamp circuits for the applications such as DAC, implement mathematical functions and precision rectifiers.
- Study the static characteristics of SCR and test the RC triggering circuit.
- Design and test the combinational and sequential logic circuits for their functionalities.
- Use the suitable ICs based on the specifications and functions.

Sl.No.	Experiments
1	Design and set up the BJT common emitter voltage amplifier with and without feedback and determine the gain- bandwidth product, input and output impedances.
2	Design and set-up BJT/FET i) Colpitts Oscillator, ii) Crystal Oscillator and iii) RC Phase shift oscillator
3	Design and set up the circuits using opamp: i) Adder, ii) Integrator, iii) Differentiator and iv) Comparator
4	Obtain the static characteristics of SCR and test SCR Controlled HWR and FWR using RC triggering circuit.
5	Design and implement (a) Half Adder & Full Adder using basic gates and NAND gates, (b) Half subtractor & Full subtractor using NAND gates, (c) 4-variable function using IC74151(8:1MUX).
6	Realize (i) Binary to Gray code conversion & vice-versa (IC74139), (ii) BCD to Excess-3 code conversion and vice versa
7	a) Realize using NAND Gates: i) Master-Slave JK Flip-Flop, ii) D Flip-Flop and iii) T Flip-Flop b) Realize the shift registers using IC7474/7495: (i) SISO (ii) SIPO (iii) PISO (iv) PIPO (v) Ring counter and (vi) Johnson counter.
8	Realize a) Design Mod – N Synchronous Up Counter & Down Counter using 7476 JK Flip-flop b) Mod-N Counter using IC7490 / 7476 c) Synchronous counter using IC74192

9	Design 4-bit R – 2R Op-Amp Digital to Analog Converter (i) for a 4-bit binary input using toggle switches (ii) by generating digital inputs using mod-16
10	Pseudorandom sequence generator using IC7495
11	Test the precision rectifiers using opamp: i) Half wave rectifier ii) Full wave rectifier
12	Design and test Monostable and Astable Multivibrator using 555 Timer

Course outcomes (Course Skill Set):

At the end of the course the student will be able to:

1. Design and analyze the BJT/FET amplifier and oscillator circuits.
2. Design and test Opamp circuits to realize the mathematical computations, DAC and precision rectifiers.
3. Design and test the combinational logic circuits for the given specifications.
4. Test the sequential logic circuits for the given functionality.
5. Demonstrate the basic electronic circuit experiments using SCR and 555 timer.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. The student has to secure not less than 35% (18 Marks out of 50) in the semester-end examination (SEE).

Continuous Internal Evaluation (CIE):

CIE marks for the practical course is **50 Marks.**

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment to be evaluated for conduction with observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments designed by the faculty who is handling the laboratory session and is made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled downed to 30 marks (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct 02 tests for 100 marks, the first test shall be conducted after the 8th week of the semester and the second test shall be conducted after the 14th week of the semester.
- In each test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability. Rubrics suggested in Annexure-II of Regulation book
- The average of 02 tests is scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and average marks of two tests is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

SEE marks for the practical course is 50 Marks.

SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the University

All laboratory experiments are to be included for practical examination.

(Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.

Students can pick one question (experiment) from the questions lot prepared by the internal /external examiners jointly.

Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)

Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.

The duration of SEE is 03 hours

Rubrics suggested in Annexure-II of Regulation book

Suggested Learning Resources:

1. Fundamentals of Electronic Devices and Circuits Lab Manual, David A Bell, 5th Edition, 2009, Oxford University Press.
2. Op-Amps and Linear Integrated Circuits, Ramakant A Gayakwad, 4th Edition, Pearson Education, 2018. ISBN: 978-93-325-4991-3.
3. Fundamentals of Logic Design, Charles H Roth Jr., Larry L Kinney, Cengage Learning, 7th Edition.

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III Semester

LD (Logic Design) Lab using Pspice / MultiSIM			
Course Code	**21EC381**	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	0:0:2:0	SEE Marks	50
Credits	1	Exam Hours	03

Course objectives:

- Impart the concepts of De Morgan's Theorem, SOP, POS forms.
- Impart the concepts of designing and analyzing combinational logic circuits.
- Impart the concepts of analysis of sequential logic circuits.
- Analyze and design any given synchronous sequential circuits.

Sl.No	Experiments
1	Implementation of De Morgan's theorem and SOP/POS expressions using Pspice/Multisim.
2	Implementation of Half Adder, Full Adder, Half Subtractor and Full Subtractor using Pspice/ Multisim.
3	Design and implementation of 4-bit Parallel Adder/ Subtractor using IC 7483 and BCD to Excess-3 code conversion and vice-versa using Pspice/Multisim.
4	Design and implement of IC 7485 5-bit magnitude comparator using Pspice/Multisim.
5	To Realize Adder & Subtractor using IC 74153 (4:1 MUX) and 4-variable function using IC74151 (8:1MUX) using Pspice/Multisim.
6	To realize Adder and Subtractor using IC 74139/ 74155N (Demux/Decoder) and Binary to Gray code conversion & vice versa using 74139/ 74155N using Pspice/Multisim.
7	SR, Master-Slave JK, D & T flip-flops using NAND Gates using Pspice/Multisim.
8	Design and realize the Synchronous counters (up/down decade/binary) using Pspice/Multisim.
9	Realize the shift registers and their modes (SISO, PISO, PIPO, SIPO) using 7474/7495 using Pspice/Multisim.
10	Design Pseudo Random Sequence generator using 7495 using Pspice/Multisim.
11	Design Serial Adder with Accumulator and simulate using Pspice/Multisim.
12	Design using Pspice/Multisim Mod-N Counters.

Course outcomes (Course Skill Set):

At the end of the course the student will be able to:

1. Demonstrate the truth table of various expressions and combinational circuits using logic gates.
2. Design various combinational circuits such as adders, subtractors, comparators, multiplexers and code converters.
3. Construct flips-flops, counters and shift registers.
4. Design and implement synchronous counters.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. The student has to secure not less than 35% (18 Marks out of 50) in the semester-end examination (SEE).

Continuous Internal Evaluation (CIE):

CIE marks for the practical course is **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment to be evaluated for conduction with observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments designed by the faculty who is handling the laboratory session and is made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled downed to 30 marks (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct 02 tests for 100 marks, the first test shall be conducted after the 8^{th} week of the semester and the second test shall be conducted after the 14^{th} week of the semester.
- In each test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability. Rubrics suggested in Annexure-II of Regulation book
- The average of 02 tests is scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and average marks of two tests is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

SEE marks for the practical course is 50 Marks.

SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the University

All laboratory experiments are to be included for practical examination.

(Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.

Students can pick one question (experiment) from the questions lot prepared by the internal /external examiners jointly.

Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)

Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.

The duration of SEE is 03 hours

Rubrics suggested in Annexure-II of Regulation book

Suggested Learning Resources:

- Digital Logic Applications and Design by John M Yarbrough, Thomson Learning, 2001
- Digital Principles and Design by Donald D Givone, McGraw Hill, 2002.

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III Semester

AEC (Analog Electronic Circuits) Lab			
Course Code	21EC382	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	0:0:2:0	SEE Marks	50
Credits	1	Exam Hours	2

Course objectives:

- To provide practical exposure to the students on designing, setting up, executing and debugging various electronic circuits using simulation software.
- To give the knowledge and practical exposure on simple applications of analog electronic circuits.

Sl.No	Experiments using Pspice/MultiSIM software
1	Experiments to realize diode clipping (single, double ended) circuits.
2	Experiments to realize diode clamping (positive, negative) circuits.
3	Experiments to realize Full wave rectifier without filter (and set-up to measure the ripple factor, Vp-p, Vrms, etc.).
4	Design and conduct an experiment on Series Voltage Regulator using Zener diode to determine line/load regulation characteristics.
5	Realize BJT Darlington Emitter follower without bootstrapping and determine the gain, input and output impedances (other configurations of emitter follower can also be considered).
6	Set-up and study the working of complementary symmetry class B push pull power amplifier (other power amplifiers can also be suitably considered) and calculate the efficiency.
7	Design and set-up the oscillator circuits (Hartley, Colpitts, etc. using BJT/FET) and determine the frequency of oscillation.
8	Design and set-up the crystal oscillator and determine the frequency of oscillation.
9	Experiment to realize Input and Output characteristics of BJT Common emitter configuration and evaluation of parameters.
10	Experiments to realize Transfer and drain characteristics of a MOSFET.
11	Experiments to realize UJT triggering circuit for Controlled Full wave Rectifier.
12	Design and simulation of Regulated power supply.

Course outcomes (Course Skill Set):

At the end of the course the student will be able to:

1. Understand the circuit schematic and its working.
2. Study the characteristics of different electronic devices.
3. Design and test simple electronic circuits as per the specifications using discrete electronic components.
4. Compute the parameters from the characteristics of active devices.
5. Familiarize with EDA software which can be used for electronic circuit simulation.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. The student has to secure not less than 35% (18 Marks out of 50) in the semester-end examination (SEE).

Continuous Internal Evaluation (CIE):

CIE marks for the practical course is **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment to be evaluated for conduction with observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments designed by the faculty who is handling the laboratory session and is made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled downed to 30 marks (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct 02 tests for 100 marks, the first test shall be conducted after the 8th week of the semester and the second test shall be conducted after the 14th week of the semester.
- In each test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability. Rubrics suggested in Annexure-II of Regulation book
- The average of 02 tests is scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and average marks of two tests is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

SEE marks for the practical course is 50 Marks.

SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the University.

All laboratory experiments are to be included for practical examination.

(Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.

Students can pick one question (experiment) from the questions lot prepared by the internal /external examiners jointly.

Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners).

Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.

The duration of SEE is 03 hours.

Rubrics suggested in Annexure-II of Regulation book.

Suggested Learning Resources:

1. David A Bell, "Fundamentals of Electronic Devices and Circuits Lab Manual, 5th Edition, 2009, Oxford University Press.
2. Muhammed H Rashid, "Introduction to PSpice using OrCAD for circuits and electronics", 3rd Edition, Prentice Hall, 2003.

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III Semester

LIC (Linear Integrated Circuits) Lab using Pspice / MultiSIM			
Course Code	**21EC383**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0:0:2:0	SEE Marks	50
Credits	1	Exam Hours	03

Course objectives:

- To apply operational amplifiers in linear and nonlinear applications.
- To acquire the basic knowledge of special function ICs.
- To use Multisim/Pspice software for circuit design and simulation

Sl.No	Experiments using Pspice / MultiSIM Every experiment has to be designed, circuit to be drawn / constructed and executed in the specified software. Results are also to be noted and inferred.
	Note: Standard design procedure to be adopted.
1	To realize using op-amp an Inverting Amplifier and Non-Inverting Amplifier
2	To realize using op-amps i) Summing Amplifier ii)Difference amplifier
3	To realize using op-amps an Instrumentation Amplifier
4	To realize using op-amps i) Differentiator ii)Integrator
5	To realize using op-amps a Full wave Precision Rectifier
6	To realize using op-amps • Inverting and Non-Inverting Zero Crossing Detectors • Positive and Negative Voltage level detectors
7	To realize using op-amp an Inverting Schmitt Trigger
8	To realize using op-amp an Astable Multivibrator
9	To design and implement using op-amps • Butterworth I & II order Low Pass Filter • Butterworth I & II order High Pass Filter
10	To design and implement using op-amp a RC Phase Shift Oscillator
11	To design and implement Mono-stable Multivibrator using 555 timer
12	To design and implement 4 - bit R-2R Digital to Analog Converter

Course outcomes (Course Skill Set):

After studying this course, students will be able to;

1. Sketch/draw circuit schematics, construct circuits, analyze and troubleshoot circuits containing op-amps, resistors, diodes, capacitors and independent sources.
2. Relate to the manufacturer's data sheets of IC 555 timer and IC μa741 op-amp.
3. Realize and verify the operation of analog integrated circuits like Amplifiers, Precision Rectifiers, Comparators and Waveform generators.
4. Design and implement analog integrated circuits like Oscillators, Active filters, Timer circuits, Data converters and compare the experimental results with theoretical values.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. The student has to secure not less than 35% (18 Marks out of 50) in the semester-end examination (SEE).

Continuous Internal Evaluation (CIE):

CIE marks for the practical course is **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment to be evaluated for conduction with observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments designed by the faculty who is handling the laboratory session and is made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled downed to 30 marks (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct 02 tests for 100 marks, the first test shall be conducted after the 8th week of the semester and the second test shall be conducted after the 14th week of the semester.
- In each test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability. Rubrics suggested in Annexure-II of Regulation book
- The average of 02 tests is scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and average marks of two tests is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

SEE marks for the practical course is 50 Marks.

SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the University

All laboratory experiments are to be included for practical examination.

(Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.

Students can pick one question (experiment) from the questions lot prepared by the internal /external examiners jointly.

Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)

Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.

The duration of SEE is 03 hours

Rubrics suggested in Annexure-II of Regulation book

Suggested Learning Resources:

Op-Amps and Linear Integrated Circuits, Ramakant A Gayakwad, 4th Edition, Pearson Education, 2018.

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III Semester

LabVIEW Programming Basics			
Course Code	**21EC384**	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	0:0:2:0	SEE Marks	50
Credits	1	Exam Hours	03

Course objectives:

- Aware of various front panel controls and indicators.
- Connect and manipulate nodes and wires in the block diagram.
- Locate various toolbars and pull-down menus for the purpose of implementing specific functions.
- Locate and utilize the context help window.
- Familiar with LabVIEW and different applications using it.
- Run a Virtual Instrument (VI).

Sl.No	**VI Programs (using LabVIEW software) to realize the following:**
1	Basic arithmetic operations: addition, subtraction, multiplication and division
2	Boolean operations: AND, OR, XOR, NOT and NAND
3	Sum of 'n' numbers using 'for' loop
4	Factorial of a given number using 'for' loop
5	Determine square of a given number
6	Factorial of a given number using 'while 'loop
7	Sorting even numbers using 'while' loop in an array
8	Finding the array maximum and array minimum
	Demonstration Experiments (For CIE)
9	Build a Virtual Instrument that simulates a heating and cooling system. The system must be able to be controlled manually or automatically.
10	Build a Virtual Instrument that simulates a Basic Calculator (using formula node).
11	Build a Virtual Instrument that simulates a Water Level Detector.
12	Demonstrate how to create a basic VI which calculates the area and perimeter of a circle.

Course outcomes (Course Skill Set):

At the end of the course the student will be able to:

1. Use Lab VIEW to create data acquisition, analysis and display operations
2. Create user interfaces with charts, graph and buttons
3. Use the programming structures and data types that exist in Lab VIEW
4. Use various editing and debugging techniques

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course.

The student has to secure not less than 35% (18 Marks out of 50) in the semester-end examination (SEE).

Continuous Internal Evaluation (CIE):

CIE marks for the practical course is **50 Marks.**

The split-up of CIE marks for record/ journal and test are in the ratio **60:40.**

- Each experiment to be evaluated for conduction with observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments designed by the faculty who is handling the laboratory session and is made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled downed to 30 marks (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct 02 tests for 100 marks, the first test shall be conducted after the 8th week of the semester and the second test shall be conducted after the 14th week of the semester.
- In each test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability. Rubrics suggested in Annexure-II of Regulation book
- The average of 02 tests is scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and average marks of two tests is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

SEE marks for the practical course is 50 Marks.

SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the University

All laboratory experiments are to be included for practical examination.

(Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.

Students can pick one question (experiment) from the questions lot prepared by the internal /external examiners jointly.

Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)

Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.

The duration of SEE is 03 hours

Rubrics suggested in Annexure-II of Regulation book

Suggested Learning Resources:

1. Virtual Instrumentation using LABVIEW, Jovitha Jerome, PHI, 2011
2. Virtual Instrumentation using LABVIEW, Sanjay Gupta, Joseph John, TMH, McGraw Hill, Second Edition, 2011.

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IV Semester

Maths for Communication Engineers			
Course Code	**21EC41**	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	3:0:0:1	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3

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IV Semester

Digital Signal Processing			
Course Code	21EC42	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:2:0	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory + 8-10 Lab slots	Total Marks	100
Credits	04	Exam Hours	03

Course objectives:

1. **Preparation:** To prepare students with fundamental knowledge/ overview in the field of Digital Signal Processing
2. **Core Competence:** To equip students with a basic foundation of Signal Processing by delivering the basics of Discrete Fourier Transforms & their properties, design of filters and overview of digital signal processors

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Lecture method (L) does not mean only traditional lecture method, but different type of teaching methods may be adopted to develop the outcomes.
2. Show Video/animation films to explain the different concepts of Digital Signal Processing
3. Encourage collaborative (Group) Learning in the class
4. Ask at least three HOTS (Higher order Thinking) questions in the class, which promotes critical thinking
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Topics will be introduced in a multiple representation.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.
9. Adopt Flipped class technique by sharing the materials / Sample Videos prior to the class and have discussions on the that topic in the succeeding classes
10. Give Programming Assignments

Module-1

Discrete Fourier Transforms (DFT): Frequency domain sampling and Reconstruction of Discrete Time Signals, The Discrete Fourier Transform, DFT as a linear transformation, Properties of the DFT: Periodicity, Linearity and Symmetry properties, Multiplication of two DFTs and Circular Convolution **[Text 1]**

Teaching-Learning Process	Chalk and Talk, YouTube videos, Programming assignments **RBT Level:** L1, L2, L3

Module-2

Additional DFT Properties, Linear filtering methods based on the DFT: Use of DFT in Linear Filtering, Filtering of Long data Sequences. Fast-Fourier-Transform (FFT) algorithms: Efficient Computation of the DFT: Radix-2 FFT algorithms for the computation of DFT and IDFT decimation in-time **[Text 1]**

Teaching-Learning Process	Chalk and Talk, YouTube videos, Programming assignments **RBT Level:** L1, L2, L3
Module-3	
Design of FIR Filters: Characteristics of practical frequency-selective filters, Symmetric and Anti-symmetric FIR filters, Design of Linear-phase FIR (low pass and High pass) filters using windows - Rectangular, Hamming, Hanning, Bartlett windows. Structure for FIR Systems: Direct form, Cascade form and Lattice structures **[Text1]**	
Teaching-Learning Process	Chalk and Talk, YouTube videos, Programming assignments **RBT Level:** L1, L2, L3
Module-4	
IIR Filter Design: Infinite Impulse response Filter Format, Bilinear Transformation Design Method, Analog Filters using Low pass prototype transformation, Normalized Butterworth Functions, Bilinear Transformation and Frequency Warping, Bilinear Transformation Design Procedure, Digital Butterworth (Lowpass and Highpass) Filter Design using BLT. Realization of IIR Filters in Direct form I and II **[Text 2]**	
Teaching-Learning Process	Chalk and Talk, YouTube videos, Programming assignments **RBT Level:** L1, L2, L3
Module-5	
Digital Signal Processors: DSP Architecture, DSP Hardware Units, Fixed point format, Floating point Format, IEEE Floating point formats, Fixed point digital signal processors, FIR and IIR filter implementations in Fixed point systems. **[Text 2]**	
Teaching-Learning Process	Chalk and Talk, YouTube videos, Programming assignments **RBT Level:** L1, L2, L3

PRACTICAL COMPONENT OF IPCC

List of Programs to be implemented & executed using any programming languages like C++/Python/Java/Scilab / MATLAB/CC Studio (but not limited to)

1. Computation of N point DFT of a given sequence and to plot magnitude and phase spectrum.
2. Computation of circular convolution of two given sequences and verification of commutative, distributive and associative property of convolution.
3. Computation of linear convolution of two sequences using DFT and IDFT.
4. Computation of circular convolution of two given sequences using DFT and IDFT
5. Verification of Linearity property, circular time shift property & circular frequency shift property of DFT.
6. Verification of Parseval's theorem
7. Design and implementation of IIR (Butterworth) low pass filter to meet given specifications.
8. Design and implementation of IIR (Butterworth) high pass filter to meet given specifications.
9. Design and implementation of low pass FIR filter to meet given specifications.
10. Design and implementation of high pass FIR filter to meet given specifications.
11. To compute N- Point DFT of a given sequence using DSK 6713 simulator
12. To compute linear convolution of two given sequences using DSK 6713 simulator
13. To compute circular convolution of two given sequences using DSK 6713 simulator

Course outcomes (Course Skill Set)

At the end of the course the student will be able to:

1. Determine response of LTI systems using time domain and DFT techniques
2. Compute DFT of real and complex discrete time signals
3. Compute DFT using FFT algorithms
4. Design FIR and IIR Digital Filters
5. Design of Digital Filters using DSP processor

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

CIE for the theory component of IPCC

Two Tests each of **20 Marks (duration 01 hour**)

- First test at the end of 5th week of the semester
- Second test at the end of the 10th week of the semester

Two assignments each of **10 Marks**

- First assignment at the end of 4th week of the semester
- Programming assignment at the end of 9th week of the semester, which can be implemented using programming languages like C++/Python/Java/Scilab

Scaled-down marks of two tests and two assignments added will be CIE marks for the theory component of IPCC for **30 marks.**

CIE for the practical component of IPCC

- On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The **15 marks** are for conducting the experiment and preparation of the laboratory record, the other **05 marks shall be for the test** conducted at the end of the semester.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to 15 marks.
- The laboratory test **(duration 03 hours)** at the end of the 15th week of the semester /after completion of all the experiments (whichever is early) shall be conducted for 50 marks and scaled down to 05 marks**.**

Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **20 marks.**

SEE for IPCC

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (duration 03 hours)

- The question paper will have ten questions. Each question is set for 20 marks.
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
- The students have to answer 5 full questions, selecting one full question from each module.

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component.

- The minimum marks to be secured in CIE to appear for SEE shall be the 12 (40% of maximum marks-30) in the theory component and 08 (40% of maximum marks -20) in the practical component. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included**.** The maximum of 04/05 questions to be set from the practical component of IPCC, the total marks of all questions should not be more than the 20 marks.

SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50.

Suggested Learning Resources:

Text Books:

1. Proakis & Manolakis, "Digital Signal Processing - Principles Algorithms & Applications", 4th Edition, Pearson education, New Delhi, 2007. ISBN: 81-317-1000-9.
2. Li Tan, Jean Jiang, "Digital Signal processing - Fundamentals and Applications", Academic Press, 2013, ISBN: 978-0-12-415893.

Reference Books:

1. Sanjit K Mitra, "Digital Signal Processing, A Computer Based Approach", 4th Edition, McGraw Hill Education, 2013,
2. Oppenheim & Schaffer, "Discrete Time Signal Processing", PHI, 2003.
3. D Ganesh Rao and Vineeth P Gejji, "Digital Signal Processing" Cengage India Private Limited, 2017, ISBN: 9386858231

Web links and Video Lectures (e-Resources):

By Prof. S. C. Dutta Roy, IIT Delhi

https://nptel.ac.in/courses/117102060

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Programming Assignments / Mini Projects can be given to improve programming skills

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IV Semester

Circuits & Controls			
Course Code	**21EC43**	CIE Marks	50
Teaching Hours/Week (L: T: P: S)	(3:0:2:0)	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory + 12 Lab slots	Total Marks	100
Credits	04	Exam Hours	03

Course objectives: This course will enable students to:

1. Apply mesh and nodal techniques to solve an electrical network.
2. Solve different problems related to Electrical circuits using Network Theorems and Two port network.
3. Familiarize with the use of Laplace transforms to solve network problems.
4. Understand basics of control systems and design mathematical models using block diagram reduction, SFG, etc.
5. Understand Time domain and Frequency domain analysis.
6. Familiarize with the State Space Model of the system.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

- Lecture method (L) does not mean only traditional lecture method, but different type of teaching methods may be adopted to develop the outcomes.
- Show Video/animation films to explain the different concepts of Linear Algebra & Signal Processing.
- Encourage collaborative (Group) Learning in the class .
- Ask at least three HOTS (Higher order Thinking) questions in the class, which promotes critical thinking.
- Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
- Topics will be introduced in a multiple representation.
- Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
- Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.
- Adopt Flipped class technique by sharing the materials / Sample Videos prior to the class and have discussions on the that topic in the succeeding classes.
- Give Programming Assignments.

Module-1

Basic concepts and network theorems
Types of Sources, Loop analysis, Nodal analysis with independent DC and AC Excitations.
(Textbook 1: 2.3, 4.1, 4.2, 4.3, 4.4, 10.6)
Super position theorem, Thevenin's theorem, Norton's Theorem, Maximum Power transfer Theorem.
(Textbook 2: 9.2, 9.4, 9.5, 9.7)

Teaching-Learning Process	Chalk and Talk, YouTube videos, Demonstrate the concepts using circuits **RBT Level:** L1, L2, L3

Module-2	
Two port networks: Short- circuit Admittance parameters, Open- circuit Impedance parameters, Transmission parameters, Hybrid parameters (Textbook 3: 11.1, 11.2, 11.3, 11.4, 11.5) **Laplace transform and its Applications**: Step Ramp, Impulse, Solution of networks using Laplace transform, Initial value and final value theorem (Textbook 3: 7.1, 7.2, 7.4, 7.7, 8.4)	
Teaching-Learning Process	Chalk and Talk **RBT Level:** L1, L2, L3
Module-3	
Basic Concepts and representation: Types of control systems, effect of feedback systems, differential equation of physical systems (only electrical systems), Introduction to block diagrams, transfer functions, Signal Flow Graphs (Textbook 4: Chapter 1.1, 2.2, 2.4, 2.5, 2.6)	
Teaching-Learning Process	Chalk and Talk, YouTube videos **RBT Level:** L1, L2, L3
Module-4	
Time Response analysis: Time response of first order systems. Time response of second order systems, time response specifications of second order systems (Textbook 4: Chapter 5.3, 5.4) **Stability Analysis:** Concepts of stability necessary condition for stability, Routh stability criterion, relative stability Analysis (Textbook 4: Chapter 5.3, 5.4, 6.1, 6.2, 6.4, 6.5)	
Teaching-Learning Process	Chalk and Talk, Any software tool to show time response **RBT Level:** L1, L2, L3
Module-5	
Root locus: Introduction the root locus concepts, construction of root loci (Textbook 4: 7.1, 7.2, 7.3) **Frequency Domain analysis and stability**: Correlation between time and frequency response and Bode plots (Textbook 4: 8.1, 8.2, 8.4) **State Variable Analysis:** Introduction to state variable analysis: Concepts of state, state variable and state models. State model for Linear continuous –Time systems, solution of state equations. (Textbook 4: 12.2, 12.3, 12.6)	
Teaching-Learning Process	Chalk and Talk, Any software tool to plot Root locus, Bode plot **RBT Level:** L1, L2, L3

PRACTICAL COMPONENT OF IPCC

Using suitable hardware and simulation software, demonstrate the operation of the following circuits:

Sl.No	Experiments
1	Verification of Superposition theorem
2	Verification of Thevenin's theorem
3	Speed torque characteristics of i)AC Servomotor ii) DC Servomotors
4	Determination of time response specification of a second order Under damped System, for different damping factors.
5	Determination of frequency response of a second order System
6	Determination of frequency response of a lead lag compensator
7	Using Suitable simulation package study of speed control of DC motor using i) Armature control ii) Field control

8	Using suitable simulation package, draw Root locus & Bode plot of the given transfer function.
Demonstration Experiments (For CIE only, not for SEE)	
9	Using suitable simulation package, obtain the time response from state model of a system.
10	Implementation of PI, PD Controllers.
11	Implement a PID Controller and hence realize an Error Detector.
12	Demonstrate the effect of PI, PD and PID controller on the system response.

Course Outcomes

At the end of the course the student will be able to:

1. Analyse and solve Electric circuit, by applying, loop analysis, Nodal analysis and by applying network Theorems.
2. Evaluate two port parameters of a network and Apply Laplace transforms to solve electric networks.
3. Deduce transfer function of a given physical system, from differential equation representation or Block Diagram representation and SFG representation.
4. Calculate time response specifications and analyse the stability of the system.
5. Draw and analyse the effect of gain on system behaviour using root loci.
6. Perform frequency response Analysis and find the stability of the system.
7. Represent State model of the system and find the time response of the system.

Assessment Details (both CIE and SEE)

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CIE for the theory component of IPCC

Two Tests each of **20 Marks (duration 01 hour**)

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- Second test at the end of the 10th week of the semester

Two assignments each of **10 Marks**

- First assignment at the end of 4th week of the semester
- Second assignment at the end of 9th week of the semester

Scaled-down marks of two tests and two assignments added will be CIE marks for the theory component of IPCC for **30 marks.**

CIE for the practical component of IPCC

- On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The **15 marks** are for conducting the experiment and preparation of the laboratory record, the other **05 marks shall be for the test** conducted at the end of the semester.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to 15 marks.
- The laboratory test **(duration 03 hours)** at the end of the 15th week of the semester /after completion of all the experiments (whichever is early) shall be conducted for 50 marks and

scaled down to 05 marks.

Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **20 marks**.

SEE for IPCC

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (duration 03 hours)

- The question paper will have ten questions. Each question is set for 20 marks.
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
- The students have to answer 5 full questions, selecting one full question from each module.

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component.

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SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured out of 100 shall be reduced proportionally to 50.

Suggested Learning Resources:

Text Books

1. Engineering circuit analysis, William H Hayt, Jr, Jack E Kemmerly, Steven M Durbin, Mc Graw Hill Education, Indian Edition 8e.
2. Networks and Systems, D Roy Choudhury, New age international Publishers, second edition.
3. Network Analysis, M E Van Valkenburg, Pearson, 3e.
4. Control Systems Engineering, I J Nagrath, M. Gopal, New age international Publishers, Fifth edition.

Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/108106098
- https://nptel.ac.in/courses/108102042

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Programming Assignments / Mini Projects can be given to improve programming skills

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IV Semester

Communication Theory			
Course Code	**21EC44**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:1	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3

Course objectives: This course will enable students to

- Understand and analyse concepts of Analog Modulation schemes viz; AM, FM., Low pass sampling and Quantization as a random process.
- Understand and analyse concepts digitization of signals viz; sampling, quantizing and encoding.
- Evolve the concept of SNR in the presence of channel induced noise and study Demodulation of analog modulated signals.
- Evolve the concept of quantization noise for sampled and encoded signals and study the concepts of reconstruction from these samples at a receiver.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Lecture method (L) does not mean only traditional lecture method, but different type of teaching methods may be adopted to develop the outcomes.
2. Show Video/animation films to explain evolution of communication technologies.
3. Encourage collaborative (Group) Learning in the class.
4. Ask at least three HOTS (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
7. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

AMPLITUDE MODULATION: Introduction, Amplitude Modulation: Time & Frequency Domain description, Switching modulator, Envelop detector.

DOUBLE SIDE BAND-SUPPRESSED CARRIER MODULATION: Time and Frequency Domain description, Ring modulator, Coherent detection, Costas Receiver, Quadrature Carrier Multiplexing.

SINGLE SIDE–BAND AND VESTIGIAL SIDEBAND METHODS OF MODULATION: SSB Modulation, VSB Modulation, Frequency Translation, Frequency Division Multiplexing, Theme Example: VSB Transmission of Analog and Digital Television.

[Text1: 3.1 to 3.8]

Teaching-Learning Process	Chalk and talk method, Power Point Presentation. **Self-study topics:** Properties of the Fourier Transform, Dirac Delta Function. **RBT Level:** L1, L2, L3

Module-2

ANGLE MODULATION: Basic definitions, Frequency Modulation: Narrow Band FM, Wide Band FM, Transmission bandwidth of FM Signals, Generation of FM Signals, Demodulation of FM Signals, FM Stereo Multiplexing, Phase–Locked Loop: Nonlinear model of PLL, Linear model of PLL, Nonlinear Effects in FM

Systems. The Superheterodyne Receiver [Text1: 4.1 to 4.6]	
Teaching-Learning Process	Chalk and talk method, Power Point Presentation, YouTube videos. **Self-study topics:** FM Broadcasting System [Ref1] **RBT Level:** L1, L2, L3
Module-3	
NOISE: Shot Noise, Thermal noise, White Noise, Noise Equivalent Bandwidth. **NOISE IN ANALOG MODULATION:** Introduction, Receiver Model, Noise in DSB-SC receivers. Noise in AM receivers, Threshold effect, Noise in FM receivers, Capture effect, FM threshold effect, FM threshold reduction, Preemphasis and De-emphasis in FM (Text1: 5.10, 6.1 to 6.6)	
Teaching-Learning Process	Chalk and talk method, Power Point Presentation, YouTube videos. **Self-study topics:** Mean, Correlation and Covariance functions of Random Processes **RBT Level:** L1, L2, L3
Module-4	
SAMPLING AND QUANTIZATION: Introduction, Why Digitize Analog Sources? The Low pass Sampling process Pulse Amplitude Modulation. Time Division Multiplexing, Pulse-Position Modulation, Generation of PPM Waves, Detection of PPM Waves. (Text1: 7.1 to 7.7)	
Teaching-Learning Process	Chalk and talk method, Power Point Presentation, YouTube videos. **Self-study topics:** T1 carrier systems [Ref1] **RBT Level:** L1, L2, L3
Module-5	
SAMPLING AND QUANTIZATION (Contd): The Quantization Random Process, Quantization Noise, Pulse–Code Modulation: Sampling, Quantization, Encoding, Regeneration, Decoding, Filtering, Multiplexing; Delta Modulation (Text1: 7.8 to 7.10), Application examples - (a) Video + MPEG (Text1:7.11) and (b) Vocoders (refer Section 6.8 of Reference Book 1)	
Teaching-Learning Process	Chalk and talk method, Power Point Presentation, YouTube videos. **Self-study topics:** Digital Multiplexing. [Ref1] **RBT Level:** L1, L2, L3

Course Outcomes (Course Skill Set)

At the end of the course the student will be able to:

1. Understand the amplitude and frequency modulation techniques and perform time and frequency domain transformations.
2. Identify the schemes for amplitude and frequency modulation and demodulation of analog signals and compare the performance.
3. Characterize the influence of channel noise on analog modulated signals.
4. Understand the characteristics of pulse amplitude modulation, pulse position modulation and pulse code modulation systems.
5. Illustration of digital formatting representations used for Multiplexers, Vocoders and Video transmission.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100 shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

1. Simon Haykins & Moher, Communication Systems, 5th Edition, John Wiley, India Pvt. Ltd, 2010, ISBN 978 – 81 – 265 – 2151 – 7.

Reference Books

1. B P Lathi and Zhi Ding, Modern Digital and Analog Communication Systems, Oxford University Press., 4th edition, 2010, ISBN: 97801980738002.
2. Simon Haykins, An Introduction to Analog and Digital Communication, John Wiley India Pvt. Ltd., 2008, ISBN 978–81–265–3653–5.
3. H Taub & D L Schilling, Principles of Communication Systems, TMH, 2011.

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IV Semester

Communication Laboratory I			
Course Code	**21ECL46**	CIE Marks	50
Teaching Hours/Week (L: T: P: S)	0:0:2:0	SEE Marks	50
Credits	1	Exam Hours	3

Course objectives:

This laboratory course enables students to

- Model an analog communication system signal transmission and reception.
- Realize the electronic circuits to perform analog and pulse modulations and demodulations.
- Verify the sampling theorem and relate the signal and its spectrum before and after sampling.
- Understand the process of PCM and delta modulations.
- Understand the PLL operation.

Sl.No.	Experiments
1	Design of active second order Butterworth low pass and high pass filters.
2	Amplitude Modulation and Demodulation of (a) Standard AM and (b) DSBSC (LM741 and LF398 ICs can be used)
3	Frequency modulation and demodulation
4	Design and test Time Division Multiplexing and Demultiplexing of two bandlimited signals.
5	Design and test i) Pulse sampling, flat top sampling and reconstruction. ii) Pulse amplitude modulation and demodulation.
6	Design and test BJT/FET Mixer
7	Pulse Code Modulation and demodulation
8	Phase locked loop Synthesis
9	Illustration of (a) AM modulation and demodulation and display the signal and its spectrum. (b) DSB-SC modulation and demodulation and display the signal and its spectrum. (Use MATLAB/SCILAB)
10	Illustration of FM modulation and demodulation and display the signal and its spectrum. (Use MATLAB/SCILAB)
11	Illustrate the process of sampling and reconstruction of low pass signals. Display the signals and its spectrums of both analog and sampled signals. (Use MATLAB/SCILAB).
12	Illustration of Delta Modulation and the effects of step size selection in the design of DM encoder. (Use MATLAB/SCILAB)

Course outcomes (Course Skill Set):

At the end of the course the student will be able to:

1. Demonstrate the AM and FM modulation and demodulation by representing the signals in time and frequency domain.
2. Design and test the sampling, Multiplexing and PAM with relevant circuits.
3. Demonstrate the basic circuitry and operations used in AM and FM receivers.
4. Illustrate the operation of PCM and delta modulations for different input conditions.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. The student has to secure not less than 35% (18 Marks out of 50) in the semester-end examination (SEE).

Continuous Internal Evaluation (CIE):

CIE marks for the practical course is **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment to be evaluated for conduction with observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments designed by the faculty who is handling the laboratory session and is made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled downed to 30 marks (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct 02 tests for 100 marks, the first test shall be conducted after the 8th week of the semester and the second test shall be conducted after the 14th week of the semester.
- In each test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability. Rubrics suggested in Annexure-II of Regulation book
- The average of 02 tests is scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and average marks of two tests is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

SEE marks for the practical course is 50 Marks.

SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the University

All laboratory experiments are to be included for practical examination.

(Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.

Students can pick one question (experiment) from the questions lot prepared by the internal /external examiners jointly.

Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by

examiners. General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners). Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero. The duration of SEE is 03 hours. Rubrics suggested in Annexure-II of Regulation book
Suggested Learning Resources: 1. Louis E Frenzel, Principles of Electronic Communication Systems, McGraw Hill Education (India) Private Limited, 2016. 2. B P Lathi, Zhi Ding, Modern Digital and Analog Communication Systems, Oxford University Press, 2015.

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IV Semester

Embedded C Basics			
Course Code	**21EC481**	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	0:0:2:0	SEE Marks	50
Credits	1	Exam Hours	3

Course objectives:

- Understand the basic programming of Microprocessor and microcontroller.
- To develop the microcontroller-based programs for various applications.

Sl.No	Experiments
	Conduct the following experiments by writing C Program using Keil microvision simulator (any 8051 microcontroller can be chosen as the target).
1	Write a 8051 C program to multiply two 16 bit binary numbers.
2	Write a 8051 C program to find the sum of first 10 integer numbers.
3	Write a 8051 C program to find factorial of a given number.
4	Write a 8051 C program to add an array of 16 bit numbers and store the 32 bit result in internal RAM
5	Write a 8051 C program to find the square of a number (1 to 10) using look-up table.
6	Write a 8051 C program to find the largest/smallest number in an array of 32 numbers
7	Write a 8051 C program to arrange a series of 32 bit numbers in ascending/descending order
8	Write a 8051 C program to count the number of ones and zeros in two consecutive memory locations.
9	Write a 8051 C program to scan a series of 32 bit numbers to find how many are negative.
10	Write a 8051 C program to display "Hello World" message (either in simulation mode or interface an LCD display).
11	Write a 8051 C program to convert the hexadecimal data 0xCFh to decimal and display the digits on ports P0, P1 and P2 (port window in simulator).

Course outcomes (Course Skill Set):

At the end of the course the student will be able to:

1. Write C programs in 8051 for solving simple problems that manipulate input data using different instructions of 8051 C.
2. Develop testing and experimental procedures on 8051 Microcontroller, analyze their operation under different cases.
3. Develop programs for 8051 Microcontroller to implement real world problems.
4. Design and Develop Mini projects

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. The student has to secure not less than 35% (18 Marks out of 50) in the semester-end examination (SEE).

Continuous Internal Evaluation (CIE):

CIE marks for the practical course is **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

Each experiment to be evaluated for conduction with observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments designed by the faculty who is handling the laboratory session and is made known to students at the beginning of the practical session.

Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.

Total marks scored by the students are scaled downed to 30 marks (60% of maximum marks).

Weightage to be given for neatness and submission of record/write-up on time.

Department shall conduct 02 tests for 100 marks, the first test shall be conducted after the 8th week of the semester and the second test shall be conducted after the 14th week of the semester.

In each test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.

The suitable rubrics can be designed to evaluate each student's performance and learning ability. Rubrics suggested in Annexure-II of Regulation book

The average of 02 tests is scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and average marks of two tests is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

SEE marks for the practical course is 50 Marks.

SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the University

All laboratory experiments are to be included for practical examination.

(Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.

Students can pick one question (experiment) from the questions lot prepared by the internal /external examiners jointly.

Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)

Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.

The duration of SEE is 03 hours

Rubrics suggested in Annexure-II of Regulation book

Suggested Learning Resources:

"The 8051 Microcontroller: Hardware, Software and Applications", V Udayashankara and M S Mallikarjuna Swamy, McGraw Hill Education, 1st edition, 2017.

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IV Semester

C++ Basics			
Course Code	**21EC482**	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	0:0:2:0	SEE Marks	50
Credits	1	Exam Hours	03

Course objectives:

- Understand object-oriented programming concepts, and apply them in solving problems.
- To create, debug and run simple C++ programs.
- Introduce the concepts of functions, friend functions, inheritance, polymorphism and function overloading.
- Introduce the concepts of exception handling and multithreading.

Sl.No	Experiments
1	Write a C++ program to find largest, smallest & second largest of three numbers using inline functions MAX & Min.
2	Write a C++ program to calculate the volume of different geometric shapes like cube, cylinder and sphere using function overloading concept.
3	Define a STUDENT class with USN, Name & Marks in 3 tests of a subject. Declare an array of 10 STUDENT objects. Using appropriate functions, find the average of the two better marks for each student. Print the USN, Name & the average marks of all the students.
4	Write a C++ program to create class called MATRIX using two-dimensional array of integers, by overloading the operator == which checks the compatibility of two matrices to be added and subtracted. Perform the addition and subtraction by overloading + and – operators respectively. Display the results by overloading the operator <<. If (m1 == m2) then m3 = m1 + m2 and m4 = m1 – m2 else display error
5	Demonstrate simple inheritance concept by creating a base class FATHER with data members: *First Name, Surname, DOB & bank Balance* and creating a derived class SON, which inherits: Surname & Bank Balance feature from base class but provides its own feature: First Name & DOB. Create & initialize F1 & S1 objects with appropriate constructors & display the FATHER & SON details.
6	Write a C++ program to define class name FATHER & SON that holds the income respectively. Calculate & display total income of a family using Friend function.
7	Write a C++ program to accept the student detail such as name & 3 different marks by get_data() method & display the name & average of marks using display() method. Define a friend function for calculating the average marks using the method mark_avg().
8	Write a C++ program to explain virtual function (Polymorphism) by creating a base class polygon which has virtual function areas two classes rectangle & triangle derived from polygon & they have area to calculate & return the area of rectangle & triangle respectively.
9	Design, develop and execute a program in C++ based on the following requirements: An EMPLOYEE class containing data members & members functions: i) Data members: employee number (an integer), Employee_ Name (a string of characters), Basic_ Salary (in integer), All_ Allowances (an integer), Net_Salary (an integer). (ii) Member functions: To read the data of an employee, to calculate Net_Salary & to print the values of all the data members. (All_Allowances = 123% of Basic, Income Tax (IT) =30% of gross salary (=basic_ Salary_All_Allowances_IT).
10	Write a C++ program with different class related through multiple inheritance & demonstrate the use of different access specified by means of members variables & members functions.
11	Write a C++ program to create three objects for a class named count object with data members

	such as roll_no & Name. Create a members function set_data ( ) for setting the data values & display ( ) member function to display which object has invoked it using „this" pointer.
12	Write a C++ program to implement exception handling with minimum 5 exceptions classes including two built in exceptions.

Course outcomes (Course Skill Set):

At the end of the course the student will be able to:

1. Write C++ program to solve simple and complex problems
2. Apply and implement major object-oriented concepts like message passing, function overloading, operator overloading and inheritance to solve real-world problems.
3. Use major C++ features such as Templates for data type independent designs and File I/O to deal with large data set.
4. Analyze, design and develop solutions to real-world problems applying OOP concepts of C++

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. The student has to secure not less than 35% (18 Marks out of 50) in the semester-end examination (SEE).

Continuous Internal Evaluation (CIE):

CIE marks for the practical course is **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment to be evaluated for conduction with observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments designed by the faculty who is handling the laboratory session and is made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled downed to 30 marks (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct 02 tests for 100 marks, the first test shall be conducted after the 8th week of the semester and the second test shall be conducted after the 14th week of the semester.
- In each test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability. Rubrics suggested in Annexure-II of Regulation book
- The average of 02 tests is scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and average marks of two tests is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

SEE marks for the practical course is 50 Marks.

SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the University

All laboratory experiments are to be included for practical examination.

(Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.

Students can pick one question (experiment) from the questions lot prepared by the internal /external examiners jointly.

Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and

result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners) Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero. The duration of SEE is 03 hours Rubrics suggested in Annexure-II of Regulation book
Suggested Learning Resources: 1. Object oriented programming in TURBO C++, Robert Lafore, Galgotia Publications, 2002 2. The Complete Reference C++, Herbert Schildt, 4th Edition, Tata McGraw Hill, 2003. 3. Object Oriented Programming with C++, E Balaguruswamy, 4th Edition, Tata McGraw Hill, 2006.

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IV Semester

Octave / Scilab for Signals			
Course Code	**21EC483**	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	0:0:2:0	SEE Marks	50
Credits	1	Exam Hours	03

Course objectives:

1. **Preparation**: To prepare students with fundamental knowledge/ overview in the field of signals and processing.
2. **Core Competence**: To equip students with a basic foundation in electronic engineering and mathematics fundamentals required for comprehending the operation and application of signal processing.
3. **Professionalism & Learning Environment**: To inculcate in students an ethical and professional attitude by providing an academic environment inclusive of effective communication, teamwork, ability to relate engineering issues to a broader social context, and life-long learning needed for a successful professional career.

Sl.No	Experiments
1	Verify the Sampling theorem.
2	Determine linear convolution, Circular convolution and Correlation of two given sequences. Verify the result using theoretical computations.
3	Determine the linear convolution of two given point sequences using FFT algorithm. Verify the result using theoretical computations.
4	Determine the correlation using FFT algorithm. Verify the result using theoretical computations.
5	Determine the spectrum of the given sequence using FFT. Verify the result using theoretical computations.
6	Design and test FIR filter using Windowing method (Hamming, Hanning and Rectangular window) for the given order and cut-off frequency.
7	Design and test IIR Butterworth 1st and 2nd order low & high pass filter.
8	Design and test IIR Chebyshev 1st and 2nd order low & high pass filter.
9	Generation of an AM – Suppressed Carrier Wave & visualization of the time domain and frequency domain plots.
10	Generation and visualization of standard test signals (both continuous and discrete time).
11	Generation and visualization of audio signal (pre-recorded) and generation of echo.
12	Generation and visualization of the STFT of a chirp (and other related) signal.

Course outcomes (Course Skill Set):

At the end of the course the student will be able to:

- Demonstrate the DSP concepts on signal generation and sampling using Scilab/Octave
- Design and verify the computation of discrete signals using Scilab/Octave.
- Demonstrate and verify the application of FFT/DFT algorithm for a given signal using Scilab/Octave.
- Design and demonstrate programs to evaluate different types of low and high pass FIR filters using Scilab/Octave.
- Design, demonstrate and visualize different real world signals using Scilab/Octave programs.

Assessment Details (both CIE and SEE) The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. The student has to secure not less than 35% (18 Marks out of 50) in the semester-end examination (SEE). **Continuous Internal Evaluation (CIE):** CIE marks for the practical course is **50 Marks.** The split-up of CIE marks for record/ journal and test are in the ratio **60:40**. Each experiment to be evaluated for conduction with observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments designed by the faculty who is handling the laboratory session and is made known to students at the beginning of the practical session. Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks. Total marks scored by the students are scaled downed to 30 marks (60% of maximum marks). Weightage to be given for neatness and submission of record/write-up on time. Department shall conduct 02 tests for 100 marks, the first test shall be conducted after the 8th week of the semester and the second test shall be conducted after the 14th week of the semester. In each test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce. The suitable rubrics can be designed to evaluate each student's performance and learning ability. Rubrics suggested in Annexure-II of Regulation book The average of 02 tests is scaled down to **20 marks** (40% of the maximum marks). The Sum of scaled-down marks scored in the report write-up/journal and average marks of two tests is the total CIE marks scored by the student.
Semester End Evaluation (SEE): SEE marks for the practical course is 50 Marks. SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the University All laboratory experiments are to be included for practical examination. (Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners. Students can pick one question (experiment) from the questions lot prepared by the internal /external examiners jointly. Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners. General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners) Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero. The duration of SEE is 03 hours Rubrics suggested in Annexure-II of Regulation book
Suggested Learning Resources: Digital Signal Processing Using MATLAB, John G Proakis and Vinay K Ingle, Cengage Learning, 2011

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IV Semester

DAQ using LabVIEW			
Course Code	21EC484	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	0:0:2:0	SEE Marks	50
Credits	1	Exam Hours	03

Course objectives:

- Process the knowledge of loop constructs.
- Fundamentals of graphical programming and use LabVIEW modules
- Implement 'Timing' functions.
- Input algebraic formulas via 'Formula Nodes' and 'Expression Nodes'.

Sl.No	Experiments
1	Data acquisition using LabVIEW for temperature measurement with thermocouple.
2	Data acquisition using LabVIEW for temperature measurement with AD590.
3	Data acquisition using LabVIEW for temperature measurement with RTD.
4	Data acquisition using LabVIEW for temperature measurement with Thermistor.
5	Creation of a CRO using LabVIEW and measurement of frequency and amplitude from external source.
6	Create function generator using LabVIEW and display the amplitude and frequency on CRO (externally connected)
7	Demonstrate amplitude modulation considering modulating and carrier wave from external source.
8	Interface LEDs to DAQ output and implement counter.
9	Data acquisition using LabVIEW for load / strain measurement using suitable transducers.
10	Demonstrate binary to grey code converter (& vice versa) using DAQ card.
11	Data acquisition using LabVIEW for distance/humidity measurement using suitable transducers.
12	Reading audio input with Microphones and output using DAQ card.

Course outcomes (Course Skill Set):

At the end of the course the student will be able to:

1. Build temperature indicating instruments using LabVIEW (NI DAQ)
2. Interface peripheral devices/instruments to LabVIEW
3. Build LabVIEW modules to sense and process audio inputs
4. Apply programming structures, data types, and the analysis and signal processing algorithms in LabVIEW
5. Debug and troubleshoot applications

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course.

The student has to secure not less than 35% (18 Marks out of 50) in the semester-end examination (SEE).

Continuous Internal Evaluation (CIE):

CIE marks for the practical course is **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment to be evaluated for conduction with observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments designed by the faculty who is handling the laboratory session and is made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled downed to 30 marks (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct 02 tests for 100 marks, the first test shall be conducted after the 8th week of the semester and the second test shall be conducted after the 14th week of the semester.
- In each test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability. Rubrics suggested in Annexure-II of Regulation book
- The average of 02 tests is scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and average marks of two tests is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

SEE marks for the practical course is 50 Marks.

SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the University

All laboratory experiments are to be included for practical examination.

(Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.

Students can pick one question (experiment) from the questions lot prepared by the internal /external examiners jointly.

Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)

Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.

The duration of SEE is 03 hours

Rubrics suggested in Annexure-II of Regulation book

Suggested Learning Resources:

1. Virtual Instrumentation using LABVIEW, Jovitha Jerome, PHI, 2011
2. Virtual Instrumentation using LABVIEW, Sanjay Gupta, Joseph John, TMH, McGraw Hill, Second Edition, 2011.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
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V Semester

Digital Communication			
Course Code	**21EC51**	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	3:0:0:1	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3

Course objectives:

- Understand the concept of signal processing of digital data and signal conversion to symbols at the transmitter and receiver.
- Compute performance metrics and parameters for symbol processing and recovery in ideal and corrupted channel conditions.
- Understand the principles of spread spectrum communications.
- Understand the basic principles of information theory and various source coding techniques.
- Build a comprehensive knowledge about various Source and Channel Coding techniques.
- Discuss the different types of errors and error detection and controlling codes used in the communication channel.
- Understand the concepts of convolution codes and analyze the code words using time domain and transform domain approach.

Teaching-Learning Process (General Instructions)

The sample strategies, which the teacher can use to accelerate the attainment of the various course outcomes are listed in the following:

1. Lecture method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Arrange visits to nearby PSUs such as BHEL, BEL, ISRO, etc., and small-scale communication industries.
3. Show Video/animation films to explain the functioning of various modulation techniques, Channel, and source coding.
4. Encourage collaborative (Group) Learning in the class
5. Ask at least three HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking
6. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize & analyze information rather than simply recall it.
7. Topics will be introduced in multiple representations.
8. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
9. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Digital Modulation Techniques: Phase shift Keying techniques using coherent detection: generation, detection and error probabilities of BPSK and QPSK, M–ary PSK, M–ary QAM. Frequency shift keying techniques using Coherent detection: BFSK generation, detection and error probability. Non coherent orthogonal modulation techniques: BFSK, DPSK Symbol representation, Block diagrams treatment of Transmitter and Receiver, Probability of error (without derivation of probability of error equation).

Teaching-Learning Process	Chalk and talk method, Simulation of modulation techniques, Power Point Presentation, YouTube videos Animation of BPSK, QPSK, BFSK and DPSK. Problems on Generation and detection of DPSK, QPSK. **Self-study topic**: Minimum shift keying and Non-coherent BFSK **RBT Level:** L1, L2, L3

Module-2	
Signalling Communication through Band Limited AWGN Channels: **Signalling over AWGN Channels-** Introduction, Geometric representation of signals, Gram- Schmidt Orthogonalization procedure, Conversion of the continuous AWGN channel into a vector channel (without statistical characterization), Optimum receivers using coherent detection: ML Decoding, Correlation receiver, matched filter receiver. **Signal design for Band limited Channels**: Design of band limited signals for zero lSI-The Nyquist Criterion (statement only), Design of band limited signals with controlled lSI-Partial Response signals, Probability of error for detection of Digital PAM: Symbol-by-Symbol detection of data with controlled lSI.	
Teaching-Learning Process	Chalk & talk method, PowerPoint Presentation, YouTube videos **Self-study topics**: Maximum Likelihood detection, Channel equalization **RBT Level:** L1, L2, L3
Module-3	
Principles of Spread Spectrum: Spread Spectrum Communication Systems: Model of a Spread Spectrum Digital Communication System, Direct Sequence Spread Spectrum Systems, Effect of De-spreading on a narrowband Interference, Probability of error (statement only), Some applications of DS Spread Spectrum Signals, Generation of PN Sequences, Frequency Hopped Spread Spectrum, CDMA based on IS-95.	
Teaching-Learning Process	Chalk & talk method, Seminar about security issues in communication systems **RBT Level:** L1, L2, L3
Module-4	
Introduction to Information Theory: Measure of information, Average information content of symbols in long independent sequences. **Source Coding:** Encoding of the Source Output, Shannon's Encoding Algorithm, Shannon-Fano Encoding Algorithm, Huffman coding. **Error Control Coding:** Introduction, Examples of Error control coding, methods of Controlling Errors, Types of Errors, types of Codes.	
Teaching-Learning Process	Chalk and talk method, Problems on source coding, error control codes **RBT Level:** L1, L2, L3
Module-5	
Linear Block Codes: Matrix description of Linear Block Codes, Error Detection & Correction capabilities of Linear Block Codes, Single error correction Hamming code, Table lookup Decoding using Standard Array. **Convolution codes:** Convolution Encoder, Time domain approach, Transform domain approach, Code Tree, Trellis and State Diagram.	
Teaching-Learning Process	Chalk and talk method, Animation of convolution encoders **RBT Level:** L1, L2, L3
Course outcomes (Course Skill Set) At the end of the course the student will be able to: 1. Analyze different digital modulation techniques and choose the appropriate modulation technique for the given specifications. 2. Test and validate symbol processing and performance parameters at the receiver under ideal and corrupted bandlimited channels. 3. Differentiate various spread spectrum schemes and compute the performance parameters of communication system. 4. Apply the fundamentals of information theory and perform source coding for given message 5. Apply different encoding and decoding techniques with error Detection and Correction.	
Assessment Details (both CIE and SEE)	

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100 shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Text Books:

1. Simon Haykin, "Digital Communication Systems", John Wiley & sons, First Edition, 2014, ISBN 978-0-471-64735-5.
2. John G Proakis and Masoud Salehi, "Fundamentals of Communication Systems", 2014 Edition, Pearson Education, ISBN 978-8-131-70573-5.
3. K Sam Shanmugam, "Digital and analog communication systems", John Wiley India Pvt. Ltd, 1996.
4. Hari Bhat, Ganesh Rao, "Information Theory and Coding", Cengage, 2017.
5. Todd K Moon, "Error Correction Coding", Wiley Std. Edition, 2006.

Reference Books:

1. Bernard Sklar, "Digital Communications – Fundamentals and Applications", Second Edition, Pearson Education, 2016, ISBN: 9780134724058.
2. K Sam Shanmugam, "Digital and analog communication systems", John Wiley India Pvt. Ltd, 1996.

Web links and Video Lectures (e-Resources)

- https://nptel.ac.in/courses/108102096

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V Semester

Computer Communication Networks			
Course Code	**21EC53**	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	3:0:0:1	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3

Course objectives: This course will enable students to:

1. Understand the layering architecture of OSI reference model and TCP/IP protocol suite.
2. Understand the protocols associated with each layer.
3. Learn the different networking architectures and their representations.
4. Learn the functions and services associated with each layer.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Lecture method (L): the traditional lecture method, or a different type of teaching method may be adopted to develop the outcomes.
2. Show Video/animation films to explain the functioning of various concepts in networking.
3. Encourage collaborative (Group) Learning in the class.
4. Ask at least three HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking .
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyse information rather than simply recall it.
6. Demonstrate implementation of various protocols to help better understand the functioning of various concepts in networking.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Introduction: Data communication: Components, Data representation, Data flow, Networks: Network criteria, Physical Structures, Network types: LAN, WAN, Switching, The Internet. (1.1,1.2, 1.3 (1.3.1to 1.3.4 of Text).
Network Models: TCP/IP Protocol Suite: Layered Architecture, Layers in TCP/IP suite, Description of layers, Encapsulation and Decapsulation, Addressing, Multiplexing and Demultiplexing, The OSI Model: OSI Versus TCP/IP. (2.2, 2.3 of Text)

Data-Link Layer: Introduction: Nodes and Links, Services, Two Categories' of link, Sublayers, Link Layer addressing: Types of addresses, ARP (9.1, 9.2 (9.2.1, 9.2.2))

Teaching-Learning Process	Chalk and talk method, PowerPoint Presentation, YouTube videos, Animation of OSI and TCP-IP protocol suites, Example of ARP and RARP. **Self-Study**: Internet standards and administration, **RBT Level:** L1, L2, L3

Module-2

Data Link Control (DLC) services: Framing, Flow and Error Control. (11.1 of Text)

Media Access Control: Random Access: ALOHA, CSMA, CSMA/CD, CSMA/CA. (12.1 of Text).

Connecting Devices: Hubs, Switches, Virtual LANs: Membership, Configuration, Communication between Switches, Advantages. (17.1,17.2 of text)

Wired and Wireless LANs: Ethernet Protocol, Standard Ethernet. (13.1, 13.2 (13.2.1 to 13.2.5 of Text)

Introduction to wireless LAN: Architectural Comparison, Characteristics, Access Control. (15.1 of Text)	
Teaching-Learning Process	Chalk and talk method, PowerPoint Presentation, YouTube videos, Animations showing Framing, CSMA, Connecting devices, Problems on ALOHA, CSMA, Framing and Standard ethernet. **Self-Study**: Fast Ethernet, Gigabit ethernet & IEEE802.11 wireless LANs **RBT Level:** L1, L2, L3
Module-3	
Network Layer: Introduction, Network Layer services: Packetizing, Routing and Forwarding, Other services, Packet Switching: Datagram Approach, Virtual Circuit Approach, IPV4 Addresses: Address Space, Classful Addressing, Classless Addressing, DHCP, Network Address Resolution (18.1(excluding 18.1.3), 18.2, 18.4 of Text) **Network Layer Protocols**: Internet Protocol (IP): Datagram Format, Fragmentation, Options, Security of IPv4 Datagrams. (19.1of Text), IPv6 addressing and Protocol (22.1 and 22.2). **Unicast Routing**: Introduction, Routing Algorithms: Distance Vector Routing, Link State Routing, Path vector routing. (20.1, 20.2 of Text)	
Teaching-Learning Process	Chalk and talk method, PowerPoint Presentation, YouTube videos, Animation of DHCP, routing protocols, Numericals on Addressing, **Self-Study**: Network Layer performance, RIP, OSPF **RBT Level:** L1, L2, L3
Module-4	
Transport Layer: Introduction: Transport Layer Services, Connectionless and Connection oriented Protocols, Transport Layer Protocols: Simple protocol, Stop and wait protocol, Go-BackN Protocol, Selective repeat protocol, Piggybacking (23.1, 23.2.1, 23.2.2, 23.2.3, 23.2.4, 23.2.5 of Text) **Transport-Layer Protocols in the Internet**: User Datagram Protocol: User Datagram, UDP Services, UDP Applications, Transmission Control L1, L2, L3 Protocol: TCP Services, TCP Features, Segment, Connection, State Transition diagram, Windows in TCP, Error control, TCP congestion control. (24.2, 24.3.1, 24.3.2, 24.3.3, 24.3.4, 24.3.6, 24.3.8, 24.3.9 of Text) ***Note: Exclude FSMs for CIE and SEE**	
Teaching-Learning Process	Chalk and talk method, PowerPoint Presentation, YouTube videos, Animation/Implementation of Flow control protocols and TCP using simulators, **Self-Study**: Flow Control in TCP **RBT Level:** L1, L2, L3
Module-5	
Application Layer: Introduction: providing services, Application- layer paradigms, Standard Client –Server Protocols: Hyper Text Transfer Protocol, FTP: Two connections, Control Connection, Data Connection, Electronic Mail: Architecture, Domain Name system: Name space, DNS in internet, Resolution, DNS Messages, Registrars, DDNS, security of DNS. (25.1, 26.1.2, 26.2, 26.3, 26.6 of Text) Quality of Service (30.1, 30.2.) Network Security (31.1)	
Teaching-Learning Process	Chalk and talk method, PowerPoint Presentation, YouTube videos, Animation/Implementation of HTTP, FTP, DNS using network simulators, **Self Study**: WWW , TELNET **RBT Level:** L1, L2, L3

Course outcomes (Course Skill Set)

At the end of the course the student will be able to:

1. Understand the concepts of networking thoroughly.
2. Identify the protocols and services of different layers.
3. Distinguish the basic network configurations and standards associated with each network.
4. Discuss and analyse the various applications that can be implemented on networks.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100 shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Text Books:

Forouzan, "Data Communications and Networking", 5th Edition, McGraw Hill, 2013, ISBN: 1-25-906475-3.

Reference Books:

1. James J Kurose, Keith W Ross, "Computer Networks", Pearson Education.
2. Wayne Tomasi, "Introduction to Data Communication and Networking", Pearson India, 1st edition.
3. Andrew Tannenbaum, "Computer Networks", Prentice Hall.
4. William Stallings, "Data and Computer Communications", Prentice Hall.

Web links and Video Lectures (e-Resources)

- https://nptel.ac.in/courses/106105183.
- TCP/IP Tutorial and Technical Overview, (IBM Redbook) - Download From http://www.redbooks.ibm.com/abstracts/gg243376.html
- TCP/IP Guide, Charles M Kozierok, Available Online - http://www.tcpipguide.com/
- Request for Comments (RFC) - IETF - http://www.ietf.org/rfc.html
- https://cosmolearning.org/courses/computer-networks-524/video-lectures/
- https://www.eecis.udel.edu/~bohacek/videoLectures/ComputerNetworking/ComputerNetworking_v2.html

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Implementation of simple networks and various networking protocols and algorithms using simulators like NCTUns / CISCO packet tracer and measurement of various parameters using WireShark
- Implementation of simple networks and various networking protocols and algorithms in C/C++/Python

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V Semester

Communication Lab II			
Course Code	**21ECL55**	CIE Marks	50
Teaching Hours/Week (L: T: P: S)	0:0:2:0	SEE Marks	50
Credits	1	Exam Hours	3

Course objectives:

This laboratory course enables students to

- Design and demonstrate communication circuits for different digital modulation techniques.
- To simulate Source coding Algorithms using C/C++/ MATLAB code.
- To simulate Error correcting and detecting codes using C/C++/ MATLAB code.
- Simulate the networking concepts and protocols using C/C++/ Network simulation tool.
- Understand entropies and mutual information of different communication channels.

Sl.No.	**Experiments**
	Implement the following using discrete components
1	FSK generation and detection
2	PSK generation and detection
3	DPSK Transmitter and receiver
4	QPSK Transmitter and Receiver
	Implement the following in C/C++/MATLAB/Scilab/Python or any other Suitable software
5	Write a program to encode binary data using Huffman code and decode it.
6	Write a program to encode binary data using a (7,4) Hamming code and decode it.
7	Write a program to encode binary data using a ((3,1,2)/suitably designed) Convolution code and decode it.
8	For a given data, use CRC-CCITT polynomial to obtain the CRC code. Verify the program for the cases a) Without error b) With error
	Implement the following algorithms in C/C++/MATLAB/Network simulator
9	Write a program for congestion control using leaky bucket algorithm.
10	Write a program for distance vector algorithm to find suitable path for transmission.
11	Write a program for flow control using sliding window protocols.
12	Configure a simple network (Bus/star) topology using simulation software **OR** Configure a simple network (Ring/Mesh) topology using simulation software.
	Demonstration Experiments (For CIE)
13	Configure and simulate simple Wireless Local Area network.
14	Simulate the BER performance of (2, 1, 3) binary convolutional code with generator sequences g(1) =(1 0 1 1) and g(2) =(1 1 1 1) on AWGN channel. Use QPSK modulation scheme. Channel decoding is to be performed through Viterbi decoding. Plot the bit error rate versus SNR (dB), i.e. $P_{e,b}$ versus E_b/N_0. Consider binary input vector of size 3 lakh bits. Also find the coding gain.
15	Simulate the BER performance of (7, 4) Hamming code on AWGN channel. Use QPSK modulation

	scheme. Channel decoding is to be performed through maximum-likelihood decoding. Plot the bit error rate versus SNR (dB), i.e. $P_{e,b}$ versus E_b/N_0. Consider binary input vector of size 5 lakh bits. Use the following parity check matrix for the (7, 4) Hamming code. Also find the coding gain. $$H = \begin{bmatrix} 1 & 0 & 0 & 1 & 1 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 1 & 1 & 1 & 0 & 1 \end{bmatrix}$$
16	Simulate the BER performance of rate 1/3 Turbo code. Turbo encoder uses two recursive systematic encoders with $G(D) = \left[1, \frac{1+D^4}{1+D+D^2+D^3+D^4}\right]$ and pseudo-random interleaver. Use QPSK modulation scheme. Channel decoding is to be performed through maximum a-posteriori (MAP) decoding algorithm. Plot the bit error rate versus SNR (dB), i.e. $P_{e,b}$ versus E_b/N_0. Consider binary input vector of size of around 3 lakh bits and the block length as 10384 bits. Also find the coding gain.

Course outcomes (Course Skill Set):

On the completion of this laboratory course, the students will be able to:

1. Design and test the digital modulation circuits and display the waveforms.
2. To Implement the source coding algorithm using C/C++/ MATLAB code.
3. To Implement the Error Control coding algorithms using C/C++/ MATLAB code.
4. Illustrate the operations of networking concepts and protocols using C programming and network simulators.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. The student has to secure not less than 35% (18 Marks out of 50) in the semester-end examination (SEE).

Continuous Internal Evaluation (CIE):

CIE marks for the practical course is **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment to be evaluated for conduction with observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments designed by the faculty who is handling the laboratory session and is made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled downed to 30 marks (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct 02 tests for 100 marks, the first test shall be conducted after the 8th week of the semester and the second test shall be conducted after the 14th week of the semester.
- In each test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability. Rubrics suggested in Annexure-II of Regulation book
- The average of 02 tests is scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and average marks of two tests is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

SEE marks for the practical course is 50 Marks.

SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the University

All laboratory experiments are to be included for practical examination.
(Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.
Students can pick one question (experiment) from the questions lot prepared by the internal /external examiners jointly.
Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.
General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners).
Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.
The duration of SEE is 03 hours.

Rubrics suggested in Annexure-II of Regulation book

Suggested Learning Resources:

1. Simon Haykin, "Digital Communication Systems", John Wiley & sons, First Edition, 2014, ISBN 978-0-471-64735-5.
2. K Sam Shanmugam, "Digital and analog communication systems", John Wiley India Pvt. Ltd, 1996.
3. Forouzan, "Data Communications and Networking", 5th Edition, McGraw Hill, 2013, ISBN: 1-25-906475-3.

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V Semester

IoT (Internet of Things) Lab			
Course Code	21EC581	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	0:0:2:0	SEE Marks	50
Credits	1	Exam Hours	03

Course objectives:

- To impart necessary and practical knowledge of components of Internet of Things
- To develop skills required to build real-life IoT based projects.

Sl.No	Experiments
1	i) To interface LED/Buzzer with Arduino/Raspberry Pi and write a program to 'turn ON' LED for 1 sec after every 2 seconds. ii) To interface Push button/Digital sensor (IR/LDR) with Arduino/Raspberry Pi and write a program to 'turn ON' LED when push button is pressed or at sensor detection.
2	i) To interface DHT11 sensor with Arduino/Raspberry Pi and write a program to print temperature and humidity readings. ii) To interface OLED with Arduino/Raspberry Pi and write a program to print temperature and humidity readings on it.
3	To interface motor using relay with Arduino/Raspberry Pi and write a program to 'turn ON' motor when push button is pressed.
4	To interface Bluetooth with Arduino/Raspberry Pi and write a program to send sensor data to smartphone using Bluetooth.
5	To interface Bluetooth with Arduino/Raspberry Pi and write a program to turn LED ON/OFF when '1'/'0' is received from smartphone using Bluetooth.
6	Write a program on Arduino/Raspberry Pi to upload temperature and humidity data to thingspeak cloud.
7	Write a program on Arduino/Raspberry Pi to retrieve temperature and humidity data from thingspeak cloud.
8	To install MySQL database on Raspberry Pi and perform basic SQL queries.
9	Write a program on Arduino/Raspberry Pi to publish temperature data to MQTT broker.
10	Write a program to create UDP server on Arduino/Raspberry Pi and respond with humidity data to UDP client when requested.
11	Write a program to create TCP server on Arduino/Raspberry Pi and respond with humidity data to TCP client when requested.
12	Write a program on Arduino/Raspberry Pi to subscribe to MQTT broker for temperature data and print it.

Course outcomes (Course Skill Set):

At the end of the course the student will be able to:

1. Understand internet of Things and its hardware and software components
2. Interface I/O devices, sensors & communication modules
3. Remotely monitor data and control devices
4. Develop real life IoT based projects

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. The student has to secure not less than 35% (18 Marks out of 50) in the semester-end examination (SEE).

Continuous Internal Evaluation (CIE):

CIE marks for the practical course is **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment to be evaluated for conduction with observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments designed by the faculty who is handling the laboratory session and is made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled downed to 30 marks (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct 02 tests for 100 marks, the first test shall be conducted after the 8^{th} week of the semester and the second test shall be conducted after the 14^{th} week of the semester.
- In each test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability. Rubrics suggested in Annexure-II of Regulation book
- The average of 02 tests is scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and average marks of two tests is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

SEE marks for the practical course is 50 Marks.

SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the University

All laboratory experiments are to be included for practical examination.

(Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.

Students can pick one question (experiment) from the questions lot prepared by the internal /external examiners jointly.

Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)

Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.

The duration of SEE is 03 hours

Rubrics suggested in Annexure-II of Regulation book

Suggested Learning Resources:

1. Vijay Madisetti, Arshdeep Bahga, Internet of Things. "A Hands on Approach", University Press
2. Dr. SRN Reddy, Rachit Thukral and Manasi Mishra, "Introduction to Internet of Things: A practical Approach", ETI Labs
3. Pethuru Raj and Anupama C Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press
4. Jeeva Jose, "Internet of Things", Khanna Publishing House, Delhi
5. Adrian McEwen, "Designing the Internet of Things", Wiley
6. Raj Kamal, "Internet of Things: Architecture and Design", McGraw Hill

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V Semester

Communication Simulink Toolbox

Course Code	**21EC582**	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	0:0:2:0	SEE Marks	50
Credits	1	Exam Hours	03

Course objectives:

- To impart knowledge of simulation software in digital communications
- To develop skills required to build and analyze the performance of various simulated communication systems under different conditions

Sl. No.	Experiments
1	Modulation & demodulation of a random binary data stream using 16 – QAM.
2	Bit error rate (BER) improvement using Pulse Shaping on 16 – QAM signal. (Use forward error correction (FEC) coding.)
3	Perform OFDM modulation and obtain time domain and frequency domain plots to show a low-rate signal, a high-rate signal, and a frequency selective multipath channel response.
4	(a) Simulate basic OFDM with no cyclic prefix. (b) Perform Equalization, Convolution, and Cyclic Prefix Addition on basic OFDM.
5	OFDM with FFT Based Oversampling - Modify an OFDM+ Cyclic Prefix signal to efficiently output an oversampled waveform from the OFDM modulator.
6	Simulate a basic communication system in which the signal is first QPSK modulated and then subjected to Orthogonal Frequency Division Multiplexing (OFDM).
7	Obtain the scatter plots & eye diagrams of a QPSK signal to visualize the signal behaviour in presence of AWGN.
8	(a) Generate a multiband signal using the Communications Toolbox. (b) Random noise generation using Simulink & display histogram plots of Gaussian, Rayleigh, Rician, and Uniform noise.
9	QPSK Transmitter and Receiver in Simulink.
10	Multipath Fading Channel in Simulink – For example: Simulate QPSK transmission over a • multipath Rayleigh fading channel and • a multipath Rician fading channel.
11	Adjacent and Co-Channel Interference using Simulink. • Use PSK-modulated signals to show the effects of adjacent and co-channel interference on a transmitted signal.
12	Modulation Classification with Deep Learning • Predict Modulation Type Using CNN

Course outcomes (Course Skill Set):

At the end of the course the student will be able to:

1. Perform sampling, aliasing, filtering, and quadrature modulation through simulation.
2. Plot signal space representation of digital modulation techniques.
3. Design and implement a pulse shape and matched filter to avoid inter-symbol interference and maximize receiver SNR.
4. Demonstrate advanced wireless communication techniques like Multipath fading, CCI etc. and model the same using MATLAB / Simulink.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course.

The student has to secure not less than 35% (18 Marks out of 50) in the semester-end examination (SEE).

Continuous Internal Evaluation (CIE):

CIE marks for the practical course is **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment to be evaluated for conduction with observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments designed by the faculty who is handling the laboratory session and is made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled downed to 30 marks (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct 02 tests for 100 marks, the first test shall be conducted after the 8th week of the semester and the second test shall be conducted after the 14th week of the semester.
- In each test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability. Rubrics suggested in Annexure-II of Regulation book
- The average of 02 tests is scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and average marks of two tests is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

SEE marks for the practical course is 50 Marks.

SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the University

All laboratory experiments are to be included for practical examination.

(Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.

Students can pick one question (experiment) from the questions lot prepared by the internal /external examiners jointly.

Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)

Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.

The duration of SEE is 03 hours

Rubrics suggested in Annexure-II of Regulation book

Suggested Learning Resources:

1. Communication Toolbox – Examples (https://in.mathworks.com/)
2. "Digital Communication Laboratory" Courseware by Professor Lee C Potter, Dr. Yang Yang, Electrical and Computer Engineering, The Ohio State University.

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VI Semester

VLSI Design and Testing			
Course Code	**21EC63**	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	3:0:0:1	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3

Course objectives:

- Impart knowledge of MOS transistor theory and CMOS technology
- Learn the operation principles and analysis of inverter circuits.
- Infer the operation of Semiconductor memory circuits.
- Demonstrate the concept of CMOS testing.

Teaching-Learning Process (General Instructions)

The sample strategies, which the teacher can use to accelerate the attainment of the various course outcomes are listed in the following:

1. Lecture method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Arrange visits to nearby PSUs and industries.
3. Show Video/animation films to explain the functioning of various fabrication & testing techniques.
4. Encourage collaborative (Group) Learning in the class
5. Topics will be introduced in multiple representations.
6. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Introduction: A Brief History, MOS Transistors, CMOS Logic (1.1 to 1.4 of TEXT1)

MOS Transistor Theory: Introduction, Long-channel I-V Characteristics, Non-ideal I-V Effects, DC Transfer Characteristics (2.1, 2.2, 2.4 and 2.5 of TEXT1).

Teaching-Learning Process	Chalk and talk method, PowerPoint Presentation, YouTube videos, Videos on transistor working **Self-study topics**: MOSFET Scaling and Small-Geometry Effects **RBT Level:** L1, L2, L3

Module-2

Fabrication: CMOS Fabrication and Layout, Introduction, CMOS Technologies, Layout Design Rules, (1.5 and 3.1 to 3.3 of TEXT1).

Delay: Introduction, Transient Response, RC Delay Model, Linear Delay Model, Logical Efforts of Paths (4.1 to 4.5 of TEXT1, except sub-sections 4.3.7, 4.4.5, 4.4.6, 4.5.5 and 4.5.6).

Teaching-Learning Process	Chalk and talk method, Power point presentation, YouTube videos, Videos on fabrication **Self-study topics**: Layouts of complex design using Euler's method **RBT Level:** L1, L2, L3

Module-3

Semiconductor Memories: Introduction, Dynamic Random Access Memory (DRAM) and Static Random Access Memory (SRAM), Nonvolatile Memory, Flash Memory, Ferroelectric Random Access Memory (FRAM) (10.1 to 10.6 of TEXT2)

Teaching-Learning	Chalk and talk method, PowerPoint Presentation, YouTube videos on Standard

Process	cell memory Design **Self-study topics**: Memory array design **RBT Level:** L1, L2, L3
Module-4	
Faults in digital circuits: Failures and faults, Modelling of faults, Temporary faults **Test generation for combinational logic circuits**: Fault diagnosis of digital circuits, test generation techniques for combinational circuits, Detection of multiple faults in combinational logic circuits. (1.1 to 1.3, 2.1 to 2.3 of TEXT3)	
Teaching-Learning Process	Chalk and talk method, PowerPoint Presentation, YouTube videos, videos on testing algorithms for test generation **Self-study topics**: Testable combinational logic circuits **RBT Level:** L1, L2, L3
Module-5	
Test generation for sequential circuits: Testing of sequential circuits as iterative combinational circuits, state table verification, test generation based on circuits structure, functional fault models, test generation based on functional fault models. **Design of testable sequential circuits**: Controllability and Observability, Adhoc design rules, design of diagnosable sequential circuits, The scan path technique, LSSD, Random Access scan technique, partial scan. (4.1 to 4.5, 5.1 to 5.7 of TEXT3)	
Teaching-Learning Process	Chalk and talk method/Power point presentation, YouTube videos **Self-study topics**: Memory testing techniques **RBT Level:** L1, L2, L3

Course outcomes (Course Skill Set)

At the end of the course the student will be able to:

1. Demonstrate understanding of MOS transistor theory, CMOS fabrication flow and technology scaling.
2. Draw the basic gates using the stick and layout diagram with the knowledge of physical design aspects.
3. Interpret memory elements along with timing considerations.
4. Interpret testing and testability issues in combinational logic design.
5. Interpret testing and testability issues in combinational logic design.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20**

Marks (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100 shall be reduced proportionally to 50 marks

Suggested Learning Resources:

Text Books:

1. "CMOS VLSI Design- A Circuits and Systems Perspective", Neil H E Weste, and David Money Harris 4th Edition, Pearson Education.
2. "CMOS Digital Integrated Circuits: Analysis and Design", Sung Mo Kang & Yosuf Leblebici, Third Edition, Tata McGraw-Hill.
3. "Digital Circuit Testing and Testability", Lala Parag K, New York, Academic Press, 1997.

Reference Books:

1. "Basic VLSI Design", Douglas A Pucknell, Kamran Eshraghian, 3rd Edition, Prentice Hall of India publication, 2005.
2. "Essential of Electronic Testing for Digital, Memory and Mixed Signal Circuits", Vishwani D Agarwal, Springer, 2002.

Web links and Video Lectures (e-Resources)

- https://www.youtube.com/watch?v=oL8SKNxEaHs&list=PLLy_2iUCG87Bdulp9brz9AcvW_TnFCUmM
- https://www.youtube.com/watch?v=lRpt1fCHd8Y&list=PLCmoXVuSEVHlEJi3SwdyJ4EICffuyqpjk
- https://www.youtube.com/watch?v=yLqLD8Y4-Qc

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Model displayed for clear understanding of fabrication process of MOS transistor
- Practise session can be held to understand the significance of various layers in MOS process, with the help of coloured layouts

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VI Semester

VLSI Laboratory			
Course Code	**21ECL66**	CIE Marks	50
Teaching Hours/Week (L: T: P: S)	0:0:2:0	SEE Marks	50
Credits	1	Exam Hours	3

Course objectives:

This laboratory course enables students to

- Design, model, simulate and verify digital circuits.
- Design layouts and perform physical verification of CMOS digital circuits.
- Perform ASIC design flow and understand the process of synthesis, synthesis constraints and evaluating the synthesis reports to obtain optimum gate level netlist.
- Perform RTL-GDSII flow and understand the stages in ASIC.

Sl.No.	**Experiments**
	ASIC Digital Design
1	4-Bit Adder • Write Verilog Code • Verify the Functionality using Test-bench • Synthesize the design by setting proper constraints and obtain the netlist. From the report generated identify Critical path, Maximum delay, Total number of cells, Power requirement and Total area required
2	4-Bit Booth Multiplier • Write Verilog Code • Verify the Functionality using Test-bench • Synthesize the design by setting proper constraints and obtain the netlist. From the report generated identify Critical path, Maximum delay, Total number of cells, Power requirement and Total area required
3	32-Bit ALU Supporting 4-Logical and 4-Arithmetic operations, using case and if statement for ALU Behavioral Modeling • Write Verilog Code • Verify functionality using Test-bench • Synthesize the design targeting suitable library and by setting area and timing constraints • Tabulate the Area, Power and Delay for the Synthesized netlist • Identify Critical path
4	Latch and Flip-Flop • Synthesize the design and compare the synthesis report (D, SR, JK)
	ASIC Analog Design
5	a) Capture the schematic of CMOS inverter with load capacitance of 0.1pF and set the widths of Inverter with Wn = Wp, Wn = 2Wp, Wn = Wp/2 and length at selected technology. Carry out the following:

	i. Set the input signal to a pulse with rise time, fall time of 1ns and pulse width of 10ns and the time period of 20ns and plot the input voltage and output voltage of designed inverter? ii. From the simulation result compute tpHL, tpLH and td for all three geometrical settings of width? iii. Tabulate the results of delay and find the best geometry for minimum delay for CMOS inverter? b) Draw layout of inverter with Wp/Wn = 40/20, use optimum layout methods. Verify for DRC and LVS, extract parasitic and perform post layout simulations, compare the results with pre-layout simulations. Record the observations.
6	a) Capture the schematic of 2-input CMOS NAND gate having similar delay as that of CMOS inverter computed in experiment above. Verify the functionality of NAND gate and also find out the delay td for all four possible combinations of input vectors. Table the results. Increase the drive strength to 2X and 4X and tabulate the results. b) Draw the layout of NAND with Wp/Wn = 40/20, use optimum layout methods. Verify for DRC and LVS, extract parasitic and perform post layout simulations, compare the results with pre-layout simulations. Record the observations.
7	a) Capture schematic of Common Source Amplifier with PMOS Current Mirror Load and find its transient response and AC response? Measure the Unit Gain Bandwidth (UGB), amplification factor by varying transistor geometries, study the impact of variation in width to UGB. b) Draw Layout of common source amplifier, use optimum layout methods. Verify for DRC & LVS, extract parasitic and perform post layout simulations, compare the results with pre-layout simulations. Record the observations.
8	a) Capture schematics of two-stage operational amplifier and measure the following: i. UGB ii. dB Bandwidth iii. Gain Margin and phase margin with and without coupling capacitance iv. Use the op-amp in the inverting and non-inverting configuration and verify its functionality. v. Study the UGB, 3dB bandwidth, gain and power requirement in op-amp by varying the stage wise transistor geometries and record the observations. b) Draw layout of two-stage operational amplifier with minimum transistor width set to 300 (in 180/90/45 nm technology), choose appropriate transistor geometries as per the results obtained in part a. Use optimum layout methods. Verify for DRC and LVS, extract parasitic and perform post layout simulations, compare the results with pre-layout simulations. Record the observations.
	Demonstration Experiments (For CIE)
9	UART • Write Verilog Code • Verify the Functionality using Test-bench • Synthesize the design targeting suitable library and by setting area and timing constraints • Tabulate the Area, Power and Delay for the Synthesized netlist, Identify Critical path
10	For synthesized netlist carry out the following: • Floor planning • Placement and Routing • Record the parameters such as no. of metal layers used for routing, flip method for placement of standard cells • Physical Verification and record the DRC and LVS reports • Generate GDSII

11	Design and characterize 6T binary SRAM cell and measure the following: • Read Time, Write Time, SNM, Power • Draw Layout of 6T SRAM, use optimum layout methods. Verify for DRC & LVS, extract parasitic and perform post layout simulations, compare the results with pre-layout simulations. Record the observations.

Course outcomes (Course Skill Set):

On the completion of this laboratory course, the students will be able to:

1. Design and simulate combinational and sequential digital circuits using Verilog HDL.
2. Understand the synthesis process of digital circuits using EDA tool.
3. Perform ASIC design flow and understand the process of synthesis, synthesis constraints and evaluating the synthesis reports to obtain optimum gate level netlist.
4. Design and simulate basic CMOS circuits like inverter, common source amplifier, differential amplifier, SRAM.
5. Perform RTL_GDSII flow and understand the stages in ASIC design.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. The student has to secure not less than 35% (18 Marks out of 50) in the semester-end examination (SEE).

Continuous Internal Evaluation (CIE):

CIE marks for the practical course is **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment to be evaluated for conduction with observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments designed by the faculty who is handling the laboratory session and is made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled downed to 30 marks (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct 02 tests for 100 marks, the first test shall be conducted after the 8^{th} week of the semester and the second test shall be conducted after the 14^{th} week of the semester.
- In each test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability. Rubrics suggested in Annexure-II of Regulation book
- The average of 02 tests is scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and average marks of two tests is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

SEE marks for the practical course is 50 Marks.

SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the University

All laboratory experiments are to be included for practical examination.

(Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be

decided jointly by examiners. Students can pick one question (experiment) from the questions lot prepared by the internal /external examiners jointly. Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners. General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners). Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero. The duration of SEE is 03 hours. Rubrics suggested in Annexure-II of Regulation book

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VI Semester

Communication Engineering			
Course Code	**21EC651**	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	3:0:0: 1	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3

Course objectives:

This course will enable students to:
- Describe essential elements of an electronic communication system.
- Understand Amplitude, Frequency & Phase modulations, and Amplitude demodulation.
- Define the sampling theorem and methods to generate pulse modulations.
- Learn the various methods of digital modulation techniques and compare the different schemes.
- Introduce the basic concepts of information theory and coding.
- Understand the basic concepts of wireless and cellular communications.

Teaching-Learning Process (General Instructions)

The sample strategies, which the teacher can use to accelerate the attainment of the various course outcomes are listed in the following:
1. Lecture method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Show Video/animation films to explain the evolution of communication technologies.
3. Encourage collaborative (Group) Learning in the class
4. Ask at least three HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
7. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Introduction to Electronic Communications: Historical perspective, Electromagnetic frequency spectrum, Signal and its representation, Elements of electronic communications system, primary communication resources, signal transmission concepts, Analog and digital transmission, Modulation, Concept of frequency translation, Signal radiation and propagation (Text 1: 1.1 to 1.10)

Teaching-Learning Process	Chalk and talk method, Power Point Presentation **Self-study topics:** Classification of Signals and systems **RBT Level:** L1, L2, L3

Module-2

Amplitude Modulation Techniques: Types of analog modulation, Principle of amplitude modulation, AM power distribution, Limitations of AM, (TEXT 1: 4.1, 4.2, 4.4, 4.6)

Angle Modulation Techniques: Principles of Angle modulation, Theory of FM-basic Concepts, Theory of phase modulation (TEXT1: 5.1, 5.2, 5.5)

Teaching-Learning Process	Chalk and talk method/Power point presentation **Self-study topics:** DSBSC, SSB and VSB modulation techniques and comparison. **RBT Level:** L1, L2, L3

Module-3	
Sampling Theorem and Pulse Modulation Techniques: Digital Versus Analog Transmissions, Sampling Theorem, Classification of pulse modulation techniques, PAM, PWM, PPM, PCM, Quantization of signals (TEXT 1: 7.2 to 7.8)	
Teaching-Learning Process	Chalk and talk method **Self-study topics:** Differential PCM and Delta Modulation **RBT Level:** L1, L2, L3
Module-4	
Digital Modulation Techniques: Types of digital Modulation, ASK, FSK, PSK, QPSK. (TEXT 1: 9.1 to 9.5) **Information Theory, Source and Channel Coding:** Information, Entropy and its properties, Shannon,-Hartley Theorem, Objectives of source coding, Source coding technique, Shannon source coding theorem, Channel coding theorem, Error Control and Coding. [Text1: 10.1,10.2, 10.11.2, 11.1 to 11.3, 11.8, 11.9, 11.12]	
Teaching-Learning Process	Chalk and talk method, Power Point Presentation. **Self-study topics:** Quadrature Amplitude Modulation, Comparison of Digital Modulation techniques. **RBT Level:** L1, L2, L3
Module-5	
Evolution of wireless communication systems: Brief History of wireless communications, Advantages of wireless communication, disadvantages of wireless communications, wireless network generations, Comparison of wireless systems, Evolution of next generation networks, Applications of wireless communication (TEXT 2: 1.1 to 1.7) **Principles of Cellular Communications:** Cellular terminology, Cell structure and Cluster, Frequency reuse concept, Cluster size and system capacity, Method of locating cochannel cells, Frequency reuse distance (TEXT 2: 4.1 to 4.7)	
Teaching-Learning Process	Chalk and talk method/Power point presentation **Self-study topics:** Basic propagation mechanisms, Multipath fading. **RBT Level:** L1, L2, L3

Course outcomes (Course Skill Set)

At the end of the course the student will be able to:

1. Describe the scheme and concepts of radiation and propagation of communication signals through air.
2. Understand the AM and FM modulation techniques and represent the signal in time and frequency domain relations.
3. Understand the process of sampling and quantization of signals and describe different methods to generate digital signals.
4. Describe the basic digital modulation techniques, channel capacity, source coding technique and the channel coding.
5. Compare the different wireless communication systems and describe the structure of cellular communication.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100 shall be reduced proportionally to 50 marks

Suggested Learning Resources:

Books:

1. T L Singal, Analog and Digital Communications, McGraw Hill Education (India) Private Limited, 2012, 0-07-107269-1
2. T L Singal, Wireless Communications, McGraw Hill Education (India) Private Limited, 2016, ISBN:0-07-068178-3.

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VI Semester

Microcontrollers			
Course Code	**21EC652**	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	3:0:0:1	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3

Course objectives:

This course will enable students to:

- Understand the difference between a Microprocessor and a Microcontroller and embedded microcontrollers.
- Familiarize the basic architecture of 8051 microcontroller.
- Program 8051microprocessor using Assembly Level Language and C.
- Understand the interrupt system of 8051 and the use of interrupts.
- Understand the operation and use of inbuilt Timers/Counters and Serial port of 8051.
- Interface 8051 to external memory and I/O devices using its I/O ports.

Teaching-Learning Process (General Instructions)

The sample strategies, which the teacher can use to accelerate the attainment of the various course outcomes are listed in the following:

1. Lecture method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Show Video/animation films to explain the functioning of various techniques.
3. Encourage collaborative (Group) Learning in the class
4. Ask at least three HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
7. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.
8. Give Programming Assignments.

Module-1

8051 Microcontroller: Microprocessor Vs Microcontroller, Embedded Systems, Embedded Microcontrollers, 8051 Architecture- Registers, Pin diagram, I/O ports functions, Internal Memory organization. External Memory (ROM & RAM) interfacing.
Text2 : Chapter 1 section 1.1 to 1.3, chapter 3 sections 3.1 to 3.3

Teaching-Learning Process	Chalk and talk method, Simulation of modulation techniques **RBT Level:** L1, L2, L3

Module-2

8051 Instruction Set: Addressing Modes, Data Transfer instructions, Arithmetic instructions, Logical instructions, Bit manipulation instructions. Simple Assembly language program examples (without loops) to use these instructions.
Text2 : Chapter 5 , chapter 6, chapter 7, chapter 8

Teaching-Learning Process	Chalk and talk method/Power point presentation **RBT Level:** L1, L2, L3

Module-3	
8051 Jump and Call instructions & Embedded C Jump and Call Instructions, Calls & Subroutine instructions. Assembly language program examples on subroutine and involving loops. Text2 : chapter 8 section 8.1 to 8.4 **8051 Programming in C**: Data Types and Time delay in 8051 C, I/O programming in 8051 C, Logical Operations in C. Text1 : chapter 7 section 7.1 to 7.3	
Teaching-Learning Process	Chalk and talk method **RBT Level:** L1, L2, L3
Module-4	
8051 Timers and Serial Port **8051 Timers and Counters** – Operation and Assembly language programming to generate a pulse using Mode-1 and a square wave using Mode- 2 on a port pin. **8051 Serial Communication-** Basics of Serial Data Communication, RS- 232 standard, 9 pin RS232 signals, Simple Serial Port programming in Assembly and C to transmit a message and to receive data serially. Text1 : Chapter 9 section 9.1 Chapter 10 section 10.1 to 10.5	
Teaching-Learning Process	Chalk and talk method **RBT Level:** L1, L2, L3
Module-5	
8051 Interrupts and Interfacing Applications 8051 Interrupts. 8051 Assembly language programming to generate an external interrupt using a switch, 8051 C programming to generate a square waveform on a port pin using a Timer interrupt. **Interfacing** 8051 to ADC-0804, DAC, LCD and Stepper motor and their 8051 Assembly and C language interfacing programming. Text 1: Chapter 11 section 11.1 and 11.2 Chapter 13 section 13.1 to 13.2, chapter 12 section 12.1, chapter 17 section 17.2	
Teaching-Learning Process	Chalk and talk method/Power point presentation **RBT Level:** L1, L2, L3

Course outcome (Course Skill Set)

At the end of the course the student will be able to:

1. Explain the difference between Microprocessors & Microcontrollers, Architecture of 8051 Microcontroller, Interfacing of 8051 to external memory and Instruction set of 8051.
2. Develop 8051 Assembly level programs using 8051 instruction set.
3. Develop 8051 Assembly / C language program to generate timings and waveforms using 8051 timers, to send & receive serial data using 8051 serial port.
4. Develop 8051 Assembly / C language programs to generate square wave on 8051 I/O port pin using interrupt and C Programme to send & receive serial data using 8051 serial port.
5. Interface various peripheral devices to 8051 using I/O ports.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester

3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100 shall be reduced proportionally to 50 marks

Suggested Learning Resources:

Text Books:

1. "The 8051 Microcontroller and Embedded Systems – using assembly and C", Muhammad Ali Mazidi, Janice Gillespie Mazidi and Rollin D McKinlay; PHI, 2006 / Pearson, 2006.
2. "The 8051 Microcontroller", Kenneth J Ayala, 3rd Edition, Thomson/Cengage Learning.

Reference Books:

1. "The 8051 Microcontroller Based Embedded Systems", Manish K Patel, McGraw Hill, 2014, ISBN: 978-93-329-0125-4.
2. "Microcontrollers: Architecture, Programming, Interfacing and System Design", Raj Kamal, Pearson Education, 2005.

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VI Semester

Basic VLSI Design			
Course Code	**21EC653**	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	3:0:0:1	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3

Course objectives:

- Impart knowledge of MOS transistor theory and CMOS technologies
- Impart knowledge on architectural choices and performance trade-offs involved in designing and realizing the circuits in CMOS technology
- Cultivate the concepts of subsystem design processes
- Demonstrate the concepts of CMOS testing

Teaching-Learning Process (General Instructions)

The sample strategies, which the teacher can use to accelerate the attainment of the various course outcomes are listed in the following:

1. Lecture method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Show Video/animation films to explain the functioning of various techniques.
3. Encourage collaborative (Group) Learning in the class
4. Ask at least three HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
7. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.
8. Incorporate programming examples given under Activity based learning.

Module-1

Introduction: A Brief History, MOS Transistors, MOS Transistor Theory, Ideal I-V Characteristics, Non-ideal I-V Effects, DC Transfer Characteristics (1.1, 1.3, 2.1, 2.2, 2.4, 2.5 of TEXT2).
Fabrication: nMOS Fabrication, CMOS Fabrication [P-well process, N-well process, Twin tub process], BiCMOS Technology (1.7, 1.8, 1.10 of TEXT1).

Teaching-Learning Process	Chalk and talk method, YouTube videos, Power point presentation **RBT Level:** L1, L2

Module-2

MOS and BiCMOS Circuit Design Processes: MOS Layers, Stick Diagrams, Design Rules and Layout.
Basic Circuit Concepts: Sheet Resistance, Area Capacitances of Layers, Standard Unit of Capacitance, Some Area Capacitance Calculations, Delay Unit, Inverter Delays, Driving Large Capacitive Loads
(3.1 to 3.3, 4.1, 4.3 to 4.8 of TEXT1).

Teaching-Learning Process	Chalk and talk method/Power point presentation **RBT Level:** L1, L2, L3

Module-3	
Scaling of MOS Circuits: Scaling Models & Scaling Factors for Device Parameters **Subsystem Design Processes**: Some General considerations, An illustration of Design Processes, **Illustration of the Design Processes**: Regularity, Design of an ALU Subsystem, The Manchester Carry-chain and Adder Enhancement Techniques (5.1, 5.2, 7.1, 7.2, 8.2, 8.3, 8.4.1, 8.4.2 of TEXT1).	
Teaching-Learning Process	Chalk and talk method, YouTube videos, Power point presentation **RBT Level:** L1, L2, L3
Module-4	
Subsystem Design: Some Architectural Issues, Switch Logic, Gate (restoring) Logic, Parity Generators, Multiplexers, The Programmable Logic Array (PLA) (6.1 to 6.3, 6.4.1, 6.4.3, 6.4.6 of TEXT1). **FPGA Based Systems**: Introduction, Basic concepts, Digital design and FPGAs, FPGA based System design, FPGA architecture, Physical design for FPGAs (1.1 to 1.4, 3.2, 4.8 of TEXT3).	
Teaching-Learning Process	Chalk and talk method, YouTube videos, Power point presentation **RBT Level:** L1, L2, L3
Module-5	
Memory, Registers and Aspects of system Timing: System Timing Considerations, Some commonly used Storage/Memory elements (9.1, 9.2 of TEXT1). **Testing and Verification**: Introduction, Logic Verification, Logic Verification Principles, Manufacturing Test Principles, Design for testability (12.1, 12.1.1, 12.3, 12.5, 12.6 of TEXT 2).	
Teaching-Learning Process	Chalk and talk method/Power point presentation **RBT Level:** L1, L2, L3

Course outcome (Course Skill Set)

At the end of the course the student will be able to:

1. Demonstrate understanding of MOS transistor theory, CMOS fabrication flow and technology scaling.
2. Draw the basic gates using the stick and layout diagrams with the knowledge of physical design aspects.
3. Interpret Memory elements along with timing considerations
4. Demonstrate knowledge of FPGA based system design
5. Interpret testing and testability issues in VLSI Design
6. Analyze CMOS subsystems and architectural issues with the design constraints.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100 shall be reduced proportionally to 50 marks

Suggested Learning Resources:

Text Books:

1. "Basic VLSI Design"- Douglas A Pucknell & Kamran Eshraghian, PHI, 3rd Edition.
2. "CMOS VLSI Design- A Circuits and Systems Perspective", Neil H E Weste, David Harris, Ayan Banerjee, 3rd Edition, Pearson Education.
3. "FPGA Based System Design", Wayne Wolf, Pearson Education, 2004, Technology and Engineering.

Web links and Video Lectures (e-Resources)

- https://nptel.ac.in/courses/117101058
- https://nptel.ac.in/courses/117106093
- https://youtu.be/9SnR3M3CIm4
- https://nptel.ac.in/courses/108/107/108107129/

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Wherever necessary **Cadence/Synopsis/Menta Graphics tools** must be used.

1.Write Verilog Code for the following circuits and their Test Bench for verification, observe the waveform and synthesize the code with technological library with given Constraints*. Do the initial timing verification with gate level simulation.

i. An inverter
ii. A Buffer
iii. Transmission Gate
iv. Basic/universal gates
v. Flip flop -RS, D, JK, MS, T
vi. Serial & Parallel adder
vii. 4-bit counter [Synchronous and Asynchronous counter]

2. Design an op-amp with given specification* using given differential amplifier Common source and Common Drain amplifier in library** and completing the design flow mentioned below:

a. Draw the schematic and verify the following
i) DC Analysis
ii) AC Analysis
iii) Transient Analysis
b. Draw the Layout and verify the DRC, ERC
c. Check for LVS
d. Extract RC and back annotate the same and verify the Design.

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VI Semester

Electronic Circuits with Verilog			
Course Code	**21EC654**	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	2:0:2:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3

Course objectives:

- To understand the basic Verilog HDL design flow.
- To understand the basic Verilog programming concepts.
- To describe the simple logic circuits using dataflow, gate-level, and behavioural level modelling.
- To model digital systems using advanced concepts of Verilog HDL.

Teaching-Learning Process (General Instructions)

The sample strategies, which the teacher can use to accelerate the attainment of the various course outcomes are listed in the following:

1. Lecture method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Show Video/animation films to explain the functioning of various techniques.
3. Encourage collaborative (Group) Learning in the class
4. Ask at least three HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
7. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.
8. Give programming assignments.

Module-1

Overview of Digital Design with Verilog HDL: Evolution of CAD, emergence of HDLs, typical HDL-flow, why Verilog HDL?, trends in HDLs. (Text 1)
Hierarchical Modeling Concepts: Top-down and bottom-up design methodology, differences between modules and module instances, parts of a simulation, design block, stimulus block. (Text 1)

Teaching-Learning Process	Chalk and talk method, Power point presentation **RBT Level:** L1, L2, L3

Module-2

Basic Concepts: Lexical conventions, datatypes, system tasks, compiler directives. (Text 1)
Modules and Ports: Module definition, port declaration, connecting ports, hierarchical name referencing. (Text 1)

Teaching-Learning Process	Chalk and talk method, Power point presentation **RBT Level:** L1, L2, L3

Module-3

Gate-Level Modeling: Modeling using basic Verilog gate primitives, description of and/or and buf/not type gates, rise, fall and turn-off delays, min, max, and typical delays. (Text1)
Dataflow Modeling: Continuous assignments, delay specification, expressions, operators, operands, operator types. (Text 1)

Teaching-Learning Process	Chalk and talk method, Power point presentation **RBT Level:** L1, L2, L3
Module-4	
Behavioral Description: Behavioral Description Highlights, Structure of the HDL Behavioral Description, Sequential Statements, IF Statement, The case Statement , Verilog casex and casez The wait-for Statement. The Loop Statement, For-Loop, While-Loop, Verilog repeat, Verilog forever (content with respect to Verilog only) (Text 2)	
Teaching-Learning Process	Chalk and talk method, Power point presentation **RBT Level:** L1, L2, L3
Module-5	
Structural Description: Highlights of Structural Description, Organization of Structural Description Binding (4.1, 4.2, 4.3 till example 4.9) (Text 2) **Tasks and Functions**: Differences between tasks and functions, declaration, invocation, automatic tasks and functions. (Text 1)	
Teaching-Learning Process	Chalk and talk method, Power point presentation **RBT Level:** L1, L2, L3

Course outcomes (Course Skill Set)

At the end of the course the student will be able to:

1. Under the Verilog HDL design flow.
2. Describe the basic concepts of Verilog HDL programming.
3. Design of digital electronics circuits using dataflow, behavioural, gate-level, and structural modelling.
4. Design complex digital circuits using advanced Verilog concepts.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)** 1. The question paper will have ten questions. Each question is set for 20 marks. 2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module. The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100 shall be reduced proportionally to 50 marks
Suggested Learning Resources: **Text Books:** 1. "Verilog HDL: A Guide to Digital Design and Synthesis", Samir Palnitkar, Pearson education, Second edition. 2. "HDL programming (VHDL and Verilog)", Nazeih M Botros, John Wiley India Pvt. Ltd., 2008.

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VI Semester

Sensors & Actuators			
Course Code	**21EC655**	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3

Course objectives:

- To provide the fundamental knowledge about sensors and measurement system.
- To impart the knowledge of static and dynamic characteristics of instruments and understand the factors in selection of instruments for measurement.
- To discuss the principle, design and working of transducers for the measurement of physical time varying quantities.
- Understand the working of various actuators suitable in industrial process control systems.
- Understand the principle and application of smart sensors.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Explain the fundamental concepts required for the module in the introduction phase for the module.
2. Conducting quiz after completion of every module in class and evaluate.
3. Asking questions about completed previous topic, will aid to assess the student understanding.
4. Evaluate the internals answer booklet by correcting the mistakes if any.
5. Modules revision at the end as well use practical lab sessions and demonstrate the concepts if applicable and feasible.

Module-1

Sensors and measurement system: Sensors and transducers, Classifications of transducers-primary & secondary, active & passive, analog and digital transducers. Smart sensors.

Measurement: Definition, significance of measurement, instruments and measurement systems. mechanical, electrical and electronic instruments. Elements of generalized measurement system with example. Input-output configuration of measuring instruments and measurement systems, methods of correction for interfering and modifying inputs.

Teaching-Learning Process	Chalk and talk method, PowerPoint Presentation, More examples relating to applications **RBT Level:** L1, L2, L3

Module-2

Static and Dynamic Characteristics: Static calibration and error calibration curve, accuracy and precision, indications of precision, static error, scale range and scale span, reproducibility and drift, repeatability, signal to noise ratio, sensitivity, linearity, hysteresis, threshold, dead zone and dead time, resolution, signal to noise ratio, factors influencing the choice of transducers/instruments.

Dynamic response – Dynamic characteristics, Transfer function of generalized first order system, time constant. Transfer function of generalized second order system, natural frequency and Damping ratio.

Teaching-Learning Process	Chalk and talk method, Power point presentation, VI Lab to demonstrate the characteristics of sensors, More examples relating to applications **RBT Level:** L1, L2, L3

Module-3	
Measurement of Temperature: RTD, Thermistor, Thermocouple, laws of thermocouple, Thermopile, AD590. **Measurement of Displacement**: Introduction, Principles of Transduction, Variable resistance devices, variable Inductance Transducer, Variable Capacitance Transducer, Hall Effect Devices, Proximity Devices, Digital Transducer.	
Teaching-Learning Process	Chalk and talk method, PowerPoint Presentation, Virtual instrumentation Lab to demonstrate the characteristics of sensors **RBT Level:** L1, L2, L3
Module-4	
Measurement of Strain: Introduction, Types of Strain Gauges, Theory of operation of resistance strain gauges, Types of Electrical Strain Gauges –Wire gauges, unbounded strain gauges, foil gauges, semiconductor strain gauges (principle, types & list of characteristics only), Strain gauge Circuits – Wheatstone bride circuit, Applications. **Measurement of Force & Torque:** Introduction, Force measuring sensor –Load cells – column types devices, proving rings, cantilever beam, pressductor. Hydraulic load cell, electronic weighing system. Torque measurement: Absorption type, transmission type, stress type & deflection type.	
Teaching-Learning Process	Chalk and talk method, PowerPoint Presentation, More examples relating to applications **RBT Level:** L1, L2, L3
Module-5	
Actuators and process control system: Introduction. Block diagram and description of process control system with an example. Introduction, Block diagram of Final control operation, Signal conversions analog, digital, pneumatic signal. Actuators, Control elements. **Electrical actuating systems:** Solid-state switches, Solenoids, Electric Motors- Principle of operation and its application: D.C motors, AC motors, Synchronous Motor, Stepper motors. **Pneumatic Actuators**: Principle and working of pneumatic actuators. (Numerical problems on the topic). **Hydraulic Actuators:** Principle and working of Hydraulic actuators. (Numerical problems on the topic).	
Teaching-Learning Process	Chalk and talk method, Power point presentation More examples relating to applications **RBT Level:** L1, L2, L3

Course outcome (Course Skill Set)

At the end of the course the student will be able to:

1. Discuss the fundamental concepts related to sensors and measurement, functional elements of measurement system, I/O Characteristics of measurement system.
2. Interpret and analyse the static and dynamic characteristics of instruments.
3. Elucidate the working principle and usage of different transducers for temperature, displacement and level measurement.
4. Discuss the principle and working of different types of actuators used in industrial application.
5. Discuss the principle and working of strain, force and torque measurement.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100 shall be reduced proportionally to 50 marks

Suggested Learning Resources:

Text Books:

1. Electrical and Electronic Measurements and Instrumentation, A K Sawhney, 17th Edition, (Reprint 2004), Dhanpat Rai & Co. Pvt. Ltd., 2004.
2. Instrumentation: Devices and Systems, C S Rangan, G R Sarma, V S V Mani, 2nd Edition (32 Reprint), McGraw Hill Education (India), 2014.
3. Process Control Instrumentation Technology by C D Johnson, 7th Edition, Pearson Education Private Limited, New Delhi 2002.

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B.E: Electronics & Communication Engineering / B.E: Electronics & Telecommunication Engineering
NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
(Effective from the academic year 2021 – 22)

VI Semester

Artificial Neural Networks			
Course Code	**21EC641**	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	2:2:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3

Course objectives:

- Preparation: To prepare students with fundamental knowledge and comprehensive understanding of artificial neural networks.
- Core Competence: To equip students to develop and configure ANNs with different types of learning algorithms for real world problems.
- Professionalism & Learning Environment: To inculcate an engineering student an ethical and professional attitude by providing an academic environment inclusive of effective communication, teamwork, ability to relate engineering issues to a broader social context, and life-long learning needed for a successful professional career.

Teaching-Learning Process (General Instructions)

The sample strategies, which the teacher can use to accelerate the attainment of the various course outcomes are listed in the following:

1. Lecture method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Show Video/animation films to explain the functioning of various learning algorithms.
3. Encourage collaborative (Group) Learning in the class.
4. Ask at least three HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking.
5. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
6. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Introduction: Neural Networks, Application Scope of Neural Networks.

Artificial Neural Network: An Introduction. - Fundamental Concept, Evolution of Neural Networks, Basic models of Artificial Neural Networks (ANN), Important Technologies of ANNs, McCulloch-Pitts Neuron, Linear Separability.

Text 1: 1,1.1,1.2,2.1,2.2,2.3,2.4,2.5,2.6.

Teaching-Learning Process	Chalk and talk method, PowerPoint Presentation, YouTube videos, Animation of basic model of a neuron in comparison of biological neuron. **RBT Level:** L1, L2, L3

Module-2

Hebb Network and simple problems

Supervised Learning Network – Introduction –Perceptron Networks-Theory, Perceptron learning rule, architecture, flowchart for training Process, Perceptron training algorithm for single output classes, Perceptron training algorithm for Multiple output classes, Perceptron Network Testing Algorithm, Adaptive Linear Neuron- Theory, Delta rule, Architecture, flowchart, Training, Testing algorithm (Adaline), Multiple Adaptive Linear Neurons -Theory, Architecture, Flowchart, Training algorithm.

Teaching-	Chalk and talk method, PowerPoint Presentation, YouTube videos, Animation of

Learning Process	supervised learning algorithms. Problems on Hebb network **RBT Level:** L1, L2, L3

Module-3

Back–Propagation Network - Theory, Architecture, Flowchart for training process, Training Algorithm, Learning Factors of Back-Propagation Network, Testing Algorithm of Back-Propagation Network. Radial Basis Function Network, Time Delay Neural Network, Functional Link Networks.
Text 1: 3.5,3.6,3.7,3.8.

Teaching-Learning Process	Chalk and talk method, Power Point Presentation, YouTube videos Self-study topics: Architecture, Flowchart, Training and Testing algorithm. **RBT Level:** L1, L2, L3

Module-4

Associative Memory Network – Introduction, Training algorithm for Pattern association- Hebb Rule. Associative Memory Network - Theory, Architecture, Flowchart, Training algorithm, Testing Algorithm, Heteroassociative Memory Network- Theory, architecture, Testing algorithm, Hopfield Networks – Discrete Hopfield Network – architecture, Training algorithm, Testing algorithm of Discrete Hopfield Network.
Text 1: 4.1,4.2,4.3,4.4,4.6.

Teaching-Learning Process	Chalk and talk method, Power Point Presentation, YouTube videos Self-study topics: Architecture, Flowchart, Training and Testing algorithm. **RBT Level:** L1, L2, L3

Module-5

Unsupervised Learning Networks – Introduction, Fixed weight competitive nets – Maxnets, Architecture, Testing/application algorithm of Maxnet. Mexican Hat Net- Architecture, Flowchart, algorithm, Kohonen Self organizing Feature Maps – Theory, architecture. Learning Vector quantization – Theory, Architecture.
Text 1: 5.1,5.2-5.2.1,5.2.2,5.3- 5.3.1,5.3.2,5.4- 5.4.1,5.4.2.

Teaching-Learning Process	Chalk and talk method, Power Point Presentation, YouTube videos Self-study topics: Architecture, Flowchart, Training and Testing algorithm. **RBT Level:** L1, L2, L3

Course outcome (Course Skill Set)

At the end of the course the student will be able to:

1. Compare and contrast the biological neural network and ANN.
2. Discuss the ANN for pattern classification.
3. Develop and configure ANN's with different types of functions and learning algorithms.
4. Apply ANN for real world problems.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester

5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100 shall be reduced proportionally to 50 marks

Suggested Learning Resources:

Text Book:

S N Sivanandam and S N Deepa, "Principles of Soft Computing", 2nd Edition, Wiley India Pvt. Ltd., 2014.

Reference Book:

Simon Haykin, "Neural Networks: A comprehensive foundation", 2nd Edition, PHI, 1998.

VI Semester

Cryptography			
Course Code	**21EC642**	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	2:2:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3

Course objectives:

This course will enable students to:

- Preparation: To prepare students with fundamental knowledge/ overview in the field of Information Security with knowledge of mathematical concepts required for cryptography.
- Core Competence: To equip students with a basic foundation of Cryptography by delivering the basics of symmetric key and public key cryptography and design of pseudo random sequence generation technique

Teaching-Learning Process (General Instructions)

The sample strategies, which the teacher can use to accelerate the attainment of the various course outcomes are listed in the following:

1. Lecture method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Show Video/animation films to explain the different Cryptographic Techniques / Algorithms
3. Encourage collaborative (Group) Learning in the class
4. Ask at least three HOTS (Higher order Thinking) questions in the class, which promotes critical thinking
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Topics will be introduced in a multiple representation.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.
9. Adopt Flipped class technique by sharing the materials / Sample Videos prior to the class and have discussions on the that topic in the succeeding classes
10. Give Programming Assignments

Module-1

Basic Concepts of Number Theory and Finite Fields: Divisibility and The Division Algorithm Euclidean algorithm, Modular arithmetic, Groups, Rings and Fields, Finite fields of the form GF(p), Polynomial Arithmetic, Finite Fields of the Form GF(2^m) (Text 1: Chapter 3)

Teaching-Learning Process	Chalk and Talk, YouTube videos, Flipped Class Technique Programming on implementation of Euclidean algorithm, multiplicative inverse, Finite fields of the form GF(p), construction of finite field over GF(2^m). **RBT Level:** L1, L2, L3

Module-2

Introduction: Computer Security Concepts, A Model for Network Security (Text 1: Chapter 1)
Classical Encryption Techniques: Symmetric cipher model, Substitution techniques, Transposition techniques (Text 1: Chapter 1)

Teaching-Learning Process	Chalk and Talk, YouTube videos, Flipped Class Technique and PPTs. Programming on Substitution and Transposition techniques. Self-study topics: Security Mechanisms, Services and Attacks. **RBT Level:** L1, L2, L3

Module-3

Block Ciphers: Traditional Block Cipher structure, Data encryption standard (DES) (Text 1: Chapter 2: Section1, 2) The AES Cipher. (Text 1: Chapter 4: Section 2, 3, 4) **More on Number Theory**: Prime Numbers, Fermat's and Euler's theorem, discrete logarithm. (Text 1: Chapter 7: Section 1, 2, 5)	
Teaching-Learning Process	Chalk and Talk, YouTube videos, Flipped Class Technique and PPTs. Implementation of SDES using programming languages like C++/Python/Java/Scilab. Self-study topics: DES S-Box- Linear and differential attacks **RBT Level:** L1, L2, L3
Module-4	
ASYMMETRIC CIPHERS: Principles of Public-Key Cryptosystems, The RSA algorithm, Diffie - Hellman Key Exchange, Elliptic Curve Arithmetic, Elliptic Curve Cryptography (Text 1: Chapter 8, Chapter 9: Section 1, 3, 4)	
Teaching-Learning Process	Chalk and Talk, YouTube videos, Flipped Class Technique and PPTs. Implementation of Asymmetric key algorithms using programming languages like C++/Python/Java/Scilab Numerical examples on Elliptic Curve Cryptography **RBT Level:** L1, L2, L3
Module-5	
Pseudo-Random-Sequence Generators and Stream Ciphers: Linear Congruential Generators, Linear Feedback Shift Registers, Design and analysis of stream ciphers, Stream ciphers using LFSRs, A5, Hughes XPD/KPD, Nanoteq, Rambutan, Additive generators, Gifford, Algorithm M, PKZIP (Text 2: Chapter 16)	
Teaching-Learning Process	Chalk and Talk, YouTube videos, Flipped Class Technique and PPTs. Implementation of simple stream ciphers using programming languages like C++/Python/Java/Scilab. **RBT Level:** L1, L2, L3

Course outcomes (Course Skill Set)

At the end of the course the student will be able to:

1. Explain traditional cryptographic algorithms of encryption and decryption process.
2. Use symmetric and asymmetric cryptography algorithms to encrypt and decrypt the data.
3. Apply concepts of modern algebra in cryptography algorithms.
4. Design pseudo random sequence generation algorithms for stream cipher systems.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100 shall be reduced proportionally to 50 marks

Suggested Learning Resources:

Text Books:

1. William Stallings , "Cryptography and Network Security Principles and Practice", Pearson Education Inc., 6th Edition, 2014, ISBN: 978-93-325-1877-3
2. Bruce Schneier, "Applied Cryptography Protocols, Algorithms, and Source code in C", Wiley Publications, 2nd Edition, ISBN: 9971-51-348-X.

Reference Books:

1. Cryptography and Network Security, Behrouz A Forouzan, TMH, 2007.
2. Cryptography and Network Security, Atul Kahate, TMH, 2003.

Web links and Video Lectures (e-Resources)

- https://nptel.ac.in/courses/106105031

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Programming Assignments / Mini Projects can be given to improve programming skills

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VI Semester

Python Programming			
Course Code	**21EC643**	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	2:0:2:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3

Course objectives:

- To learn programming using Python
- Develop application using Python

Teaching-Learning Process (General Instructions)

The sample strategies, which the teacher can use to accelerate the attainment of the various course outcomes are listed in the following:

1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the delivered lessons shall develop student's theoretical and programming skills.
2. State the need for learning Programming with real-life examples.
3. Support and guide the students for self–study.
4. You will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress
5. Encourage the students for group learning to improve their creative and analytical skills.
6. Show short, related video lectures in the following ways:
    - As an introduction to new topics (pre-lecture activity).
    - As a revision of topics (post-lecture activity).
    - As additional examples (post-lecture activity).
    - As an additional material of challenging topics (pre-and post-lecture activity).
    - As a model solution of some exercises (post-lecture activity).

Module-1

Python Basics, Python language features, History , Entering Expressions into the Interactive Shell, The Integer, Floating-Point, and String Data Types, String Concatenation and Replication, Storing Values in Variables, Your First Program, Dissecting Your Program, Flow control, Boolean Values, Comparison Operators, Boolean Operators, Mixing Boolean and Comparison Operators, Elements of Flow Control, Program Execution, Flow Control Statements, Importing Modules, Ending a Program Early with sys.exit(), Functions, def Statements with Parameters, Return Values and return Statements, The None Value, Keyword Arguments and print(), Local and Global Scope, The global Statement, Exception Handling, A Short Program: Guess the Number
Textbook 1: Chapters 1 – 3

Teaching-Learning Process	Chalk and talk method, Simulation of modulation techniques **RBT Level:** L1, L2, L3

Module-2

Data Structures: Lists: The List Data Type, Working with Lists Strings: Manipulating Strings, Working with Strings, Useful String Methods Tuples and Dictionaries, basics Using Data Structures to Model Real-World Things, Manipulating Strings.
Textbook 1: Chapters 4 – 6

Teaching-Learning Process	Chalk and talk method/Power point presentation **RBT Level:** L1, L2, L3

Module-3	
Pattern Matching with Regular Expressions, Finding Patterns of Text Without Regular Expressions, Finding Patterns of Text with Regular Expressions, More Pattern Matching with Regular Expressions,, The findall() Method, Character Classes, Making Your Own Character Classes, The Caret and Dollar Sign Characters, The Wildcard Character, Review of Regex Symbols. Reading and Writing Files, Files and File Paths, The os.path Module, The File Reading/Writing Process, Saving Variables with the shelve Module, Saving Variables with the pprint. pformat() Function Textbook 1: Chapters 7, 8	
Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation **RBT Level:** L1, L2, L3
Module-4	
Classes and objects: Programmer-defined types, Attributes, Rectangles, Instances as return values, Objects are mutable, Copying, Classes and functions: Time, Pure functions, Modifiers, Prototyping versus planning, Classes and methods: Object-oriented features, Printing objects, Another example, The init method, The__str__ method, Operator overloading, Type-based dispatch, Polymorphism. Textbook 2: Textbook 2: Chapters 15 – 18	
Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation **RBT Level:** L1, L2, L3
Module-5	
HTTP, The World's simplest Web Browser, Retrieving an image over HTTP, Retrieving web pages with urllib, Parsing html and scraping the web, Parsing HTML using RE, BeautifulSoup, Reading binary files using urllib, XML, Parsing XML, Looping through nodes, JSON, Parsing JSON, API, geocoding Web Service, Security & API usage, What is database?, Database Concepts, Database Browser, Creating a database table, SQL, Spidering Twitter, Basic data modeling, Programming with multiple tables, Three kinds of Keys, JOIN Text book : Chapter 2, 13, 15	
Teaching-Learning Process	Chalk and talk method/Power point presentation **RBT Level:** L1, L2, L3

Course outcomes (Course Skill Set)

At the end of the course the student will be able to:

1. To acquire programming skills in Python
2. To demonstrate data structure representation using Python
3. To develop the skill of pattern matching and files in Python
4. To acquire Object Oriented Skills in Python
5. To develop the ability to write database applications in Python

Assessment Details (both CIE and SEE)

The weightage of Continuous 5 End Examination) taken together.

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100 shall be reduced proportionally to 50 marks

Suggested Learning Resources:

Text Books:

1. Al Sweigart, "Automate the Boring Stuff with Python",1st Edition, No Starch Press, 2015. (Available under CC-BY-NC-SA license at https://automatetheboringstuff.com/) (Chapters 1 to 8)
2. Allen B Downey, "Think Python: How to Think Like a Computer Scientist", 2nd Edition, Green Tea Press, 2015. (Available under CC-BY-NC license at http://greenteapress.com/thinkpython2/thinkpython2.pdf) (Chapters 15 - 18)
   (Download pdf/html files from the above links)
3. Charles R. Severance, "Python for Everybody: Exploring Data Using Python 3", 1st, Create Space Independent Publishing Platform, 2016

Web links and Video Lectures (e-Resources)

- https://www.youtube.com/watch?v=_xQNeOTRyig
- https://www.youtube.com/watch?v=kqtD5dpn9C8

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Write a program to generate Fibonacci series
- Write a program to find factorial of a number using function.
- Write a menu driven program to implement stack using Lists
- Create a DB using dictionaries containing key as USN and related fields containing Name, gender, Marks1, Marks2 & Marks3 of students. Implement the following functions to perform i) Update Name/gender/marks ii) search for usn and display the relevant fields iii) delete based on search for name iv)generate the report with avg marks more than 70%
- Write a program to implement search and replace multiple occurrences of a given substring in the main string in a list.
- Write a function called most_frequent that takes a string and prints the letters in decreasing order of frequency.
- Write a program that reads a file, display the contents, builds a histogram of the words in the file and print most common words in the file.
- Write a program that searches a directory and all of its subdirectories, recursively, and returns a list of complete paths for all files with a given suffix.

- Write python code to extract From: and To: Email Addresses from the given text file using regular expressions. https://www.py4e.com/code3/mbox.txt.
- Consider the sentence *"From rjlowe@iupui.edu Fri Jan 4 14:50:18 2008"*, Write python code to extract email address and time of the day from the given sentence
- Write a program to read, display and count number of sentences of the given file.
- Write a program that gets the current date and prints the day of the week.
- Write a function called print_time that takes two Time objects and prints total time it in the form hour:minute:second.
- Write a program that takes a birthday as input and prints the user's age and the number of days, hours, minutes and seconds until their next birthday.

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VI Semester

Micro Electro Mechanical Systems			
Course Code	**21EC644**	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	3: 0 :0 : 1	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3

Course objectives:

- **Preparation**: To prepare students with fundamental knowledge/ overview in the field of Micro Electro Mechanical Systems.
- **Core Competence**: To equip students with a basic foundation in electronic engineering, mechanical engineering, electrical engineering, chemistry, physics and mathematics fundamentals required for comprehending the operation and application of MEMS circuits, design.
- **Professionalism & Learning Environment:** To inculcate in students an ethical and professional attitude by providing an academic environment inclusive of effective communication, teamwork, ability to relate engineering issues to a broader social context, and life-long learning needed for a successful professional career.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Lecture method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes
2. Show Video/animation films to explain the functioning of various
3. Encourage collaborative (Group) Learning in the class to promote critical thinking
4. Topics for seminars on several MEMS related topics and their applications
5. Encourage the students to take up mini projects and main projects
6. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Overview of MEMS and Microsystems: MEMS and Microsystem, Typical MEMS and Microsystems Products, Evolution of Microfabrication, Microsystems and Microelectronics, Multidisciplinary Nature of Microsystems, Miniaturization. Applications and Markets.
Text1: **1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7, 1.8, 1.9**

Teaching-Learning Process	Chalk and talk method, Animation of MEMS products and applications **RBT Level:** L1, L2, L3

Module-2

Working Principles of Microsystems: Introduction, Microsensors, Micro actuation, MEMS with Micro actuators, Micro accelerometers, Microfluidics. **Text1: 2.1,2.2, 2.3, 2.4, 2.5, 2.6**
Engineering Science for Microsystems Design and Fabrication: Introduction, Atomic Structure of Matter, Ions and Ionization Molecular Theory of Matter and Intermolecular Forces, Plasma Physics, Electrochemistry**. Text1: 3.1, 3.2, 3.3, 3.4, 3.7, 3.8**

Teaching-Learning Process	PowerPoint Presentation, YouTube videos, Animations of MEMS Micro sensors, Micro actuators, Micro accelerometers and Microfluidics, molecules, Ions and matter **RBT Level:** L1, L2, L3

Module-3	
Engineering Mechanics for Microsystems Design: Introduction, Static Bending of Thin Plates, Mechanical Vibration, Thermo mechanics, Fracture Mechanics, Thin Film Mechanics, Overview on Finite Element Stress Analysis. **Text1: 4.1,4.2,4.3,4.4,4.5,4.6,4.7**	
Teaching-Learning Process	Chalk and talk method, Power Point Presentations and supporting YouTube Videos Solve numericals related to Thin Plates, and Vibration. Self study topics: solve numericals related to other topics **RBT Level:** L1, L2, L3
Module-4	
Scaling Laws in Miniaturization: Introduction, Scaling in Geometry, Scaling in Rigid-Body Dynamics, Scaling in Electrostatic Forces, Scaling in Electromagnetic Forces, Scaling in Electricity, Scaling in Fluid Mechanics, Scaling in Heat Transfer. **Text1: 6.1, 6.2,6.3,6.4,6.5,6.6,6.7,6.8**	
Teaching-Learning Process	Chalk and Talk Method, You Tube Videos, Solve numericals related to scaling in Geometry Self study topics: solve numericals of other topics **RBT Level:** L1, L2, L3
Module-5	
Overview of Micromanufacturing: Introduction, Bulk Micromanufacturing, Surface Micromachining, The LIGA Process, Summary on Micromanufacturing. **Text1: 9.1,9.2,9.3,9.4,9.5** **Microsystem Packaging**: Introduction, Overview of Mechanical Packaging of Microelectronics, Microsystem Packaging. **Text1: 11.1,11.2, 11.3**	
Teaching-Learning Process	Power Point Presentation, YouTube videos, Animation of MEMS micromanufacturing Supporting animation videos on packaging **RBT Level:** L1, L2, L3

Course outcomes (Course Skill Set)

At the end of the course the student will be able to:

1. Appreciate the technologies related to Micro Electro Mechanical Systems.
2. Understand design and fabrication processes involved with MEMS devices.
3. Analyse the MEMS devices and develop suitable mathematical models
4. Know various application areas for MEMS device.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100 shall be reduced proportionally to 50 marks

Suggested Learning Resources:

Text Book:

Tai-Ran Hsu, MEMS and Micro systems: Design and Manufacture, 1st Ed, Tata Mc Graw Hill.

Reference Books:

1. **Hans H Gatzen, Volker Saile, JurgLeuthold**, Micro and Nano Fabrication: Tools and Processes, Springer, 2015.
2. **Dilip Kumar Bhattacharya, Brajesh Kumar Kaushik**, Microelectromechanical Systems (MEMS), Cengage Learning.
3. **Chang Liu**, Foundations of MEMS, Pearson Ed.

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Develop mini projects and Final year projects using MEMS components to address the real world problems

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VII Semester

Advanced VLSI			
Course Code	**21EC71**	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	3:0:0:1	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3

Course objectives:

- Learn overview of VLSI design flow
- Emphasise on Back end VLSI design flow
- Learn basics of verification with reference to System Verilog

Teaching-Learning Process (General Instructions)

The sample strategies, which the teacher can use to accelerate the attainment of the various course outcomes are listed in the following:

1. Lecture method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Show Video/animation films to explain the functioning of various techniques.
3. Encourage collaborative (Group) Learning in the class
4. Ask at least three HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Topics will be introduced in multiple representations.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Introduction to ASICs: Full custom, Semi-custom and Programmable ASICs, ASIC Design flow, ASIC cell libraries. CMOS Logic: Data path Logic Cells: Data Path Elements, Adders: Carry skip, Carry bypass, Carry save, Carry select, Conditional sum, Multiplier (Booth encoding), Data path Operators, I/O cells, Cell Compilers. Text Book 1

Teaching-Learning Process	Chalk and talk method, Power point presentation **RBT Level:** L1, L2, L3

Module-2

Floor planning and placement: Goals and objectives, Measurement of delay in Floor planning, Floor planning tools, Channel definition, I/O and Power planning and Clock planning. Placement: Goals and Objectives, Min-cut Placement algorithm, Iterative Placement Improvement, Time driven placement methods, Physical Design Flow.
Routing: Global Routing: Goals and objectives, Global Routing Methods, Global routing between blocks, Back annotation. Text Book 1

Teaching-Learning Process	Chalk and talk method, Power point presentation **RBT Level:** L1, L2, L3

Module-3	
Verification Guidelines: The verification process, basic test bench functionality, directed testing, methodology basics, constrained random stimulus, randomization, functional coverage, test bench components, layered testbench. **Data Types**: Built in Data types, fixed and dynamic arrays, Queues, associative arrays, linked lists, array methods, choosing a type, creating new types with type def, creating user defined structures, type conversion, Enumerated types, constants and strings, Expression width. Text Book 2	
Teaching-Learning Process	Chalk and talk method, Power point presentation **RBT Level:** L1, L2, L3
Module-4	
Procedural Statements and Routines: Procedural statements, Tasks, Functions and void functions, Task and function overview, Routine arguments, returning from a routine, Local data storage, time values. **Connecting the test bench and design**: Separating the test bench and design, The interface construct, Stimulus timing, Interface driving and sampling, System Verilog assertions. Text Book 2	
Teaching-Learning Process	Chalk and talk method, Power point presentation **RBT Level:** L1, L2, L3
Module-5	
Randomization: Introduction, What to randomize? , Randomization in System Verilog, Random number functions, Common randomization problems, Random Number Generators. **Functional Coverage**: Coverage types, Coverage strategies, Simple coverage example, Anatomy of Cover group and Triggering a Cover group, Data sampling, Cross coverage, Generic Cover groups, Coverage options, Analyzing coverage data, measuring coverage statistics during simulation. Text Book 2	
Teaching-Learning Process	Chalk and talk method, Power point presentation **RBT Level:** L1, L2, L3

Course outcomes (Course Skill Set)

At the end of the course the student will be able to:

1. Understand VLSI design flow
2. Describe the concepts of ASIC design methodology
3. Create floor plan including partition and routing with the use of CAD algorithms
4. Will have better insights into VLSI back-end design flow
5. Learn verification basics and System Verilog

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100 shall be reduced proportionally to 50 marks

Suggested Learning Resources:

Text Books:

1. Michael John Sebastian Smith, Application - Specific Integrated Circuits, Addison-Wesley Professional, 2005.
2. Chris Spear, System Verilog for Verification – A guide to learning the Test bench language features, Springer Publications, Second Edition, 2010.

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Use EDA tool to design basic Analog blocks like amplifiers and 4-bit RAM
- Prepare a white paper on ASIC design flow referring to literatures of Cadence and Synopsys EDA tools
- Mini project using System Verilog

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VII Semester

Optical & Wireless Communication			
Course Code	**21EC72**	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	2:0:0:1	SEE Marks	50
Total Hours of Pedagogy	30	Total Marks	100
Credits	2	Exam Hours	3
Non-MCQ pattern of CIE and SEE			

Course objectives:

This course will enable students to:

- Learn the basic principle of optical fiber communication with different modes of light propagation.
- Understand the transmission characteristics and losses in optical fiber.
- Study of optical components and its applications in optical communication networks.
- Understand the concepts of propagation over wireless channels from a physics standpoint
- Understand the multiple access techniques used in cellular communications standards.
- Application of Communication theory both Physical and networking to understand GSM systems that handle mobile telephony.

Teaching-Learning Process (General Instructions)

The sample strategies, which the teacher can use to accelerate the attainment of the various course outcomes are listed in the following:

1. Lecture method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Show Video/animation films to explain the functioning of various techniques.
3. Encourage collaborative (Group) Learning in the class
4. Ask at least three HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Topics will be introduced in multiple representations.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Optical Fiber Structures: Optical Fiber Modes and Configurations, Mode theory for circular waveguides, Single mode fibers, Fiber materials.

Attenuation and Dispersion: Attenuation, Absorption, Scattering Losses, Bending loss, Signal Dispersion: Modal delay, Group delay, Material dispersion.

[Text1 : 3.1, 3.2, 2.3[2.3.1 to 2.3.4], 2.4[2.4.1, 2.4.2],2.5, 2.7].

Teaching-Learning Process	Chalk and talk method, Power point presentation **RBT Level:** L1, L2, L3

Module-2

Optical Sources and detectors: Light Emitting Diode: LED Structures, Light source materials, Quantum efficiency and LED power, Laser Diodes: Modes and threshold conditions, Rate equations, External quantum efficiency, Resonant frequencies, Photodetectors: The pin Photodetector, Avalanche Photodiodes.

WDM Concepts: Overview of WDM, Isolators and Circulators, Fiber grating filters, Dielectric thin-film filters, Diffraction Gratings. [Text1: 4.2 ,4.3, 6.1, 10.1, 10.3, 10.4, 10.5, 10.7]	
Teaching-Learning Process	Chalk and talk method, Power point presentation **RBT Level:** L1, L2, L3
Module-3	
Mobile Communication Engineering: Wireless Network generations, Basic propagation Mechanisms, Mobile radio Channel. **Principles of Cellular Communications:** Cellular terminology, Cell structure and Cluster, Frequency reuse concept, Cluster size and system capacity, Frequency Reuse Distance, Cochannel Interference and signal quality. [Text2: 1.4, 2.4, 2.5, 4.1 to 4.4, 4.6, 4.7]	
Teaching-Learning Process	Chalk and talk method, Power point presentation **RBT Level:** L1, L2, L3
Module-4	
Multiple Access Techniques: FDMA, TDMA, CDMA, SDMA, Hybrid Multiple Access Techniques, Multicarrier Multiple Access Schemes. **A Basic Cellular System:** A basic cellular system connected to PSTN, Parts of basic cellular system, Operation of a cellular system. [Text2: 8.2, 8.3, 8.4.5, 8.5, 8.6, 8.10, 9.2.2, 9.2.3, 9.3]	
Teaching-Learning Process	Chalk and talk method, Power point presentation **RBT Level:** L1, L2, L3
Module-5	
Global System for Mobile (GSM): GSM Network Architecture, GSM signalling protocol architecture, Identifiers used in GSM system, GSM Channels, Frame structure for GSM, GSM Call procedures, GSM hand-off Procedures, GSM Services and features. [Text2: 11.1, 11.2,11.3,11.4, 11.5, 11.8, 11.9. 11.10]	
Teaching-Learning Process	Chalk and talk method, Power point presentation **RBT Level:** L1, L2, L3

Course outcomes (Course Skill Set)

At the end of the course the student will be able to:

1. Classification and characterization of optical fibers with different modes of signal propagation.
2. Describe the constructional features and the characteristics of optical fiber and optical devices used for signal transmission and reception.
3. Understand the essential concepts and principles of mobile radio channel and cellular communication.
4. Describe various multiple access techniques used in wireless communication systems.
5. Describe the GSM architecture and procedures to establish call set up, call progress handling and call tear down in a GSM cellular network.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation (CIE):

CIE will be the same as other core theory courses.

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.
Semester End Examination (SEE):

For non-MCQ pattern of CIE and SEE

Continuous Internal Evaluation (CIE):

At the beginning of the semester, the instructor/faculty teaching the course has to announce the methods of CIE for the course.

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100 shall be reduced proportionally to 50 marks

Suggested Learning Resources:

Text Books

1. Gerd Keiser, Optical Fiber Communication, 5th Edition, McGraw Hill Education (India) Private Limited, 2016. ISBN:1-25-900687-5.
2. T L Singal, Wireless Communications, McGraw Hill Education (India) Private Limited, 2016, ISBN:0-07-068178-3.

Reference Books

1. John M Senior, Optical Fiber Communications, Principles and Practice, 3rd Edition, Pearson Education, 2010, ISBN:978-81-317-3266-3
2. Theodore Rappaport, Wireless Communications: Principles and Practice, 2nd Edition, Prentice Hall Communications Engineering and Emerging Technologies Series, 2002, ISBN 0-13-042232-0.
3. Gary Mullet, Introduction to Wireless Telecommunications Systems and Networks, First Edition, Cengage Learning India Pvt Ltd., 2006, ISBN - 13: 978-81-315-0559-5.

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VII Semester

Optical & Satellite Communication			
Course Code	**21EC751**	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	3:0:0:1	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3

Course objectives: This course will enable students to:

- Learn the basic principle of optical fiber communication with different modes of light propagation.
- Understand the transmission characteristics and losses in optical fiber.
- Study of optical components and its applications in optical communication networks.
- Understand the basic principle of satellite orbits and trajectories.
- Study of electronic systems associated with a satellite and the earth station.
- Study satellite applications focusing various domains services such as remote sensing, weather forecasting and navigation.

Teaching-Learning Process (General Instructions)

The sample strategies, which the teacher can use to accelerate the attainment of the various course outcomes are listed in the following:

1. Lecture method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Show Video/animation films to explain the functioning of various techniques.
3. Encourage collaborative (Group) Learning in the class
4. Ask at least three HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Topics will be introduced in multiple representations.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Optical Fiber Structures: Optical Fiber Modes and Configurations, Mode theory for circular waveguides, Single mode fibers, Fiber materials, Photonic Crystal Fibers, Fiber Optic Cables.

Attenuation and Dispersion: Attenuation: Absorption, Scattering Losses, Bending loss, Signal Dispersion: Modal delay, Group delay, Material dispersion.

[Text1 : 2.3[2.3.1 to 2.3.4], 2.4[2.4.1, 2.4.2],2.5, 2.7,2.8, 2.11, 3.1, 3.2].

Teaching-Learning Process	Chalk and talk method, Power Point Presentation. Self-study topics: Optical Spectral bands, Basic optical laws and definitions. **RBT Level:** L1, L2, L3

Module-2

Optical Sources and detectors: Light Emitting Diode: LED Structures, Light source materials, Quantum efficiency and LED power, Laser Diodes: Modes and threshold conditions, Rate equations, External quantum efficiency, Resonant frequencies, Photodetectors: The pin Photodetector, Avalanche Photodiodes.

WDM Concepts: Overview of WDM, Isolators and Circulators, Fiber grating filters, Dielectric thin-film filters, Diffraction Gratings.

Optical Amplifiers: Basic Applications and types, Erbium doped fiber amplifiers. [Text1: 4.2 ,4.3, 6.1, 10.1, 10.3, 10.4, 10.5, 10.7, 11.1, 11.3.1,11.3.2]	
Teaching-Learning Process	Chalk and talk method, Power point presentation Self-study topics: Raman Amplifiers. **RBT Level:** L1, L2, L3
Module-3	
Satellite Orbit and Trajectories: Definition, Basic Principles, Orbital parameters, Injection velocity and satellite trajectory, Types of Satellite orbits. [Text2: 2.1, 2.2, 2.3,2.4,2.5] **Satellite In-orbit Operations:** Orbital perturbations, Satellite stabilization, Orbital effects on satellite's performance, Eclipses, Look angles: Azimuth angle, Elevation angle. [Text2: 3.3, 3.4, 3.5, 3.6, 3.7]	
Teaching-Learning Process	Chalk and talk method, Power Point Presentation. Self-study topics: Satellite launch sequence. **RBT Level:** L1, L2, L3
Module-4	
Satellite Hardware: Satellite Subsystems, Power supply subsystem, Attitude and Orbit control, Tracking, Telemetry and command subsystem, Payload. [Text2: 4.1, 4.5, 4.6, 4.7,4.8] **Earth Station:** Types of earth station, Architecture, Design considerations, Testing, Earth station Hardware, Satellite tracking. [Text2: 8.1, 8.2, 8.3,8.4,8.5,8.6]	
Teaching-Learning Process	Chalk and talk method, Power Point Presentation. Self-study topics: Mechanical structure and propulsion subsystem **RBT Level:** L1, L2, L3
Module-5	
Communication Satellites: Introduction, Related Applications, Frequency Bands, Payloads, Satellite Vs. Terrestrial Networks, Satellite Television, Satellite Data Communication Services. **Applications:** Remote Sensing Satellites: Classification, Orbits, payloads. Weather Forecasting Satellites: Overview, Fundamentals, orbits and payload. Global Positioning Satellite System.	
Teaching-Learning Process	Chalk and talk method, Power point presentation Self-study topics: Regional, National and International Satellite systems **RBT Level:** L1, L2, L3

Course outcomes (Course Skill Set)

At the end of the course the student will be able to:

1. Classification and characterization of optical fibers and devices used for optical communication.
2. Understand the principle of operation of optical devices used for multiplexing and amplification of light.
3. Describe the satellite orbits and its trajectories with the definitions of parameters associated with it.
4. Describe the electronic hardware systems associated with the satellite subsystem and earth station.
5. Understand the functioning of satellites for communication, remote sensing, and weather and navigation applications.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester

2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100 shall be reduced proportionally to 50 marks

Suggested Learning Resources:

Text Books:

1. Gerd Keiser, Optical Fiber Communication, 5th Edition, McGraw Hill Education (India) Private Limited, 2016. ISBN:1-25-900687-5.
2. Anil K Maini, Varsha Agrawal, Satellite Communication, Wiley India Pvt. Ltd., 2015, ISBN: 978-81-265-2071-8.

Reference Books:

1. John M Senior, Optical Fiber Communications, Principles and Practice, 3rd Edition, Pearson Education, 2010, ISBN:978-81-317-3266-3
2. Timothy Pratt, Charles Bostian, Jeremy Allnutt, Satellite Communications, 2nd Edition, Wiley India Pvt. Ltd , 2017, ISBN: 978-81-265-0833-4
3. Dennis Roddy, Satellite Communications, 4th Edition, McGraw- Hill International edition, 2006.

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VII Semester

ARM Embedded Systems			
Course Code	**21EC752**	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	3:0:0:1	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3

Course objectives:

This course will enable students to:

- Explain the architectural features and instructions of 32 bit ARM microcontroller
- Develop Programs using the various instructions of ARM for different Applications.
- Understand the basic hardware components and their selection method based on the characteristics and
- Attributes of an embedded system.
- Develop the hardware software co-design and firmware design approaches.
- Explain the need of real time operating system for embedded system applications.

Teaching-Learning Process (General Instructions)

The sample strategies, which the teacher can use to accelerate the attainment of the various course outcomes are listed in the following:

1. Lecture method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Show Video/animation films to explain the functioning of various techniques.
3. Encourage collaborative (Group) Learning in the class
4. Ask at least three HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
7. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.
8. Give programming assignments.

Module-1

ARM Embedded System: RISC Design Philosophy, ARM design Philosophy, Embedded System hardware and Embedded System software.

ARM Processor Fundamentals: Registers, Current Program Status Registers, Pipeline, Exceptions, Interrupts and the Vector table, Core Extensions, Architecture Revisions, ARM processor families

(Text1 : Chapter 1 and Chapter 2)

Teaching-Learning Process	Chalk and talk method, Power point presentation **RBT Level:** L1, L2, L3

Module-2

ARM Instructions: Introduction, Data Processing Instructions, Branch Instructions, Load – Store Instructions Software Instructions, Program Status Register Instructions, Conditional Execution.

Thumb Instructions: Thumb register usage, ARM – Thumb Interworking, Other branch Instructions, Data Processing instructions, Single and Multiple Register Load Store Instructions, Stack Instructions, Software Interrupt Instructions.

(Text1: Chapter 3 and chapter 4,)

Teaching-Learning Process	Chalk and talk method, Power point presentation **RBT Level:** L1, L2, L3

Module-3

Embedded System Components: Embedded Vs General computing system, Classification of Embedded systems, Major applications and purpose of ES. Elements of an Embedded System (Block diagram and explanation), Differences between RISC and CISC, Harvard and Princeton, Big and Little Endian formats, Memory (ROM and RAM types), Sensors, Actuators, Optocoupler, Communication Interfaces (I2C, SPI, IrDA, Bluetooth, Wi-Fi, Zigbee only)

(Text 2: All the Topics from Ch-1 and Ch-2 (Fig and explanation before 2.1) 2.1.1.6 to 2.1.1.8, 2.2 to 2.2.2.3, 2.3 to 2.3.2, 2.3.3.3, selected topics of 2.4.1 and 2.4.2 only).

Teaching-Learning Process	Chalk and talk method, Power point presentation **RBT Level:** L1, L2, L3

Module-4

Embedded System Design Concepts: Characteristics and Quality Attributes of Embedded Systems, Operational and non-operational quality attributes, Embedded Systems-Application and Domain specific, Hardware Software Co-Design and Program Modeling (excluding UML), Embedded firmware design and development (excluding C language).
Text 2: Ch-3, Ch-4 (4.1, 4.2.1 and 4.2.2 only), Ch-7 (Sections 7.1, 7.2 only), Ch-9 (Sections 9.1, 9.2, 9.3.1, 9.3.2 only)

Teaching-Learning Process	Chalk and talk method, Power point presentation **RBT Level:** L1, L2, L3

Module-5

RTOS and IDE for Embedded System Design: Operating System basics, Types of operating systems, Task, process and threads (Only POSIX Threads with an example program), Thread preemption, Preemptive Task scheduling techniques, Task Communication, Task synchronization issues – Racing and Deadlock, Concept of Binary and counting semaphores (Mutex example without any program), How to choose an RTOS, Integration and testing of Embedded hardware and firmware, Embedded system Development Environment – Block diagram (excluding Keil), Disassembler/decompiler, simulator, emulator and debugging techniques
(Text 2: Ch-10 (Sections 10.1, 10.2, 10.3, 10.5.2 , 10.7, 10.8.1.1, 10.8.1.2, 10.8.2.2, 10.10 only), Ch-12, Ch-13 (a block diagram before 13.1, 13.3, 13.4, 13.5, 13.6 only)

Teaching-Learning Process	Chalk and talk method, Power point presentation **RBT Level:** L1, L2, L3

Course outcomes (Course Skill Set)

At the end of the course the student will be able to:

1. Describe the architectural features and instructions of 32 bit microcontroller ARM Cortex M3.
2. Apply the knowledge gained for Programming ARM Cortex M3 for different applications.
3. Understand the basic hardware components and their selection method based on the characteristics and attributes of an embedded system.
4. -design and firmware design approaches.
5. Explain the need of real time operating system for embedded system applications.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100 shall be reduced proportionally to 50 marks

Suggested Learning Resources:

Text Books:

1. Andrew N Sloss, "ARM System Developer's guide", Elsevier Publications, 2016
2. Shibu K V, "Introduction to Embedded Systems", Tata McGraw Hill Education Private Limited, 2nd Edition.

Reference Books:

1. James K Peckol, "Embedded systems- A contemporary design tool", John Wiley, 2008.
2. Yifeng Zhu, "Embedded Systems with Arm Cortex-M Microcontrollers in Assembly Language and C", 2nd Ed., Man Press LLC ©, 2015.
3. K V K K Prasad, "Embedded real time systems", Dreamtech publications, 2003.
4. Rajkamal, "Embedded Systems",2nd Edition, McGraw hill Publications, 2010.

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VII Semester

Basic Digital Image Processing			
Course Code	**21EC753**	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	2:0:2:1	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3

Course objectives:

- Understand the fundamentals of digital image processing
- Understand the image enhancement techniques in spatial domain used in digital image processing
- Understand the frequency domain enhancement techniques in digital image processing
- Understand the Color Image Processing in digital image processing
- Understand the image restoration techniques and methods used in digital image processing

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Show Video/animation films to explain the functioning of various image processing concepts.
2. Encourage cooperative (Group) Learning through puzzles, diagrams, coding etc., in the class.
3. Encourage students to ask questions and investigate their own ideas helps improve their problem-solving skills as well as gain a deeper understanding of academic concepts.
4. Ask at least three HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking
5. Students are encouraged to do coding based projects to gain knowledge in image processing.
6. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
7. Topics will be introduced in multiple representations.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.
9. Arrange visits to nearby PSUs such as CAIR(DRDO), NAL, BEL, ISRO, etc., and small-scale software industries to give industry exposure.

Module-1

Digital Image Fundamentals: What is Digital Image Processing?, Origins of Digital Image Processing, Examples of fields that use DIP, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Elements of Visual Perception, Image Sensing and Acquisition, Image Sampling and Quantization, Some Basic Relationships Between Pixels.
[Text 1: Chapter 1, Chapter 2: Sections 2.1 to 2.5]

Teaching-Learning Process	Chalk and talk method, PowerPoint Presentation, YouTube videos, Videos on Image processing applications Self-study topics: Arithmetic and Logical operations Practical topics: Problems on Basic Relationships Between Pixels. **RBT Level:** L1, L2, L3

Module-2

Spatial Domain: Some Basic Intensity Transformation Functions, Histogram Processing, Fundamentals of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters
[Text 1: Chapter 3: Sections 3.2 to 3.6]

Teaching-Learning Process	Chalk and talk method, PowerPoint Presentation, YouTube videos and animations of Intensity Transformation Functions, Histogram Processing, Spatial domain filters. Self-study topics: Point, line and edge detection. Practical topics: Problems on Intensity Transformation Functions, Histogram, Spatial domain filters **RBT Level:** L1, L2, L3

Module-3

Frequency Domain: Basics of Filtering in the Frequency Domain, Image Smoothing and Image Sharpening Using Frequency Domain Filters.

[Text 1: Chapter 4: Sections 4.7 to 4.9]

Teaching-Learning Process	Chalk and talk method, PowerPoint Presentation, YouTube videos on frequency domain filtering, Color image processing. Self-study topics: Basic concept of segmentation. Practical topics: Problems on Image smoothing and sharpening **RBT Level:** L1, L2, L3

Module-4

Color Image Processing: Color Fundamentals, Color Models, Pseudo-color Image Processing.

[Text 1: Chapter 6: Sections 6.1 to 6.3]

Teaching-Learning Process	Chalk and talk method, PowerPoint Presentation, YouTube videos on Color image processing. Practical topics: Problems on Pseudo-color Image Processing **RBT Level:** L1, L2, L3

Module-5

Restoration: A model of the Image Degradation/Restoration Process, Noise models, Restoration in the Presence of Noise Only using Spatial Filtering and Frequency Domain Filtering, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering.

[Text 1: Chapter 5: Sections 5.1, to 5.4.3, 5.7, 5.8]

Teaching-Learning Process	Chalk and talk method, PowerPoint Presentation, YouTube videos on Noise models, filters and its applications. Self-study topics: Linear position invariant degradation, Estimation of degradation function. **RBT Level:** L1, L2, L3

Course outcome (Course Skill Set)

At the end of the course the student will be able to:

1. Understand image formation and the role of human visual system plays in perception of gray and color image data.
2. Apply image processing techniques in spatial domains.
3. Apply image processing techniques in frequency (Fourier) domains.
4. Conduct independent study and analysis of Image Enhancement techniques.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester

3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100 shall be reduced proportionally to 50 marks

Suggested Learning Resources:

Text Book:

Digital Image Processing- Rafael C Gonzalez and Richard E Woods, PHI, 3rd Edition, 2010.

Reference Books:

1. Digital Image Processing- S Jayaraman, S Esakkirajan, T Veerakumar, Tata McGraw Hill, 2014.
2. Fundamentals of Digital Image Processing- A K Jain, PHI Learning Private Limited 2014.

Web links and Video Lectures (e-Resources)

- Image databases, https://imageprocessingplace.com/root_files_V3/image_databases.htm
- Student support materials, https://imageprocessingplace.com/root_files_V3/students/students.htm
- NPTEL Course, Introduction to Digital Image Processing, https://nptel.ac.in/courses/117105079
- Computer Vision and Image Processing, https://nptel.ac.in/courses/108103174
- Image Processing and Computer Vision – Matlab and Simulink,
- https://in.mathworks.com/solutions/image-video-processing.html

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Simulink models for Image processing

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VII Semester

Basic Digital Signal Processing			
Course Code	**21EC754**	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	3:0:0:1	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3

Course objectives:

This course will enable students to:

- **Preparation**: To prepare students with fundamental knowledge/ overview in the field of Signal Processing
- **Core Competence**: To equip students with a basic foundation of Signal Processing by delivering the mathematical description of discrete time signals and systems, classifying signals into different categories based on their properties, analyzing Linear Time Invariant (LTI)systems in time and transform domains, basics of FIR & IIR Filter Design

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Lecture method (L) does not mean only traditional lecture method, but different type of teaching methods may be adopted to develop the outcomes.
2. Show Video/animation films to explain the different concepts Digital Signal Processing.
3. Encourage collaborative (Group) Learning in the class.
4. Ask at least three HOTS (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Topics will be introduced in a multiple representation.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.
9. Adopt Flipped class technique by sharing the materials / Sample Videos prior to the class and have discussions on the that topic in the succeeding classes
10. Give Programming Assignments.

Module-1

Signal Definition, Signal Classification, System definition, System classification, for both continuous time and discrete time, Definition of LTI systems (Chapter1)

Teaching-Learning Process	Chalk and talk method, YouTube videos, Flipped Class Technique, Programming assignments **RBT Level:** L1, L2, L3

Module-2

Introduction to Fourier Transform, Fourier Series, Relating the Laplace Transform to Fourier Transform, Frequency response of continuous time systems (Chapter3)

Teaching-Learning Process	Chalk and talk method, YouTube videos, Flipped Class Technique, Programming assignments **RBT Level:** L1, L2, L3

Module-3	
Frequency response of ideal analog filters, Salient features of Butterworth filters Design and implementation of Analog Butterworth filters to meet given specifications (Chapter8)	
Teaching-Learning Process	Chalk and talk method, YouTube videos, Flipped Class Technique, Programming assignments **RBT Level:** L1, L2, L3
Module-4	
Sampling Theorem- Statement and proof, converting the analog signal to a digital signal, Practical sampling, The Discrete Fourier Transform, Properties of DFT, Comparing the frequency response of analog and digital systems (FFT not included) (Chapter 3,4)	
Teaching-Learning Process	Chalk and talk method, YouTube videos, Flipped Class Technique, Programming assignments **RBT Level:** L1, L2, L3
Module-5	
Definition of FIR and IIR filters, Frequency response of ideal digital filters. Transforming the Analog Butterworth filter to the Digital IIR Filter using BLT to meet given specifications. Design of Low pass / High pass FIR Filters using the Window technique, to meet given specifications, Comparing the designed filter with the desired filter frequency response (Chapter8)	
Teaching-Learning Process	Chalk and talk method, Power point presentation, YouTube videos, Flipped Class Technique, Programming assignments **RBT Level:** L1, L2, L3

Course outcome (Course Skill Set)

At the end of the course the student will be able to:

1. Understand the continuous time and discrete time signals and systems, in time and frequency domain
2. Apply the concepts of signals and systems to obtain the desired parameter/representation
3. Design analog/digital filters to meet given specifications
4. Design and implement the analog filter using components/suitable simulation tools
5. Design and implement the digital filter (FIR/IIR) using suitable simulation tools, and record the input and output of the filter for the given audio signal

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100 shall be reduced proportionally to 50 marks

Suggested Learning Resources:

Text Books:

1. 'Signals and Systems', Simon Haykin and Barry Van Veen, Wiley.
2. "Fundamentals of Digital Signal Processing", Lonnie C Ludeman, John Wiley and Sons, 1986.

Reference Books:

3. 'Theory and Application of Digital Signal Processing', Rabiner and Gold
4. 'Signals and Systems', Schaum's Outline series
5. 'Digital Signal Processing', Schaum's Outline series

Web links and Video Lectures (e-Resources)

By Prof. S C Dutta Roy, IIT Delhi
https://nptel.ac.in/courses/117102060

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Programming Assignments / Mini Projects can be given to improve programming skills

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VII Semester

E-waste Management			
Course Code	**21EC755**	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	3:0:0:1	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3

Course objectives:

- **Current Status:** According to a report on e-waste presented by the United Nations (UN) in World Economic Forum on January 24, 2019, the waste stream reached 48.5 MT in 2018. With such a large quantity of e-waste being generated each year, the future of e-waste recycling in India looks pretty bright. The E-waste (Management) Rules, 2016, enacted on October 1, 2017, added over 21 products (Schedule-I) under the purview of the rule.
- **Purview:** This course covers an extensive review of e-waste management in India. With a focus on the evolution of legal frameworks in India and the world, it presents impacts and outcomes; challenges and opportunities; and management strategies and practices to deal with e-waste. It also includes a survey of pan-India initiatives and trajectories of law-driven initiatives for effective e-waste management along with responses from industries and producers.
- **Scope:** There is a considerable scope for e-waste recycling in India. It is not only a solution to help mitigate e-waste management issues, but it also helps to generate employment. With the rise in e-waste recycling plants, the demand for employees with all levels of qualification and skills also increases.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Lecture method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Show Video/animation films to explain the functioning of various techniques.
3. Encourage collaborative (Group) Learning in the class
4. Ask at least three HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Topics will be introduced in multiple representations.
7. Discuss how every concept can be applied to the real world - and when that's possible, it helps to improve the students' understanding.
8. Arrange visits to nearby industries to give industry exposure.

Module-1

Sustainable development and e-waste management: Importance of electrical and electronic equipment in a nation's development, and e-waste as toxic companion of digital era, I: Let's understand e-waste, II: E-waste statistics: quantities, collection and recycling, E-waste categories and harmonising statistics, III: An overview on status of e-waste related legislation across the globe; IV: UN initiatives for e-waste management: creating partnerships and achieving Agenda 2030; V: Indian scenario: e-waste generation, collection and recycling.

Teaching-Learning Process	Chalk and talk method, YouTube videos. **RBT Level:** L1, L2

Module-2

Extended producer responsibility: a mainstay for e-waste management: Evolution of concept of 'extended producer responsibility', EPR applied for waste management and extended for e-waste

management, EPR: goals, implementation, and challenges for e-waste management, EPR implemented for e-waste management under the existing regulatory frameworks in different countries, Role of a PRO prescribed in regulatory framework, Considerations for successful implementation of EPR, Challenges in implementation of EPR for e-waste management, Impact of EPR, EPR and e-waste management in India. **Toxicity and impacts on environment and human health**: Toxicity, recycling, and regulations, I: Environmental concerns, II: Human health concerns.	
Teaching-Learning Process	Chalk and talk method, PowerPoint Presentation, More examples relating to applications. **RBT Level:** L1, L2, L3
Module-3	
Treating e-waste, resource efficiency, and circular economy: Safe environment, resource use, and circular economy, Circular economy: recycling, resource recovery, and resource efficiency, Potentials of urban mining in circular economy, Recycling and resource efficiency related challenges to the circular economy, Urban mining, recycling, resource use, resource efficiency, and circular economy in India. **E-waste management through legislations in India**: I: Historical backdrop of regulatory regime for e-waste in India, II: E-waste (management) Rules, 2016 and E-waste (management) Amendment Rules, 2018, III: Analysing performance of EPR and CPCB as regulatory mechanisms, IV: Legal cases and judicial directives.	
Teaching-Learning Process	Chalk and talk method, PowerPoint Presentation **RBT Level:** L1, L2, L3
Module-4	
Strategies and initiatives for dealing with e-waste in India: I: Overview of pan-India initiatives for dealing with e-waste during 2000 and 2012, II: Law-driven e-waste management – initiatives by the government, non-government agencies, and judiciary.	
Teaching-Learning Process	Chalk and talk method, PowerPoint Presentation. **RBT Level:** L1, L2, L3
Module-5	
Moving towards horizons: I: Legal and judicial domain, II: Economic concerns, III: Environment concerns, IV: Recycling culture/recycling society.	
Teaching-Learning Process	Chalk and talk method, PowerPoint Presentation, More examples relating to applications. **RBT Level:** L1, L2, L3

Course outcome (Course Skill Set)

At the end of the course the student will be able to:

1. Understand the existing discourse on e-waste and its management, statistics across the world, opportunities, and challenges w.r.t. regulatory framework, SDGs, CE, and LCIA (Life Cycle Impact Assessment) and MFA (Material Flow Analysis), Indian scenario.
2. Describe EPR, a regulatory framework for achieving specified goals across different countries and impacts on environment and human health.
3. Explain themes in the context of resource use and sustainable development. Urban mining, informal sector operations and need for resource use policy, financial support for recycling infrastructure building, etc. in Indian context and also explain to what extent – different aspects of e-waste management have been incorporated in the existing regulatory framework in comparison with international legislatures.
4. Identify and infer pan-Indian initiatives dealing with e-waste management, ranging from building knowledge base through research and social action by different stakeholders to technological and legal advancements, and industrial initiatives. Analyse roadmap for the Agenda 2030.
5. Use opportunities and challenges around four domains: legal and judicial domain; economic concerns; recycling culture/society; and environment concerns.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100 shall be reduced proportionally to 50 marks

Suggested Learning Resources:

Text Book:

Varsha Bhagat Gangulay, 'E-Waste Management', Taylor and Francis, 2022.

Web links and Video Lectures (e-Resources)

•https://link.springer.com/book/10.1007/978-3-030-14184-4
•https://rajyasabha.nic.in/rsnew/publication_electronic/E-Waste_in_india.pdf
•https://greene.gov.in/wp-content/uploads/2018/01/E-waste-Vol-II-E-waste-Management-Manual.pdf
•https://nptel.ac.in/courses/105105169

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

• Groups can be made to conduct a survey on the present scenario of India and top 5 countries facing ewaste management challenges.
• Industry visits to give an exposure of the e waste management process and also business.
• Case studies to develop e-waste management models.
• Survey of few e-waste management companies can be carried out and submit report.

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VII Semester

Advanced Design Tools for VLSI			
Course Code	**21EC731**	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	3:0:0:1	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3

Course objectives:

- Impart knowledge of EDA tools and methodology for FPGA
- Learn principles of IP core for FPGA and embedded systems
- Infer the concept of machine learning in fabrication and physical design

Teaching-Learning Process (General Instructions)

The sample strategies, which the teacher can use to accelerate the attainment of the various course outcomes are listed in the following:

1. Lecture method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Arrange visits to nearby PSUs and small-scale communication industries.
3. Show Video/animation films to explain the functioning of various techniques.
4. Encourage collaborative (Group) Learning in the class
5. Ask at least three HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking
6. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
7. Topics will be introduced in multiple representations.
8. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
9. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Introduction: Introduction, Prologue, EDA: From Methodologies, Algorithms, Tools to Integrated Circuits and Systems, EDA from Halcyon's Days to the Blooming Paradigm of Chip Industry, Categories of the EDA Tools, Quo Vadis, EDA? The Challenges and Opportunities, Designing the System as SoC Using the Soft IP Cores, Types of IP Cores, Design Issues Pertaining to the Soft IP Cores
Text Book1: 1.1 to 1.5, 1.7 to 1.10

Development of FPGA Based Network on Chip for Circumventing Spam: Introduction, Conception of the Spam Mail, FPGA Based Network on Chip for Circumventing Spam, Tools Infrastructure and Design Flow, Introducing Hardware-Software Co-design, Hardware Software Co-design, Framework Proposed in the Present Case Study, Description of System at Higher Level, Resolving the System a Step Down, System Design, Development of Soft IP Core of Bloom Filter, Presenting System Design of Purely Software Modules, Integrating of the Hardware-Software Modules Using EDK
Text Book1: 2.1 to 2.13

Teaching-Learning Process	Chalk and talk method, , PowerPoint Presentation, YouTube videos **RBT Level:** L1, L2, L3

Module-2

Analog Front End and FPGA Based Soft IP Core for ECG Logger: Prior Art, The Very Rationale of the System, Analog Front End of the Setup, VHDL Implementation of the ECG Soft IP Core, ModelSim Simulation Results, Synthesis Results Using Mentor Graphics Tool, Monitoring the ECG Using MODEM

Based Setup, ECG Signal Reconstruction Mechanism at the Hospital End, VHDL Listing for Driving the Analog Demultiplexer and Serial DAC from Spartan-3E FPGA, Discussion Regarding the VHDL Implementation, ModelSim Simulation Results, Synthesis Results Using Mentor Graphics Tool: Leonardo Spectrum. Text Book1: 3.1 to 3.12	
Teaching-Learning Process	Chalk and talk method/Power point presentation **RBT Level:** L1, L2, L3
Module-3	
FPGA Based Multifunction Interface for Embedded Applications: Introduction, Universal FPGA Based Interface for High End Embedded Applications, Soft IP Core for the LCD Interface, Soft IP Core for the DAC Interface, Handel C Listing of the Soft IP Core for the DAC Interface, Soft IP Core for the Linear Tech LTC6912-1 Dual Amp, Soft IP Core for the ADC Interface, Soft IP Core for the VGA Interface, Soft IP Core for the Keyboard Interface, Triangular Wave Generator Using DAC Text Book1: 4.1 - 4.10	
Teaching-Learning Process	Chalk and talk method, Power point presentation **RBT Level:** L1, L2, L3
Module-4	
Machine Learning for Compact Lithographic Process Models: Introduction, The Lithographic Patterning Process, Machine Learning of Compact Process Models, Neural Network Compact Patterning Models. Text Book2: 2.1 to 2.4 **Machine Learning for Mask Synthesis**: Introduction, Machine Learning-Guided OPC, Machine Learning-Guided EPC. Text Book2: 3.1 to 3.4	
Teaching-Learning Process	Chalk and talk method, Power point presentation **RBT Level:** L1, L2, L3
Module-5	
Machine Learning in Physical Verification, Mask Synthesis, and Physical Design: Introduction, Machine Learning in Physical Verification, Machine Learning in Mask Synthesis, Machine Learning in Physical Design. Text Book2: 4.1 to 4.4	
Teaching-Learning Process	Chalk and talk method, Power point presentation **RBT Level:** L1, L2, L3

Course outcome (Course Skill Set)

At the end of the course the student will be able to:

1. Demonstrate the EDA methodologies and Tools for FPGA based NoC
2. Interpretation of soft core for ECG logger
3. Interfacing of DAC for embedded Application
4. Interpretation of Machine Learning for fabrication
5. Interpretation of ML in physical design

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5^{th} week of the semester

2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100 shall be reduced proportionally to 50 marks

Suggested Learning Resources:

Text Books:

1. Rajanish K Kamat, Santosh A Shinde, Pawan K Gaikwad, Hansraj Guhilot, 'Harnessing VLSI System Design with EDA Tools', Springer, 2012.
2. Ibrahim (Abe) M Elfadel, Duane S Boning, Xin Li, 'Machine Learning in VLSI Computer-Aided Design', Springer, 2011.

Web links and Video Lectures (e-Resources)

- https://www.digimat.in/nptel/courses/video/117101004/L01.html
- https://www.youtube.com/watch?v=zC5b5_7oRKk

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VII Semester

Digital Image Processing			
Course Code	**21EC732**	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	3:0:0:1	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3

Course objectives:

- Understand the fundamentals of digital image processing.
- Understand the image transform used in digital image processing.
- Understand the image enhancement techniques in spatial domain used in digital image processing.
- Understand the Color Image Processing and frequency domain enhancement techniques in digital image processing.
- Understand the image restoration techniques and methods used in digital image processing.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Show Video/animation films to explain the functioning of various image processing concepts.
2. Encourage cooperative (Group) Learning through puzzles, diagrams, coding etc., in the class.
3. Encourage students to ask questions and investigate their own ideas helps improve their problem-solving skills as well as gain a deeper understanding of academic concepts.
4. Ask at least three HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking
5. Students are encouraged to do coding based projects to gain knowledge in image processing.
6. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
7. Topics will be introduced in multiple representations.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding
9. Arrange visits to nearby PSUs such as CAIR (DRDO), NAL, BEL, ISRO, etc., and small-scale software industries to give industry exposure.

Module-1

Digital Image Fundamentals: What is Digital Image Processing?, Origins of Digital Image Processing, Examples of fields that use DIP, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Elements of Visual Perception, Image Sensing and Acquisition, Image Sampling and Quantization, Some Basic Relationships Between Pixels.
[Text 1: Chapter 1, Chapter 2: Sections 2.1 to 2.5]

Teaching-Learning Process	Chalk and talk method, PowerPoint Presentation, YouTube videos, Videos on Image processing applications Self-study topics: Arithmetic and Logical operations Practical topics: Problems on Basic Relationships Between Pixels. **RBT Level:** L1, L2, L3

Module-2	
Image Transforms: Introduction, Two-Dimensional Orthogonal and Unitary Transforms, Properties of Unitary Transforms, Two-Dimensional DFT, cosine Transform, Haar Transform. Text 2: Chapter 5: Sections 5.1 to 5.3, 5.5, 5.6, 5.9]	
Teaching-Learning Process	Chalk and talk method, PowerPoint Presentation, YouTube videos of various transformation techniques and related applications. Self-study topics: Sine transforms, Hadamard transforms, KL transform, Slant transform. Practical topics: Problems on DFT and DCT **RBT Level:** L1, L2, L3
Module-3	
Spatial Domain: Some Basic Intensity Transformation Functions, Histogram Processing, Fundamentals of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters [Text: Chapter 3: Sections 3.2 to 3.6]	
Teaching-Learning Process	Chalk and talk method, PowerPoint Presentation, YouTube videos and animations of Intensity Transformation Functions, Histogram Processing, Spatial domain filters. Self-study topics: Point, line and edge detection. Practical topics: Problems on Intensity Transformation Functions, Histogram, Spatial domain filters **RBT Level:** L1, L2, L3
Module-4	
Frequency Domain: Basics of Filtering in the Frequency Domain, Image Smoothing and Image Sharpening Using Frequency Domain Filters. **Color Image Processing:** Color Fundamentals, Color Models, Pseudo-color Image Processing. [Text 1: Chapter 4: Sections 4.7 to 4.9 and Chapter 6: Sections 6.1 to 6.3]	
Teaching-Learning Process	Chalk and talk method, PowerPoint Presentation, YouTube videos on frequency domain filtering, Color image processing. Self-study topics: Basic concept of segmentation. Practical topics: Problems on Pseudo-color Image Processing **RBT Level:** L1, L2, L3
Module-5	
Restoration: A model of the Image Degradation/Restoration Process, Noise models, Restoration in the Presence of Noise Only using Spatial Filtering and Frequency Domain Filtering, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering. [Text 1: Chapter 5: Sections 5.1, to 5.4.3, 5.7, 5.8]	
Teaching-Learning Process	Chalk and talk method, PowerPoint Presentation, YouTube videos on Noise models, filters and its applications. Self-study topics: Linear position invariant degradation, Estimation of degradation function. **RBT Level:** L1, L2, L3

Course outcomes (Course Skill Set)

At the end of the course the student will be able to:

1. Understand image formation and the role of human visual system plays in perception of gray and color image data.
2. Compute various transforms on digital images.
3. Conduct independent study and analysis of Image Enhancement techniques.
4. Apply image processing techniques in frequency (Fourier) domain.
5. Design image restoration techniques.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100 shall be reduced proportionally to 50 marks

Suggested Learning Resources:

Text Books:

1. Digital Image Processing- Rafael C Gonzalez and Richard E Woods, PHI, 3rd Edition 2010.
2. Fundamentals of Digital Image Processing- A K Jain, PHI Learning Private Limited 2014.

Reference Book:

Digital Image Processing- S Jayaraman, S Esakkirajan, T Veerakumar, Tata McGraw Hill, 2014.

Web links and Video Lectures (e-Resources)

- Image databases, https://imageprocessingplace.com/root_files_V3/image_databases.htm
- Student support materials, https://imageprocessingplace.com/root_files_V3/students/students.htm
- NPTEL Course, Introduction to Digital Image Processing, https://nptel.ac.in/courses/117105079
- Computer Vision and Image Processing, https://nptel.ac.in/courses/108103174
- Image Processing and Computer Vision – Matlab and Simulink,
- https://in.mathworks.com/solutions/image-video-processing.html

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Verilog /VHDL coding for Image manipulation.
- Simulink models for Image processing.

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VII Semester

DSP Algorithms & Architecture			
Course Code	**21EC733**	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	3:0:0:1	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3

Course objectives:

This course will enable the students to

- Understand the concepts of digital signal processing techniques.
- Understand the computational building blocks of DSP processors and its speed issues.
- Understand the various addressing modes, peripherals, interrupts and pipelining structure of the TMS320C54xx processor.
- Learn how to interface the external devices to the TMS320C54xx processor in various modes.
- Understand DSP algorithms and applications with their implementation using TMS320C54xx processor.

Teaching-Learning Process (General Instructions)

The sample strategies, which the teacher can use to accelerate the attainment of the various course outcomes are listed in the following:

1. Lecture method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Show Video/animation films to explain the functioning of various techniques.
3. Encourage collaborative (Group) Learning in the class
4. Ask at least three HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Topics will be introduced in multiple representations.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Introduction to Digital Signal Processing: Introduction, A Digital Signal – Processing system, Major features of programmable Digital signal processors, The Sampling Process, Discrete Time Sequences, Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT), Linear Time-Invariant Systems, Digital Filters, Decimation and Interpolation.
Section 1.3, 2.1 to 2.8 of Text 1

Teaching-Learning Process	Chalk and talk method, Power point presentation **RBT Level:** L1, L2, L3

Module-2

Architectures for Programmable Digital Signal Processing Devices: Introduction, Basic Architectural Features, DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, Address Generation Unit, Programmability and Program Execution, Speed Issues, Features for External Interfacing.
Section 4.1 to 4.9 of Text 1

Teaching-Learning	Chalk and talk method, Power point presentation

Process	**RBT Level:** L1, L2, L3
Module-3	
Programmable Digital Signal Processors: Introduction, Commercial Digital Signal-processing Devices, Data Addressing Modes of TMS32OC54XX, Memory Space of TMS32OC54xx Processors, Program Control. Detail Study of TMS320C54X & 54xx Instructions and Programming, On – Chip Peripherals, Interrupts of TMS32OC54XX Processors, Pipeline Operation of TMS32OC54xx Processor. Section 5.1 to 5.10 of Text 1	
Teaching-Learning Process	Chalk and talk method, Power point presentation **RBT Level:** L1, L2, L3
Module-4	
Implementation of Basic DSP Algorithms: Introduction, The Q – notation, FIR Filters, IIR Filters, Interpolation and Decimation Filters (one example in each case). **Implementation of FFT Algorithms**: Introduction, An FFT Algorithm for DFT Computation, Overflow and Scaling, Bit – Reversed Index. Generation & Implementation on the TMS32OC54xx. Section 7.1 to 7.6 and 8.1 to 8.6 of Text 1	
Teaching-Learning Process	Chalk and talk method, Power point presentation **RBT Level:** L1, L2, L3
Module-5	
Interfacing Memory and Parallel I/O Peripherals to Programmable DSP Devices: Introduction, Memory Space Organization, External Bus Interfacing Signals. Memory Interface, Parallel I/O Interface, Programmed I/O, Interrupts and I/O Direct Memory Access (DMA). **Interfacing and Applications of DSP Processors**: Introduction, Synchronous Serial Interface, A CODEC Interface Circuit, DSP Based Bio-telemetry Receiver, A Speech Processing System, An Image Processing System. Section 9.1 to 9.8, 10.1 to 10.5 and11.1 to 11.5 of Text 1	
Teaching-Learning Process	Chalk and talk method, Power point presentation **RBT Level:** L1, L2, L3

Course outcome (Course Skill Set)

At the end of the course the student will be able to:

1. Comprehend the knowledge & concepts of digital signal processing techniques.
2. Apply knowledge of various types of addressing modes, interrupts, peripherals and pipelining structure of TMS320C54xx processor.
3. Develop assembly language programs to implement FIR, IIR filters and FFT algorithms.
4. Build the Applications on Programmable DSP devices.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20**

Marks (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100 shall be reduced proportionally to 50 marks

Suggested Learning Resources:

Text Book:

"Digital Signal Processing", Avatar Singh and S Srinivasan, Thomson Learning, 2004

Reference Books:

1. "Digital Signal Processing: A practical approach", Ifeachor E C, Jervis B. W Pearson-Education, PHI, 2002.
2. "Digital Signal Processors", B Venkataramani and M Bhaskar, TMH, 2nd Ed., 2010
3. "Architectures for Digital Signal Processing", Peter Pirsch, John Wiley.

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VII Semester

Biomedical Signal Processing			
Course Code	**21EC734**	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	3:0:0:1	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3

Course objectives:

This course will enable students to:

- Possess the basic mathematical, scientific and computational skills necessary to analyse ECG and EEG signals.
- Apply classical and modern filtering and compression techniques for ECG and EEG signals.
- Develop a thorough understanding on basics of ECG and EEG feature extraction.

Teaching-Learning Process (General Instructions)

The sample strategies, which the teacher can use to accelerate the attainment of the various course outcomes are listed in the following:

1. Lecture method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Show Video/animation films to explain the functioning of various techniques.
3. Encourage collaborative (Group) Learning in the class
4. Ask at least three HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking
5. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Introduction to Biomedical Signals: The nature of Biomedical Signals, Examples of Biomedical Signals, Objectives of Biomedical Signal analysis, Difficulties in Biomedical Signal analysis.
(Text-1: 1.1, 1.2, 1.3, 1.4)

Electrocardiography: Techniques used in electrocardiography, ECG Electrodes, the cardiac equivalent generator, genesis of the ECG, the standard and augmented limb leads, 12 lead ECG, the vectorcardiogram, ECG signal characteristics.
(Text-2: 2.1, 2.1.1, 2.1.2, 2.1.3, 2.1.4, 2.1.5, 2.2.1, 2.2.2, 2.3)

Signal Conversion: Simple signal conversion systems, Conversion requirements for biomedical signals, Signal converter characteristics, D to A converters, A to D converters, Sample and Hold circuit, Analog Multiplexer, Amplifiers
(Text-2: 3.2, 3.3, 3.4.1, 3.4.2, 3.4.3, 3.4.4, 3.4.5, 3.4.6).

Teaching-Learning Process	Chalk and talk method, PowerPoint Presentation, YouTube videos **RBT Level:** L1, L2, L3

Module-2

Signal Averaging: Basics of signal averaging, Signal averaging as a digital filter, a typical averager, Software for signal averaging, Limitations of signal averaging.
(Text-2: 9.1, 9.2, 9.3, 9.4, 9.5).

Adaptive Filters: Principal noise canceller model, 60-Hz adaptive cancelling using a sine wave model, Applications: Maternal ECG in fetal ECG, Cardiogenic artifact, detection of ventricular fibrillation and tachycardia. (Text-2: 8.1, 8.2, 8.3.1, 8.3.2, 8.3.3).

Teaching-Learning	Chalk and talk method, PowerPoint Presentation, YouTube videos

Process	**RBT Level:** L1, L2, L3
Module-3	
Data Reduction Techniques: Introduction, Turning point algorithm, AZTEC algorithm, Fano algorithm, Huffman coding: Static coding, Modified coding, Adaptive coding, Residual differencing, Runlength coding. (Text-2: 10.1, 10.2, 10.3, 10.4.1, 10.4.2, 10.4.3, 10.4.4, 10.4.5). **Time and Frequency domain techniques:** The Fourier transform for a discrete nonperiodic and periodic signals, the Fast Fourier transform, Correlation in time domain and in frequency domain, Convolution in time domain and in frequency domain, Power spectrum estimation: Parseval's theorem (Text-2: 11.1.1, 11.1.2, 11.1.3, 11.2.1, 11.2.2, 11.2.3, 11.3.1, 11.3.2, 11.3.3, 11.4.1)	
Teaching-Learning Process	Chalk and talk method, PowerPoint Presentation, YouTube videos **RBT Level:** L1, L2, L3
Module-4	
ECG QRS detection: Power spectrum of the ECG, Bandpass filtering techniques, Differentiation techniques, Template matching techniques: Template cross correlation, template subtraction, automata based template matching, a QRS detection algorithm. **ECG Analysis Systems:** Interpretation of the 12 lead ECG, ST segment analyzer, Portable arrhythmia monitor: Holter recording, software and hardware design, arrhythmia analysis (Text -2)	
Teaching-Learning Process	Chalk and talk method, PowerPoint Presentation, YouTube videos **RBT Level:** L1, L2, L3
Module-5	
Neurological signal processing: The brain and its potentials, origin of brain waves, the EEG signal and its characteristics, EEG analysis, Linear prediction theory, The Autoregressive method, Recursive estimation of AR parameters, Spectral error measure. (Text-3: 4.1, 4.2, 4.3 4.4, 4.5, 4.6, 4.7, 4.8) **Event detection and waveform analysis:** EEG rhythms, waves and transients, Detection of EEG rhythms, Template matching for EEG spike and wave detection, the matched filter (Text-1: 4.2.4, 4.4.1, 4.4.2, 4.6)	
Teaching-Learning Process	Chalk and talk method, Power point presentation **RBT Level:** L1, L2, L3

Course outcome (Course Skill Set)

At the end of the course the student will be able to:

1. Describe the origin, properties and suitable models of important biological signals such as ECG and EEG.
2. Know the basic signal processing techniques in analysing biological signals.
3. Acquire mathematical and computational skills relevant to the field of biomedical signal processing.
4. Describe the basics of ECG signal compression algorithms.
5. Know the complexity of various biological phenomena.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5^{th} week of the semester
2. Second test at the end of the 10^{th} week of the semester

3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100 shall be reduced proportionally to 50 marks

Suggested Learning Resources:

Books:

1. Biomedical Signal Analysis-Rangaraj M Rangayyan, John Wiley & Sons 2002
2. Biomedical Digital Signal Processing- Willis J Tompkins, PHI2001.
3. Biomedical Signal Processing Principles and Techniques-D C Reddy, McGraw-Hill publications, 2005.

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VII Semester

Speech Signal Processing			
Course Code	**21EC735**	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3

Course objectives:

- Introduce the models for speech production
- Develop Time domain and frequency domain speech processing techniques
- Introduce a predictive technique for speech compression
- Provide fundamental knowledge required to understand and analyze speech recognition, synthesis and speaker identification systems.

Teaching-Learning Process (General Instructions)

The sample strategies, which the teacher can use to accelerate the attainment of the various course outcomes are listed in the following:

1. Lecture method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Show Video/animation films to explain the functioning of various techniques.
3. Encourage collaborative (Group) Learning in the class
4. Ask at least three HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Fundamentals of Human Speech Production: The Process of Speech Production, Short-Time Fourier representation of Speech, The Acoustic Theory of Speech production, Digital Models for Sampled Speech Signals.

Teaching-Learning Process	Chalk and talk method, Power point presentations, Animation of process of speech production **RBT Level:** L1, L2, L3

Module-2

Time-Domain Methods for Speech Processing: Introduction to Short-Time Analysis of Speech, Short-Time Energy and Short-Time Magnitude, Short-Time Zero-Crossing Rate, The Short-Time Autocorrelation Function, Speech vs Silence detection.

Teaching-Learning Process	Chalk and talk method, Power point presentation Simulation of Short Time analysis algorithm using tools like Matlab/simulink **RBT Level:** L1, L2, L3

Module-3

Frequency Domain Representations: Discrete-Time Fourier Analysis, Short-Time Fourier Analysis, Overlap Addition (OLA) and Filter Bank Summation (FBS) Method of Synthesis, Time-Decimated Filter Banks, Two-Channel Filter Banks, Modifications of the STFT.

Teaching-Learning Process	Chalk and talk method, Power point presentation Visualization of speech using spectrogram **RBT Level:** L1, L2, L3

Module-4	
The Cepstrum and Homomorphic Speech Processing: Introduction, Homomorphic Systems for Convolution, Homomorphic Analysis of the Speech Model, Computing the Short-Time Cepstrum and Complex Cepstrum of Speech, Homomorphic Filtering of Natural Speech, Cepstrum Analysis of All-Pole Models, Cepstrum Distance Measures.	
Teaching-Learning Process	Chalk and talk method, Power point presentation **RBT Level:** L1, L2, L3
Module-5	
Linear Predictive Analysis of Speech Signals: Introduction to Basic Principles of Linear Predictive Analysis, Computation of the Gain for the Model, Frequency Domain Interpretations of Linear Predictive Analysis, Solution of the LPC Equations, The Prediction Error Signal.	
Teaching-Learning Process	Chalk and talk method, Power point presentation **RBT Level:** L1, L2, L3

Course outcomes (Course Skill Set)

At the end of the course the student will be able to:

1. Model speech production system and describe the fundamentals of speech.
2. Apply time domain and frequency domain algorithms, on speech to find, enhance and modify speech parameters.
3. Choose an appropriate processing technique for a given application.
4. Analyse speech recognition, synthesis and speaker identification systems

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100 shall be reduced proportionally to 50 marks

Suggested Learning Resources:

Text Books

1. **Digital Processing of Speech Signals -** L R Rabiner and R W Schafer, Pearson Education Asia, 2004.
2. **Theory and Applications of Digital Speech Processing-**Rabiner and Schafer, Pearson Education 2011.

Reference Books

1. **Fundamentals of Speech Recognition-** Lawrence Rabiner and Biing-Hwang Juang, Pearson Education, 2003.
2. **Speech and Language Processing**–An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition- Daniel Jurafsky and James H Martin, Pearson Prentice Hall, 2009.

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VII Semester

IoT & Wireless Sensor Networks			
Course Code	**21EC741**	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3

Course objectives:

- To provide an exposure to the broad perspective of Internet of Things with respect to the characteristics, design, technologies and applications.
- To provide a basic understanding of the important aspects of Wireless sensor networks covering applications, sensor and transmission technology & systems, middleware, performance and traffic management.

Teaching-Learning Process (General Instructions)

The sample strategies, which the teacher can use to accelerate the attainment of the various course outcomes are listed in the following:

1. Lecture method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Show Video/animation films to explain the various concepts.
3. Encourage collaborative (Group) Learning in the class
4. Ask at least three HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Topics will be introduced in multiple representations.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Internet of Things: Introduction, Physical design, Logical design, Enabling technologies, Levels & deployment templates.
Text 1: Chapter 1

Teaching-Learning Process	Chalk and talk method, Power point presentation **RBT Level:** L1, L2, L3

Module-2

Domain Specific IoTs: Home automation, cities, environment, energy, retail, logistics, agriculture, industry, health & lifestyle.
Text 1: Chapter 2

Teaching-Learning Process	Chalk and talk method, Power point presentation **RBT Level:** L1, L2, L3

Module-3

Wireless Sensor Networks: Introduction, applications of sensor networks, basic overview of the technology, basic sensor network architectural elements, present day sensor network research, challenges and hurdles, examples of Category 2 WSN applications, examples of Category 1 WSN applications

Text 2: Chapter 1 – 1.1, 1.1.2, 1.2, 1.2.1, 1.2.2 (phase 4), 1.2.3 Chapter 2: 2.4, 2.5	
Teaching-Learning Process	Chalk and talk method, Power point presentation **RBT Level:** L1, L2, L3
Module-4	
Wireless sensor technology: Introduction, sensor node technology – overview, hardware and software, sensor taxonomy, WN operating environment, WN trends. **Wireless Transmission technology and systems:** Introduction, Campus applications, MAN/WAN applications. Text 2: Chapter 3: 3.1, 3.2 – 3.2.1, 3.2.2, 3.3, 3.4, 3.5 Chapter 4: 4.1, 4.3.1, 4.3.2	
Teaching-Learning Process	Chalk and talk method, Power point presentation **RBT Level:** L1, L2, L3
Module-5	
Middleware for WSNs: Introduction, principles, architecture, data related functions **Performance and traffic management:** background, WSN Design issues, performance modelling of WSNs. Text 2: Chapter 8: 8.1, 8.2, 8.3, 8.3.1 Chapter 11: 11.2, 11.3, 11.4	
Teaching-Learning Process	Chalk and talk method, Power point presentation **RBT Level:** L1, L2, L3

Course outcome (Course Skill Set)

At the end of the course the student will be able to:

1. Understand the characteristics, building blocks, enabling technologies of the IoT systems
2. Describe the characteristics and applications of domain specific IoTs.
3. Discuss the overview of the Wireless sensor networks characteristics and applications.
4. Present the sensor, transmission technology and systems associated with WSN.
5. Understand the concepts of middleware, performance evaluation and traffic management in WSN.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per

the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100 shall be reduced proportionally to 50 marks

Suggested Learning Resources:

Text Books:

1. 'Internet of Things', Arshdeep Bagha and Vijay Madisetti, Universities Press, 2015
2. 'Wireless Sensor Networks', Kazem Sohraby, Daniel Minoli and Taieb Znati, Wiley, 2015.

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VII Semester

Network Security			
Course Code	**21EC742**	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	3:0:0:1	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3

Course objectives:

- **Preparation**: To prepare students with fundamental knowledge/ overview in the field of Network Security with knowledge of security mechanisms and services.
- **Core Competence**: To equip students with a basic foundation of Network Security by delivering the basics of Transport Level Security, Secure Socket Layer, Internet Protocol security, Intruders, Intrusion detection and Malicious Software, Firewalls, Firewall characteristics, Biasing and Configuration.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Lecture method (L) does not mean only traditional lecture method, but different type of teaching methods may be adopted to develop the outcomes.
2. Show Video/animation films to explain the different Network Security Techniques / Algorithms
3. Encourage collaborative (Group) Learning in the class
4. Ask at least three HOTS (Higher order Thinking) questions in the class, which promotes critical thinking
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Topics will be introduced in a multiple representation.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.
9. Adopt Flipped class technique by sharing the materials / Sample Videos prior to the class and have discussions on the that topic in the succeeding classes
10. Give Programming Assignments

Module-1

Attacks on Computers and Computer Security: Need for Security, Security Approaches, Principles of Security Types of Attacks. **(Text2: Chapter1)**
Security Mechanisms, Services and Attacks, A model for Network security **(Text1: Chapter1: 3, 4, 5, 6)**
Network Access Control, Extensible Authentication Protocol **(Text1: Chapter 16: Section 1,2)**

Teaching-Learning Process	Chalk and talk method, YouTube videos, Flipped Class Technique **RBT Level:** L1, L2, L3

Module-2

Transport Level Security: Web Security Considerations, Secure Sockets Layer, Transport Layer Security, HTTPS, Secure Shell (SSH) **(Text1: Chapter15)**

Teaching-Learning Process	Chalk and talk method YouTube videos, Flipped Class Technique and PPTs. Self-study topics: Block cipher modes, Cryptographic Hash functions and MAC codes **RBT Level:** L1, L2, L3

Module-3	
IP Security: Overview of IP Security (IPSec), IP Security Architecture, Modes of Operation, Security Associations (SA), Authentication Header (AH), Encapsulating Security Payload (ESP), Internet Key Exchange. **(Text1: Chapter19)**	
Teaching-Learning Process	Chalk and talk method, YouTube videos, Flipped Class Technique and PPTs. Self-study topics: OSI Model **RBT Level:** L1, L2, L3
Module-4	
Intruders: Intruders, Intrusion Detection, Password Management. **(Chapter20-Text1)** **MALICIOUS SOFTWARE:** Viruses and Related Threats, Virus Countermeasures, **(Chapter21-Text1)**	
Teaching-Learning Process	Chalk and talk method, YouTube videos, Flipped Class Technique and PPTs. **RBT Level:** L1, L2, L3
Module-5	
Firewalls: The Need for firewalls, Firewall Characteristics, Types of Firewalls, Firewall Biasing, Firewall location and configuration **(Chapter 22-Text 1)**	
Teaching-Learning Process	Chalk and talk method, YouTube videos, Flipped Class Technique and PPTs. **RBT Level:** L1, L2, L3

Course outcomes (Course Skill Set)

At the end of the course the student will be able to:

1. Explain network security services and mechanisms and explain security concepts
2. Understand the concept of Transport Level Security and Secure Socket Layer.
3. Explain Security concerns in Internet Protocol security
4. Explain Intruders, Intrusion detection and Malicious Software
5. Describe Firewalls, Firewall Characteristics, Biasing and Configuration

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per

the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100 shall be reduced proportionally to 50 marks

Suggested Learning Resources:

Text Books:

1. William Stallings, "Cryptography and Network Security Principles and Practice", Pearson Education Inc., 5th Edition, 2014, ISBN: 978-81-317- 6166-3
2. Atul Kahate, "Cryptography and Network Security", TMH, 2003.

Reference Books:

1. Cryptography and Network Security, Behrouz A Forouzan, TMH, 2007.
2. Introduction to Computer Security, Matt Bishop, Sathyanarayana S V, Pearson Education, 2006, ISBN 81-7758-425/1.

Web links and Video Lectures (e-Resources)

https://nptel.ac.in/courses/106105031
https://nptel.ac.in/courses/128106006

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Programming Assignments / Mini Projects can be given to improve programming skills.

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VII Semester

Fabrication Technology			
Course Code	**21EC743**	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	3:0:0:1	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3

Course objectives:

- Familiarise with the concepts of different processes involved in fabrication process and also with packaging issues.
- Apply principles to identify and analyse the various steps for the fabrication of various components.
- Introduce the fundamental concepts relevant to VLSI fabrication.
- Enable the students to understand the various VLSI fabrication techniques.

Teaching-Learning Process (General Instructions)

The sample strategies, which the teacher can use to accelerate the attainment of the various course outcomes are listed in the following:

1. Lecture method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Show Video/animation films to explain the functioning of various techniques.
3. Encourage collaborative (Group) Learning in the class.
4. Topics will be introduced in multiple representations.
5. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Crystal Growth and Wafer Preparation: Introduction, Electronic grade Silicon, Czochralski Crystal Growing, Silicon Shaping

Epitaxy: Introduction, Vapor-Phase Epitaxy

Text Book 1.1 to 1.4, 2.1 to 2.2

Teaching-Learning Process	Chalk and talk method, PowerPoint Presentation, Videos on crystal growth process Self-study topics: Mask Preparation **RBT Level:** L1, L2, L3

Module-2

Epitaxy: Molecular beam epitaxy, Epitaxial evaluation

Oxidation: Introduction, Growth mechanism and kinetics, Thin oxides, oxidation techniques, oxide properties, redistribution of dopants, oxidation of polysilicon, oxidation-induced defects

Text Book 2.3 and 2.5, 3.1 to 3.8

Teaching-Learning Process	Chalk and talk method, Power point presentation, videos on Epitaxial process Self-study topics: Advanced oxidation techniques **RBT Level:** L1, L2, L3

Module-3

Lithography: Introduction, Optical Lithography, Electron Lithography, X-ray lithography, Ion Lithography

Text Book 4.1 to 4.5

Teaching-	Chalk and talk method, PowerPoint Presentation, Videos on Lithography

Learning Process	Self-study topics: Sputtering and edge lithography **RBT Level:** L1, L2, L3
Module-4	
Diffusion: Introduction, Models of diffusion in solids, fick's 1D diffusion equation, atomic diffusion mechanism, Diffussivities, Measurement techniques, fast diffusants in silicon, diffusion in polycrystalline silicon, diffusion in SiO2 **Ion Implantation:** Introduction, Implantation equipment **Text Book** 7.1 to 7.9, 8.1 and 8.3	
Teaching-Learning Process	Chalk and talk method, PowerPoint Presentation, Videos on diffusion method Self-study topics: Effect of doping concentration in diffusion process **RBT Level:** L1, L2, L3
Module-5	
Ion Implantation: Annealing, Shallow Junctions, High energy implantation **Metallization**: Introduction, Metallization applications, metallization choices, Metallization problems, New role of metallization. **Text Book** 8.4 to 8.6, 9.1 to 9.7 (except 9.4 and 9.5)	
Teaching-Learning Process	Chalk and talk method, Power point presentation, Videos on Annealing process Self-study topics: e-beam evaporation, plasma spray deposition **RBT Level:** L1, L2, L3

Course outcome (Course Skill Set)

At the end of the course the student will be able to:

1. Understanding the process in the field of Fabrication technology.
2. Understand the properties and growth mechanism of oxidation.
3. Relate to the competing methods of various lithographic techniques and their limitations.
4. Analyse the diffusion profiles and models in various materials.
5. Describe the Metallization choices, properties and selection of optimum deposition process.

Assessment Details (both CIE and SEE)

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Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per

the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100 shall be reduced proportionally to 50 marks

Suggested Learning Resources:

Text Book:

VLSI Technology, S M Sze, 2nd edition, Mc Graw Hill.

Reference Books:

1. VLSI Fabrication Principles, S K Gandhi, John Willey & Sons.
2. Micromachined transducer, G T A Kovacs, McGraw Hill.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
B.E: Electronics & Communication Engineering / B.E: Electronics & Telecommunication Engineering
NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
(Effective from the academic year 2021 – 22)

VII Semester

Machine Learning with Python			
Course Code	**21EC744**	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	2:0: 2:1	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3

Course objectives:

- To understand the basic theory underlying machine learning.
- To be able to formulate machine learning problems corresponding to different applications.
- To understand a range of machine learning algorithms along with their strengths and weaknesses.
- To be able to apply machine learning algorithms to solve problems of moderate complexity.
- To apply the algorithms to a real-world problem, optimize the models learned and report on the expected accuracy that can be achieved by applying the models.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the delivered lessons shall develop student's theoretical and programming skills.
2. State the need for learning Machine Learning with real-life examples.
3. Support and guide the students for self–study.
4. You will also be responsible for assigning homework, grading assignments and quizzes, and documenting students & progress
5. Encourage the students for group learning to improve their creative and analytical skills.
6. Show short, related video lectures in the following ways:
   - As an introduction to new topics (pre-lecture activity).
   - As a revision of topics (post-lecture activity).
   - As additional examples (post-lecture activity).
   - As an additional material of challenging topics (pre-and post-lecture activity).
   - As a model solution of some real world problems. (post-lecture activity).

Module-1

Introduction:

Introduction to Machine Learning, Building intelligent machines to transform data into knowledge, The three different types of machine learning, An introduction to the basic terminology and notations, A roadmap for building machine learning systems, Using Python for machine learning.

Training Machine Learning Algorithms for Classification

Artificial neurons – a brief glimpse into the early history of machine learning, Implementing a perceptron learning algorithm in Python, Adaptive linear neurons and the convergence of learning.

Textbook 1: Chapters 1, 2

Teaching-Learning Process	Chalk and talk method, Power point presentation **RBT Level:** L1, L2, L3

Module-2

A Tour of Machine Learning Classifiers Using Scikit-Learn

Choosing a classification algorithm, First steps with scikit-learn, Modeling class probabilities via logistic regression, Maximum margin classification with support vector machines, Solving nonlinear problems using a kernel SVM, Decision tree learning, K-nearest neighbors – a lazy learning algorithm

<table>
<tr><td colspan="2">Building Good Training Sets – Data Preprocessing
Dealing with missing data, Handling categorical data, Partitioning a dataset in training and test sets, Bringing features onto the same scale, Selecting meaningful features, Assessing feature importance with random forests.
Textbook 1: Chapters 3 ,4</td></tr>
<tr><td>Teaching-Learning Process</td><td>Chalk and talk method, Power point presentation
RBT Level: L1, L2, L3</td></tr>
<tr><td colspan="2">Module-3</td></tr>
<tr><td colspan="2">Compressing Data via Dimensionality Reduction
Unsupervised dimensionality reduction via principal component Analysis, Supervised data compression via linear discriminant analysis, Using kernel principal component analysis for nonlinear mappings
Learning Best Practices for Model Evaluation and Hyperparameter Tuning
Streamlining workflows with pipelines, Using k-fold cross-validation to assess model performance, Debugging algorithms with learning and validation curves, Fine-tuning machine learning models via grid search, Looking at different performance evaluation metrics
Applying Machine Learning to Sentiment Analysis
Obtaining the IMDb movie review dataset, Introducing the bag-of-words model, training a logistic regression model for document classification , Working with bigger data – online algorithms and out-of-core learning
Textbook 1: Chapters 5,6,8</td></tr>
<tr><td>Teaching-Learning Process</td><td>Chalk and talk method, Power point presentation
RBT Level: L1, L2, L3</td></tr>
<tr><td colspan="2">Module-4</td></tr>
<tr><td colspan="2">Embedding a Machine Learning Model into a Web Application
Serializing fitted scikit-learn estimators, Setting up a SQLite database for data storage, Developing a web application with Flask, Turning the movie classifier into a web application, Deploying the web application to a public server
Predicting Continuous Target Variables with Regression Analysis
Introducing a simple linear regression model, Exploring the Housing Dataset, Implementing an ordinary least squares linear regression model, Fitting a robust regression model using RANSAC, Evaluating the performance of linear regression models, Using regularized methods for regression- Turning a linear regression model into a curve – polynomial regression Textbook 1: Chapters 9,10</td></tr>
<tr><td>Teaching-Learning Process</td><td>Chalk and talk method, Power point presentation
RBT Level: L1, L2, L3</td></tr>
<tr><td colspan="2">Module-5</td></tr>
<tr><td colspan="2">Working with Unlabeled Data – Clustering Analysis
Grouping objects by similarity using k-means, Organizing clusters as a hierarchical tree,
Training Artificial Neural Networks for Image Recognition
Modeling complex functions with artificial neural networks, Classifying handwritten digits, Training an artificial neural network, Other neural network architectures
Textbook 1: Chapters 11,12</td></tr>
<tr><td>Teaching-Learning Process</td><td>Chalk and talk method, Power point presentation
RBT Level: L1, L2, L3</td></tr>
</table>

Course outcomes (Course Skill Set)

At the end of the course the student will be able to:

1. Appreciate the importance of visualization in the data analytics solution
2. Apply structured thinking to unstructured problems
3. Understand a very broad collection of machine learning algorithms and problems
4. Learn algorithmic topics of machine learning and mathematically deep enough to introduce the required theory
5. Develop an appreciation for what is involved in learning from data.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100 shall be reduced proportionally to 50 marks

Suggested Learning Resources:

Text Books:

1. Python Machine Learning by Sebastian Raschka, Published by Packt Publishing Ltd.
2. Machine Learning with Python for Everyone by Mark E Fenner
3. Machine Learning using Python by Manaranjan Pradhan & U Dinesh Kumar
4. Practical Machine Learning with Python by Dipanjan Sarkar, Raghav Bali &Tushar Sharma

Web links and Video Lectures (e-Resources)
• https://www.youtube.com/watch?v=RnFGwxJwx-0 • https://www.youtube.com/watch?v=eq7KF7JTinU
Activity Based Learning (Suggested Activities in Class)/ Practical Based learning • Using IRIS data set implement Adaline rule Classification Algorithm. • Implement Logistic Regression algorithm and generate corresponding graphs for overfitting and under fitting. • Implement linear SVM algorithm with maximum margin intuition. • Implement a kernel SVM to solve nonlinear problems. • Implement KNN Algorithm. • Implement decision tree algorithm. • Implement s rbf_kernel_pca for separating half-moon shapes. • Develop web application using flask.

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(Effective from the academic year 2021 – 22)

VII Semester

Multimedia Communication			
Course Code	**21EC745**	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	3:0:0:1	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3

Course objectives:

This course will enable students to:

- Understand the importance of multimedia in today's online and offline information sources and repositories.
- Understand the how Text, Audio, Image and Video information can be represented digitally in a computer so that it can be processed, transmitted and stored efficiently.
- Understand the Multimedia Transport in Wireless Networks
- Understand the Real-time multimedia network applications.
- Understand the Different network layer based application.

Teaching-Learning Process (General Instructions)

The sample strategies, which the teacher can use to accelerate the attainment of the various course outcomes are listed in the following:

1. Lecture method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Show Video/animation films to explain the functioning of various techniques.
3. Encourage collaborative (Group) Learning in the class
4. Ask at least three HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking
5. Topics will be introduced in multiple representations.
6. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Multimedia Communications: Introduction, Multimedia information representation, Multimedia networks, multimedia applications, Application and networking terminology.
(Chapter 1 of Text 1)

Teaching-Learning Process	Chalk and talk method, Power point presentation **RBT Level:** L1, L2

Module-2

Information Representation: Introduction, Digitization principles, Text, Images, Audio and Video. (Chapter 2 of Text 1)

Teaching-Learning Process	Chalk and talk method, Power point presentation **RBT Level:** L1, L2, L3

Module-3

Text and Image Compression: Introduction, Compression principles, text compression, image Compression. (Chapter 3 of Text 1)

Teaching-Learning Process	Chalk and talk method, Power point presentation **RBT Level:** L1, L2, L3

Module-4	
Audio and video compression: Introduction, Audio compression, video compression, video compression principles, video compression. (Chapter 4 of Text 1)	
Teaching-Learning Process	Chalk and talk method, Power point presentation **RBT Level:** L1, L2, L3
Module-5	
Multimedia Information Networks: Introduction, LANs, Ethernet, Token ring, Bridges, FDDI High-speed LANs, LAN protocol (Chap. 8 of Text 1).	
Teaching-Learning Process	Chalk and talk method, Power point presentation **RBT Level:** L1, L2

Course outcomes (Course Skill Set)

At the end of the course the student will be able to:

1. Understand basics of different multimedia networks and applications.
2. Understand different compression techniques to compress audio and video.
3. Describe multimedia Communication across Networks.
4. Analyse different media types to represent them in digital form.
5. Compress different types of text and images using different compression techniques.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

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(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

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2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module. Marks scored

out of 100 shall be reduced proportionally to 50 marks
Suggested Learning Resources: **Text Books:** Multimedia Communications- Fred Halsall, Pearson Education, 2001, ISBN -978813170994 **Reference Books:** 1. Multimedia: Computing, Communications and Applications- Raif Steinmetz, Klara Nahrstedt, Pearson Education, 2002, ISBN-978817758 2. Fundamentals of Multimedia – Ze-Nian Li, Mark S Drew, and Jiangchuan Liu.
Activity Based Learning (Suggested Activities in Class)/ Practical Based learning • Implementation of compression algorithms using MATLAB/ any open source tools (Python, Scilab, etc.)

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of
B.E. in Electrical and Electronic Engineering

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VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
B.E. in Electrical and Electronic Engineering
Scheme of Teaching and Examinations2021
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III SEMESTER

Sl No	Course and Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week: Theory Lecture (L)	Tutorial (T)	Practical/ Drawing (P)	Self -Study (S)	Examination: Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
1	BSC 21MAT31	Transform Calculus, Fourier Series and Numerical Technics	Maths	2	2	0		03	50	50	100	3
2	IPCC 21EE32	Analog Electronic Circuits and Op - Amps	TD: PSB	3	0	2		03	50	50	100	4
3	IPCC 21EE33	Electric Circuit Analysis	TD: PSB	3	0	2		03	50	50	100	4
4	PCC 21EE34	Transformers and Generators	TD: PSB	2	2	0		03	50	50	100	3
5	PCC 21EEL35	Electrical Machines Laboratory - I	TD: PSB	0	0	2		03	50	50	100	1
6	UHV 21UH36/49	Social Connect and Responsibility	Any Department	0	2	0		01	50	50	100	1
7	HSMC 21KSK37/47	Samskrutika Kannada	TD and PSB: HSMC	0	2	0		01	50	50	100	1
	HSMC 21KBK37/47	Balake Kannada										
	OR											
	HSMC 21CIP37/47	Constitution of India and Professional Ethics										
8	AEC 21EE38X	Ability Enhancement Course - III	TD: Concerned department PSB: Concerned Board	If offered as theory course				01	50	50	100	1
				0	2	0						
				If offered as lab. course				02				
				0	0	2						
								Total	**400**	**400**	**800**	**18**

Sl No		Course and Course Code	Course Title	TD and PSB	
9	Scheduled activities for III to VIII semesters	NMDC 21NS83	National Service Scheme (NSS)	NSS	All students have to register for any one of the course namely National Service Scheme, Physical Education (PE) (Sports and Athletics), and Yoga with the concerned coordinator of the course during the first week of III semester. The activities shall be carried out from III semester to VIII semester. SEE in the above courses shall be conducted during VIII semester examinations and the accumulated CIE marks shall be added to the SEE marks. Successful completion of the registered course is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE and Yoga activities.
		NMDC 21PE83	Physical Education (PE)(Sports and Athletics)	PE	
		NMDC 21YO83	Yoga	Yoga	

Course prescribed to lateral entry Diploma holders admitted to III semester B.E./B.Tech programs

Sl No	Course and Course Code	Course Title	TD/PSB	L	T	P	S	Duration	CIE Marks	SEE Marks	Total Marks	Credits
1	NCMC 21MATDIP31	Additional Mathematics - I	Maths	02	02	--	--	---	100	---	100	0

Note: BSC: Basic Science Course, **IPCC:** Integrated Professional Core Course, **PCC:** Professional Core Course, **INT** –Internship, **HSMC:** Humanity and Social Science & Management Courses, **AEC**–Ability Enhancement Courses. **UHV:** Universal Human Value Course.
L –Lecture, **T –** Tutorial, P- Practical/ Drawing, **S –** Self Study Component, **CIE:** Continuous Internal Evaluation, **SEE:** Semester End Examination.
TD- Teaching Department, **PSB**: Paper Setting department

21KSK37/47 Samskrutika Kannada is for students who speak, read and write Kannada and **21KBK37/47** Balake Kannada is for non-Kannada speaking, reading, and writing students.

Integrated Professional Core Course (IPCC): Refers to Professional Theory Core Course Integrated with Practicals of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (BE/B.Tech.) 2021-22 may be referred.
21INT49 Inter/Intra Institutional Internship: All the students admitted to engineering programs under the lateral entry category shall have to undergo a mandatory 21INT49 Inter/Intra Institutional Internship of 03 weeks during the intervening period of III and IV semesters. The internship shall be slated for CIE only and will not have SEE. The letter grade earned through CIE shall be included in the IV semester grade card. The internship shall be considered as a head of passing and shall be considered for vertical progression and for the award of degree. Those, who do not take up / complete the internship shall be declared fail and shall have to complete subsequently after satisfying the internship requirements. The faculty coordinator or mentor shall monitor the students' internship progress and interact with them for the successful completion of the internship.
Non–credit mandatory courses (NCMC): **(A) Additional Mathematics I and II:** **(1)** These courses are prescribed for III and IV semesters respectively to lateral entry Diploma holders admitted to III semester of B.E./B.Tech., programs. They shall attend the classes during the respective semesters to complete all the formalities of the course and appear for the Continuous Internal Evaluation (CIE). In case, any student fails to register for the said course/fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have secured an F grade. In such a case, the student has to fulfill the course requirements during subsequent semester/s to earn the qualifying CIE marks. These courses are slated for CIE only and has no SEE. **(2)**Additional Mathematics I and II shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses shall be mandatory for the award of degree. **(3)** Successful completion of the courses Additional Mathematics I and II shall be indicated as satisfactory in the grade card. Non-completion of the courses Additional Mathematics I and II shall be indicated as Unsatisfactory. **(B) National Service Scheme/Physical Education (Sport and Athletics)/ Yoga:** **(1)** Securing 40 % or more in CIE,35 % or more marks in SEE and 40 % or more in the sum total of CIE + SEE leads to successful completion of the registered course. **(2)** In case, students fail to secure 35 % marks in SEE, they has to appear for SEE during the subsequent examinations conducted by the University. **(3)**In case, any student fails to register for NSS, PE or Yoga/fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have not completed the requirements of the course. In such a case, the student has to fulfill the course requirements during subsequent semester/s to earn the qualifying CIE marks. **(4)** Successful completion of the course shall be indicated as satisfactory in the grade card. Non-completion of the course shall be indicated as Unsatisfactory. **(5)** These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses shall be mandatory for the award of degree.

Ability Enhancement Course – III			
21EEL381	Scilab for Transformers and Generators	21EEL383	555 IC Laboratory
21EEL382	Circuit laboratory using Pspice	21EEL384	Scilab for Mathematics

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IV SEMESTER

Sl. No	Course and Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board	Teaching Hours /Week: Theory Lecture (L)	Tutorial (T)	Practical/ Drawing (P)	Self -Study (S)	Examination: Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
1	BSC 21MAT41	Complex Analysis, Probability and Statistical Methods	Maths	2	2	0		03	50	50	100	3
2	IPCC 21EE42	Digital System Design	EE	3	0	2		03	50	50	100	4
3	IPCC 21EE43	Microcontroller	EE	3	0	2		03	50	50	100	4
4	PCC 21EE44	Electric Motors	EE	2	2	0		03	50	50	100	3
5	AEC 21BE45	Biology for Engineers	BT, CHE, PHY	2	0	0		02	50	50	100	2
6	PCC 21EEL46	Electrical Machines Laboratory - II	EE	0	0	2		03	50	50	100	1
7	HSMC 21KSK37/47	Samskrutika Kannada	HSMC	0	2	0		01	50	50	100	1
	HSMC 21KBK37/47	Balake Kannada										
	OR											
	HSMC 21CIP37/47	Constitution of India & Professional Ethics										
8	AEC 21EE48X	Ability Enhancement Course- IV	TD and PSB: Concerned department	If offered as theory Course				01	50	50	100	1
				0	2	0						
				If offered as lab. course				02				
				0	0	2						
9	UHV 21UH36/49	Universal Human Values	Any Department	0	2	0		01	50	50	100	1
10	INT 21INT49	Inter/Intra Institutional Internship	Evaluation By the appropriate authorities	Completed during the intervening period of II and III semesters by students admitted to first year of BE./B.Tech and during the intervening period of III and IV semesters by Lateral entry students admitted to III semester.				--	100	--	100	2
								Total	**550**	**450**	**1000**	**22**

Course prescribed to lateral entry Diploma holders admitted to III semester of Engineering programs

1	NCMC 21MATDIP41	Additional Mathematics - II	Maths	02	02	--	--	--	100	--	100	0

Note: BSC: Basic Science Course, IPCC: Integrated Professional Core Course, PCC: Professional Core Course, AEC –Ability Enhancement Courses, HSMC: Humanity and Social Science and Management Courses, UHV- Universal Human Value Courses.
L –Lecture, T – Tutorial, P- Practical/ Drawing, S – Self Study Component, CIE: Continuous Internal Evaluation, SEE: Semester End Examination.

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Integrated Professional Core Course (IPCC): Refers to Professional Theory Core Course Integrated with Practicals of the same course. Credit for IPCC can be 04 and its Teaching – Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from practical part of IPCC shall be included in the SEE question paper.For more details the regulation governing the Degree of Bachelor of Engineering /Technology (BE/B.Tech.) 2021-22 may be referred.

Non – credit mandatory course (NCMC):
Additional Mathematics - II:
(1) Lateral entry Diploma holders admitted to III semester of B.E./B.Tech., shall attend the classes during the IV semester to complete all the formalities of the course and appear for the Continuous Internal Evaluation (CIE). In case, any student fails to register for the said course/fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have secured an F grade. In such a case, the student has to fulfill the course requirements during subsequent semester/s to earn the qualifying CIE marks. These courses are slated for CIE only and has no SEE.
(2) Additional Mathematics I and II shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses shall be mandatory for the award of degree.
(3) Successful completion of the course Additional Mathematics II shall be indicated as satisfactory in the grade card. Non-completion of the courses Additional Mathematics II shall be indicated as Unsatisfactory.

Ability Enhancement Course - IV			
21EEP481	Microcontroller Based Projects	21EEL483	Scilab for Electrical and Electronic Measurements
21EEL482	Scilab for Electric Motors	21EEL484	Simulation of Op-Amp Circuits

Internship of 04 weeks during the intervening period of IV and V semesters; 21INT68 Innovation/ Entrepreneurship/ Societal Internship.
(1) All the students shall have to undergo a mandatory internship of 04 weeks during the intervening period of IV and V semesters. The internship shall be slated for CIE only and will not have SEE. The letter grade earned through CIE shall be included in the VI semester grade card.The internship shall be considered as a head of passing and shall be considered for vertical progression and for the award of degree. Those, who do not take up / complete the internship shall be considered under F(fail) grade and shall have to complete subsequently after satisfying the internship requirements.
(2) Innovation/ Entrepreneurship Internship shall be carried out at industry, State and Central Government /Non-government organizations (NGOs), micro, small and medium enterprise (MSME), Innovation centers or Incubation centers, etc. Innovation need not be a single major breakthrough, it can also be a series of small or incremental changes. Innovation of any kind can also happen outside of the business world.
Entrepreneurship internships offers a chance to gain hands on experience in the world of entrepreneurship and helps to learn what it takes to run a small entrepreneurial business by performing intern duties with an established company. This experience can then be applied to future business endeavours. Start-ups and small companies are a preferred place to learn the business tactics for future entrepreneurs as learning how a small business operates will serve the intern well when he/she manages his/her own company. Entrepreneurship acts as a catalyst to open the minds to creativity and innovation. Entrepreneurship internship can be from several sectors, including technology, small and medium-sized sectors, and service sector.
(3) Societal or social internship.
Urbanization is increasing on a global scale; and yet, half the world's population still resides in rural areas and is devoid of many things that urban population enjoy. Rural internship, is a work-based activity in which students will have a chance to solve/reduce the problems of the rural place for better living.
As proposed under the AICTE rural internship programme, activities under Societal or social internship, particularly in rural areas, shall be considered for 40 points under AICTE activity point programme.

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V SEMESTER

Sl. No	Course and Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
				Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
				L	T	P	S					
1	PCC 21EE51	Transmission and Distribution	EE	2	2	0		03	50	50	100	3
2	IPCC 21EE52	Control Systems	EE	3	0	2		03	50	50	100	4
3	PCC 21EE53	Power System Analysis - 1	EE	2	2	0		03	50	50	100	3
4	PCC 21EE54	Power Electronics	EE	2	2	0		03	50	50	100	3
5	PCC 21EEL55	Power Electronics Laboratory	EE	0	0	2		03	50	50	100	1
6	AEC 21RMI56	Research Methodology & Intellectual Property Rights	TD: Any Department PSB: As identified by University	1	2	0		02	50	50	100	2
7	HSMC 21CIV57	Environmental Studies	TD: Civil/ Environmental /Chemistry/ Biotech. PSB: Civil Engg	0	2	0		1	50	50	100	1
8	AEC 21EE58X	Ability Enhancement Course-V	Concerned Board	If offered as theory courses				01	50	50	100	1
				0	2	0						
				If offered as lab. courses				02				
				0	0	2						
								Total	**400**	**400**	**800**	**18**

Ability Enhancement Course - V

21EEL581	Scilab for Analysis of Power Systems	21EEP583	Energy Audit project
21EEL582	Scilab for Power Electronics	21EEP584	Renewable Energy Project

Note: BSC: Basic Science Course, PCC: Professional Core Course, IPCC: Integrated Professional Core Course, AEC –Ability Enhancement Course INT –Internship, HSMC: Humanity and Social Science & Management Courses.
L –Lecture, T – Tutorial, P- Practical/ Drawing, S – Self Study Component, CIE: Continuous Internal Evaluation, SEE: Semester End Examination.

Integrated Professional Core Course (IPCC): refers to Professional Theory Core Course Integrated with Practical of the same course. Credit for IPCC can be 04 and its Teaching – Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). Theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by CIE only and there shall be no SEE. For more details the regulation governing the Degree of Bachelor of Engineering /Technology (BE/B.Tech.) 2021-22 may be referred.

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VI SEMESTER

Sl. No	Course and Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
				Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
				L	T	P	S					
1	HSMC 21EE61	Management and Entrepreneurship	HSME/EE	3	0	0		03	50	50	100	3
2	IPCC 21EE62	Power System Analysis - 2	EE	3	0	2		03	50	50	100	4
3	PCC 21EE63	Signals and Digital Signal Processing	EE	2	2	0		03	50	50	100	3
4	PEC 21EE64x	Professional Elective Course-I	EE	3	0	0		03	50	50	100	3
5	OEC 21EE65x	Open Elective Course-I	Concerned Department	3	0	0		03	50	50	100	3
6	PCC 21EEL66	Digital Signal Processing Laboratory	EE	0	0	2		03	50	50	100	1
7	MP 21EEMP67	Mini Project	EE	Two contact hours /week for interaction between the faculty and students.				--	100	--	100	2
8	INT 21INT68	Innovation/Entrepreneurship /Societal Internship	Completed during the intervening period of IV and V semesters.					--	100	--	100	3
								Total	**500**	**300**	**800**	**22**

Professional Elective - I

21EE641	Sensors and Transducers	21EE643	Electrical Machine Design
21EE642	Electromagnetic Field Theory	21EE644	Electrical Engineering Materials

Open Electives – I offered by the Department of Electrical and Electronics Engineering to other Department students

21EE651	Utilization of Electrical Power	21EE653	Industrial Servo Control Systems
21EE652	Renewable Energy Resources	21EE654	Advanced Control Systems

Note: HSMC: Humanity and Social Science & Management Courses, **IPCC:** Integrated Professional Core Course, **PCC:** Professional Core Course, **PEC:** Professional Elective Courses, O**EC**–Open Elective Course, **MP** –Mini Project, INT –Internship.
L –Lecture, T – Tutorial, P - Practical / Drawing, S – Self Study Component, CIE: Continuous Internal Evaluation, SEE: Semester End Examination.

Integrated Professional Core Course (IPCC): Refers to Professional Theory Core Course Integrated with Practical of the same course. Credit for IPCC can be 04 and its Teaching – Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by CIE only and there shall be no SEE. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (BE/B.Tech) 2021-22 may be referred.

Professional Elective Courses(PEC):
A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an option to select one course. The minimum students' strength for offering professional electives is 10. However, this conditional shall not be applicable to cases where the admission to the programme is less than 10.

Open Elective Courses:
Students belonging to a particular stream of Engineering and Technology are not entitled for the open electives offered by their parent Department. However, they can opt an elective offered by other Departments, provided they satisfy the prerequisite condition if any. Registration to open electives shall be documented under the guidance of the Program Coordinator/ Advisor/Mentor.
Selection of an open elective shall not be allowed if,
(i) The candidate has studied the same course during the previous semesters of the program.
(ii) The syllabus content of open electives is similar to that of the Departmental core courses or professional electives.
(iii) A similar course, under any category, is prescribed in the higher semesters of the program.
In case, any college is desirous of offering a course (not included in the Open Elective List of the University) from streams such as Law, Business (MBA), Medicine, Arts, Commerce, etc., can seek permission, at least one month before the commencement of the semester, from the University by submitting a copy of the syllabus along with the details of expertise available to teach the same in the college.

The minimum students' strength for offering open electives is 10. However, this conditional shall not be applicable to cases where the admission to the programme is less than 10.

Mini-project work: Mini Project is a laboratory-oriented course which will provide a platform to students to enhance their practical knowledge and skills by the development of small systems/applications.

Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary Mini- project can be assigned to an individual student or to a group having not more than 4 students.

CIE procedure for Mini-project:

(i) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two faculty members of the Department, one of them being the Guide. The CIE marks awarded for the Mini-project work shall be based on the evaluation of project report, project presentation skill, and question and answer session in the ratio of 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

(ii) Interdisciplinary: Continuous Internal Evaluation shall be group-wise at the college level with the participation of all the guides of the project.

The CIE marks awarded for the Mini-project, shall be based on the evaluation of project report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

No SEE component for Mini-Project.

VII semester Classwork and Research Internship /Industry Internship (21INT82)

Swapping Facility

Institutions can swap VII and VIII Semester Scheme of Teaching and Examinations to accommodate research internship/ industry internship after the VI semester**.**

(2) Credits earned for the courses of VII and VIII Semester Scheme of Teaching and Examinations shall be counted against the corresponding semesters whether VII or VIII semester is completed during the beginning of IV year or later part of IV year of the program.

Elucidation:

At the beginning of IV year of the programme i.e., after VI semester, VII semester classwork and VIII semester Research Internship /Industrial Internship shall be permitted to be operated simultaneously by the University so that students have ample opportunity for internship. In other words, a good percentage of the class shall attend VII semester classwork and similar percentage of others shall attend to Research Internship or Industrial Internship.

Research/Industrial Internship shall be carried out at an Industry, NGO, MSME, Innovation centre, Incubation centre, Start-up, Centers of Excellence (CoE), Study Centre established in the parent institute and /or at reputed research organizations / institutes. The intership can also be rural internship.

The mandatory Research internship /Industry internship is for 24 weeks. The internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take up/complete the internship shall be declared fail and shall have to complete during the subsequent University examination after satisfying the internship requirements.

INT21INT82 Research Internship/ Industry Internship/Rural Internship

Research internship: A research internship is intended to offer the flavour of current research going on in the research field. It helps students get familiarized with the field and imparts the skill required for carrying out research.

Industry internship: Is an extended period of work experience undertaken by students to supplement their degree for professional development. It also helps them learn to overcome unexpected obstacles and successfully navigate organizations, perspectives, and cultures. Dealing with contingencies helps students recognize, appreciate, and adapt to organizational realities by tempering their knowledge with practical constraints.

Rural internship: A long-term goal, as proposed under the AICTE rural internship programme, shall be counted as rural internship activity.

The student can take up Interdisciplinary Research Internship or Industry Internship.

The faculty coordinator or mentor has to monitor the students' internship progress and interact with them to guide for the successful completion of the internship.

The students are permitted to carry out the internship anywhere in India or abroad. University shall not bear any expenses incurred in respect of internship.

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Swappable VII and VIII SEMESTER

VII SEMESTER

Sl. No	Course and Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board	Teaching Hours /Week: Theory Lecture (L)	Tutorial (T)	Practical/ Drawing (P)	Self -Study (S)	Examination: Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
1	PCC 21EE71	High Voltage and Power System Protection	EE	2	0	2		3	50	50	100	3
2	PCC 21EE72	Power System Operation and Control	EE	1	2	0		3	50	50	100	2
3	PEC 21EE73X	Professional elective Course-II	EE	3	0	0		3	50	50	100	3
4	PEC 21EE74X	Professional elective Course-III	EE	3	0	0		3	50	50	100	3
5	OEC 21EE75X	Open elective Course-II	Concerned Department	3	0	0		3	50	50	100	3
6	Project 21EE76	Project work	EE	Two contact hours /week for interaction between the faculty and students.				3	100	100	200	10
								Total	**350**	**350**	**700**	**24**

VIII SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department	Teaching Hours /Week: Theory Lecture (L)	Tutorial (T)	Practical/ Drawing (P)	Self -Study (S)	Examination: Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
1	Seminar 21EE81		Technical Seminar	EE	One contact hour /week for interaction between the faculty and students.				--	100	--	100	01
2	INT 21INT82		Research Internship/ Industry Internship	EE	Two contact hours /week for interaction between the faculty and students.				03 (Batch wise)	100	100	200	15
3	NCMC	21NS83	National Service Scheme (NSS)	NSS	Completed during the intervening period of III semester to VIII semester.				--	50	50	100	0
		21PE83	Physical Education (PE) (Sports and Athletics)	PE									
		21YO83	Yoga	Yoga									
									Total	**250**	**150**	**400**	**16**

Professional Elective - II

21EE731	Power System Planning	**21EE734**	Electric Vehicle Technologies
21EE732	Smart Grid	**21EE735**	PLC and SCADA
21EE733	ANN for Power Systems Applications		

Professional Elective - III

21EE741	Computer Aided Electrical Drawing	**21EE744**	Industrial Drives and Applications
21EE742	Micro- and Nano-Scale Sensors and Transducers	**21EE745**	FACTS and HVDC
21EE743	Big Data Analytics in Power Systems		

Open Electives - II offered by the Department of Electrical and Electronics Engineering to other Department students			
21EE751	Carbon Capture and Storage	**21EE754**	Electrical Power Quality
21EE752	Electric Vehicles	**21EE755**	Energy Conservation and Audit
21EE753	Disasters Management		

Note: PCC: Professional Core Course, **PEC:** Professional Elective Courses, **OEC**–Open Elective Course, **AEC** –Ability Enhancement Courses.
L –Lecture, T – Tutorial, P- Practical / Drawing, S – Self Study Component, CIE: Continuous Internal Evaluation, SEE: Semester End Examination.

Note: VII and VIII semesters of IV year of the programme
(1) Institutions can swap VII and VIII Semester Scheme of Teaching and Examinations to accommodate research internship/ industry internship after the VI semester**.**
(2) Credits earned for the courses of VII and VIII Semester Scheme of Teaching and Examinations shall be counted against the corresponding semesters whether VII or VIII semester is completed during the beginning of IV year or later part of IV year of the programme.

PROJECT WORK (21EEP75): The objective of the Project work is
- **(i)** To encourage independent learning and the innovative attitude of the students.
- **(ii)** To develop interactive attitude, communication skills, organization, time management, and presentation skills.
- **(iii)** To impart flexibility and adaptability.
- **(iv)** To inspire team working.
- **(v)** To expand intellectual capacity, credibility, judgment and intuition.
- **(vi)** To adhere to punctuality, setting and meeting deadlines.
- **(vii)** To instill responsibilities to oneself and others.
- **(viii)**To train students to present the topic of project work in a seminar without any fear, face the audience confidently, enhance communication skills, involve in group discussion to present and exchange ideas.

CIE procedure for Project Work:
(1) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide.
The CIE marks awarded for the project work, shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.
(2) Interdisciplinary: Continuous Internal Evaluation shall be group-wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable. The CIE marks awarded for the project work, shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.
SEE procedure for Project Work: SEE for project work will be conducted by the two examiners appointed by the University. The SEE marks awarded for the project work, shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25.

TECHNICAL SEMINAR (21EES81): The objective of the seminar is to inculcate self-learning, present the seminar topic confidently, enhance communication skill, involve in group discussion for exchange of ideas. Each student, under the guidance of a Faculty, shall choose, preferably, a recent topic of his/her interest relevant to the programme of Specialization.
- **(i)** Carry out literature survey, systematically organize the content.
- **(ii)** Prepare the report with own sentences, avoiding a cut and paste act.
- **(iii)**Type the matter to acquaint with the use of Micro-soft equation and drawing tools or any such facilities.
- **(iv)** Present the seminar topic orally and/or through PowerPoint slides.
- **(v)** Answer the queries and involve in debate/discussion.
- **(vi)** Submit a typed report with a list of references.

The participants shall take part in the discussion to foster a friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident.
Evaluation Procedure:
The CIE marks for the seminar shall be awarded (based on the relevance of the topic, presentation skill, participation in the question and answer session, and quality of report) by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three teachers from the department with the senior-most acting as the Chairman.
Marks distribution for CIE of the course:
Seminar Report:50 marks
Presentation skill:25 marks
Question and Answer: 25 marks.■ No SEE component for Technical Seminar

Non – credit mandatory courses (NCMC):
National Service Scheme/Physical Education (Sport and Athletics)/ Yoga:
(1) Securing 40 % or more in CIE,35 % or more marks in SEE and 40 % or more in the sum total of CIE + SEE leads to successful completion of the registered course.
(2) In case, students fail to secure 35 % marks in SEE, they has to appear for SEE during the subsequent examinations conducted by the University.
(3) In case, any student fails to register for NSS, PE or Yoga/fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have not completed the requirements of the course. In such a case, the student has to fulfill the course requirements during subsequently to earn the qualifying CIE marks subject to the maximum programme period.
(4) Successful completion of the course shall be indicated as satisfactory in the grade card. Non-completion of the course shall be indicated as Unsatisfactory.
(5) These course shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses shall be mandatory for the award of degree.

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III SEMESTER

Sl. No	Course and Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week: Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Examination: Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
				L	T	P	S					
1	BSC 21MAT31	Transform Calculus, Fourier Series and Numerical Techniques	Maths	3	0	0		03	50	50	100	3
2	IPCC 21CS32	Data Structures and Applications	Any CS Board Department	3	0	2		03	50	50	100	4
3	IPCC 21CS33	Analog and Digital Electronics		3	0	2		03	50	50	100	4
4	PCC 21CS34	Computer Organization and Architecture		3	0	0		03	50	50	100	3
5	PCC 21CSL35	Object Oriented Programming with JAVA Laboratory		0	0	2		03	50	50	100	1
6	UHV 21UH36	Social Connect and Responsibility	Any Department	0	0	1		01	50	50	100	1
7	HSMC 21KSK37/47	Samskrutika Kannada	TD and PSB: HSMC	1	0	0		01	50	50	100	1
	HSMC 21KBK37/47	Balake Kannada										
	OR											
	HSMC 21CIP37/47	Constitution of India and Professional Ethics										
8	AEC 21CS38X/21CSL38X	Ability Enhancement Course - III	TD: Concerned department PSB: Concerned Board	If offered as Theory Course				01	50	50	100	1
				1	0	0						
				If offered as lab. course				02				
				0	0	2						
								Total	**400**	**400**	**800**	**18**

9	Scheduled activities for III to VIII semesters	NMDC 21NS83	National Service Scheme (NSS)	NSS	All students have to register for any one of the course namely National Service Scheme, Physical Education (PE)(Sports and Athletics) and Yoga with the concerned coordinator of the course during the first week of III semester. The activities shall be carried out from (for 5 semesters) between III semester to VIII semester. SEE in the above courses shall be conducted during VIII semester examinations and the accumulated CIE marks shall be added to the SEE marks. Successful completion of the registered course is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the colander prepared for the NSS, PE and Yoga activities.
		NMDC 21PE83	Physical Education (PE) (Sports and Athletics)	PE	
		NMDC 21YO83	Yoga	Yoga	

Course prescribed to lateral entry Diploma holders admitted to III semester B.E./B.Tech programs

1	NCMC 21MATDIP31	Additional Mathematics - I	Maths	02	02	--	--	---	100	---	100	0

Note: BSC: Basic Science Course, **IPCC:** Integrated Professional Core Course, **PCC:** Professional Core Course, **INT** –Internship, **HSMC:** Humanity and Social Science & Management Courses, **AEC**–Ability Enhancement Courses. **UHV:** Universal Human Value Course.
L –Lecture, **T** – Tutorial, P- Practical/ Drawing, **S** – Self Study Component, **CIE:** Continuous Internal Evaluation, **SEE:** Semester End Examination. **TD-** Teaching Department, **PSB**: Paper Setting department

21KSK37/47 Samskrutika Kannada is for students who speak, read and write Kannada and **21KBK37/47** Balake Kannada is for non-Kannada speaking, reading, and writing students.

Integrated Professional Core Course (IPCC): Refers to Professional Theory Core Course Integrated with Practical's of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (BE/B.Tech.) 2021-22 may be referred.

21INT49 Inter/Intra Institutional Internship: All the students admitted to engineering programs under the lateral entry category shall have to undergo a mandatory 21INT49 Inter/Intra Institutional Internship of 03 weeks during the intervening period of III and IV semesters. The internship shall be slated for CIE only and will not have SEE. The letter grade earned through CIE shall be included in the IV semester grade card. The internship shall be considered as a head of passing and shall be considered for vertical progression and for the award of degree. Those, who do not take up / complete the internship shall be declared fail and shall have to complete during subsequently after satisfying the internship requirements. The faculty coordinator or mentor shall monitor the students' internship progress and interact with them for the successful completion of the internship.

Non–credit mandatory courses (NCMC):

(A) Additional Mathematics I and II:

(1) These courses are prescribed for III and IV semesters respectively to lateral entry Diploma holders admitted to III semester of B.E./B.Tech., programs. They shall attend the classes during the respective semesters to complete all the formalities of the course and appear for the Continuous Internal Evaluation (CIE). In case, any student fails to register for the said course/fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have secured an F grade. In such a case, the student has to fulfill the course requirements during subsequent semester/s to earn the qualifying CIE marks. These courses are slated for CIE only and has no SEE.

(2) Additional Mathematics I and II shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses shall be mandatory for the award of degree.

(3) Successful completion of the courses Additional Mathematics I and II shall be indicated as satisfactory in the grade card. Non-completion of the courses Additional Mathematics I and II shall be indicated as Unsatisfactory.

(B) National Service Scheme/Physical Education (Sport and Athletics)/ Yoga:

(1) Securing 40 % or more in CIE,35 % or more marks in SEE and 40 % or more in the sum total of CIE + SEE leads to successful completion of the registered course.

(2) In case, students fail to secure 35 % marks in SEE, they have to appear for SEE during the subsequent examinations conducted by the University.

(3) In case, any student fails to register for NSS, PE or Yoga/fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have not completed the requirements of the course. In such a case, the student has to fulfill the course requirements during subsequent semester/s to earn the qualifying CIE marks.

(4) Successful completion of the course shall be indicated as satisfactory in the grade card. Non-completion of the course shall be indicated as Unsatisfactory.

(5) These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses shall be mandatory for the award of degree.

Ability Enhancement Course - III

21CSL381	Mastering Office	21CS383	
21CS382	C++ Programming	21CS384	

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IV SEMESTER

Sl. No	Course and Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week: Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Examination: Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
				L	T	P	S					
1	BSC 21CS41	Mathematical Foundations for Computing	Maths	2	2	0		03	50	50	100	3
2	IPCC 21CS42	Design and Analysis of Algorithms	Any CS Board Department	3	0	2		03	50	50	100	4
3	IPCC 21CS43	Microcontroller and Embedded System	Any CS Board Department	3	0	2		03	50	50	100	4
4	PCC 21CS44	Operating System	Any CS Board Department	2	2	0		03	50	50	100	3
5	AEC 21BE45	Biology For Engineers	BT, CHE, PHY	2	0	0		02	50	50	100	2
6	PCC 21CSL46	Python Programming Laboratory	Any CS Board Department	0	0	2		03	50	50	100	1
7	HSMC 21KSK37/47	Samskrutika Kannada	HSMC	1	0	0		01	50	50	100	1
	HSMC 21KBK37/47	Balake Kannada										
	OR											
	HSMC 21CIP37/47	Constitution of India & Professional Ethics										
8	AEC 21CS48X/21CS48LX	Ability Enhancement Course- IV	TD and PSB: Concerned department	If offered as theory Course				01	50	50	100	1
				1	0	0						
				If offered as lab. course				02				
				0	0	2						
9	UHV 21UH49	Universal Human Values	Any Department	1	0	0		01	50	50	100	1
10	INT 21INT49	Inter/Intra Institutional Internship	Evaluation By the appropriate authorities	Completed during the intervening period of II and III semesters by students admitted to first year of BE./B.Tech and during the intervening period of III and IV semesters by Lateral entry students admitted to III semester.				3	100	--	100	2
								Total	**550**	**450**	**1000**	**22**
		Course prescribed to lateral entry Diploma holders admitted to III semester of Engineering programs										
1	NCMC 21MATDIP41	Additional Mathematics - II	Maths	02	02	--	--	--	100	--	100	0

Note: BSC: Basic Science Course, IPCC: Integrated Professional Core Course, PCC: Professional Core Course, AEC –Ability Enhancement Courses, HSMC: Humanity and Social Science and Management Courses, UHV- Universal Human Value Courses.
L –Lecture, T – Tutorial, P- Practical/ Drawing, S – Self Study Component, CIE: Continuous Internal Evaluation, SEE: Semester End Examination.

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Integrated Professional Core Course (IPCC): Refers to Professional Theory Core Course Integrated with Practical's of the same course. Credit for IPCC can be 04 and its Teaching – Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from practical part of IPCC shall be included in the SEE question paper. For more details the regulation governing the Degree of Bachelor of Engineering /Technology (BE/B.Tech.) 2021-22 may be referred.

Non – credit mandatory course (NCMC):
Additional Mathematics - II:
(1) Lateral entry Diploma holders admitted to III semester of B.E./B.Tech., shall attend the classes during the IV semester to complete all the formalities of the course and appear for the Continuous Internal Evaluation (CIE). In case, any student fails to register for the said course/fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have secured an F grade. In such a case, the student has to fulfil the course requirements during subsequent semester/s to earn the qualifying CIE marks. These courses are slated for CIE only and has no SEE.
(2) Additional Mathematics I and II shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses shall be mandatory for the award of degree.
(3) Successful completion of the course Additional Mathematics II shall be indicated as satisfactory in the grade card. Non-completion of the courses Additional Mathematics II shall be indicated as Unsatisfactory.

Ability Enhancement Course - IV

21CSL481	Web Programming	21CSL483	R Programming
21CS482	Unix Shell Programming	21CS484	

Internship of 04 weeks during the intervening period of IV and V semesters; 21INT68 Innovation/ Entrepreneurship/ Societal based Internship.
(1) All the students shall have to undergo a mandatory internship of 04 weeks during the intervening period of IV and V semesters. The internship shall be slated for CIE only and will not have SEE. The letter grade earned through CIE shall be included in the VI semester grade card. The internship shall be considered as a head of passing and shall be considered for vertical progression and for the award of degree. Those, who do not take up / complete the internship shall be considered under F (fail) grade and shall have to complete during subsequently after satisfying the internship requirements.
(2) Innovation/ Entrepreneurship Internship shall be carried out at industry, State and Central Government /Non-government organizations (NGOs), micro, small and medium enterprise (MSME), Innovation centers or Incubation centers. Innovation need not be a single major breakthrough; it can also be a series of small or incremental changes. Innovation of any kind can also happen outside of the business world.
Entrepreneurship internships offers a chance to gain hands on experience in the world of entrepreneurship and helps to learn what it takes to run a small entrepreneurial business by performing intern duties with an established company. This experience can then be applied to future business endeavours. Start-ups and small companies are a preferred place to learn the business tack ticks for future entrepreneurs as learning how a small business operates will serve the intern well when he/she manages his/her own company. Entrepreneurship acts as a catalyst to open the minds to creativity and innovation. Entrepreneurship internship can be from several sectors, including technology, small and medium-sized, and the service sector.
(3) Societal or social internship.
Urbanization is increasing on a global scale; and yet, half the world's population still resides in rural areas and is devoid of many things that urban population enjoy. Rural internship, is a work-based activity in which students will have a chance to solve/reduce the problems of the rural place for better living.
As proposed under the AICTE rural internship programme, activities under Societal or social internship, particularly in rural areas, shall be considered for 40 points under AICTE activity point programme.

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V SEMESTER

Sl. No	Course and Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
				Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
				L	T	P	S					
1	BSC 21CS51	Automata Theory and compiler Design	Any CS Board Department	3	0	0		03	50	50	100	3
2	IPCC 21CS52	Computer Networks		3	0	2		03	50	50	100	4
3	PCC 21CS53	Database Management Systems		3	0	0		03	50	50	100	3
4	PCC 21CS54	Artificial Intelligence and Machine Learning		3	0	0		03	50	50	100	3
5	PCC 21CSL55	Database Management Systems Laboratory with Mini Project		0	0	2		03	50	50	100	1
6	AEC 21XX56	Research Methodology & Intellectual Property Rights	TD: Any Department PSB: As identified by university	2	0	0		02	50	50	100	2
7	HSMC 21CIV57	Environmental Studies	TD: Civil/ Environmental /Chemistry/ Biotech. PSB: Civil Engg	1	0	0		1	50	50	100	1
8	AEC 21CS58X/21CSL58X	Ability Enhancement Course-V	Concerned Board	If offered as Theory courses				01	50	50	100	1
				1	0	0						
				If offered as lab. courses				02				
				0	0	2						
								Total	**400**	**400**	**800**	**18**

Ability Enhancement Course - IV

21CSL581	Angular JS and Node JS	21CS583	
21CS582	C# and .Net Framework	21CS584	

Note: BSC: Basic Science Course, PCC: Professional Core Course, IPCC: Integrated Professional Core Course, AEC –Ability Enhancement Course INT – Internship, HSMC: Humanity and Social Science & Management Courses.
L –Lecture, T – Tutorial, P- Practical/ Drawing, S – Self Study Component, CIE: Continuous Internal Evaluation, SEE: Semester End Examination.

Integrated Professional Core Course (IPCC): refers to Professional Theory Core Course Integrated with Practical of the same course. Credit for IPCC can be 04 and its Teaching – Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). Theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by CIE only and there shall be no SEE. For more details the regulation governing the Degree of Bachelor of Engineering /Technology (BE/B.Tech.) 2021-22 may be referred.

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VI SEMESTER

Sl. No	Course and Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
				Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
				L	T	P	S					
1	HSMC 21CS61	Software Engineering and Project Management	Any CS Board Department	2	2	0		03	50	50	100	3
2	IPCC 21CS62	Fullstack Development		3	0	2		03	50	50	100	4
3	PCC 21IS63	Software Testing		3	0	0		03	50	50	100	3
4	PEC 21XX64x	Professional Elective Course-I		3	0	0		03	50	50	100	3
5	OEC 21XX65x	Open Elective Course-I	Concerned Department	3	0	0		03	50	50	100	3
6	PCC 21ISL66	Software Testing Laboratory	Any CS Board Department	0	0	2		03	50	50	100	1
7	MP 21ISMP67	Mini Project		Two contact hours /week for interaction between the faculty and students.				--	100	--	100	2
8	INT 21INT68	Innovation/Entrepreneurship /Societal Internship	Completed during the intervening period of IV and V semesters.					--	100	--	100	3
								Total	**500**	**300**	**800**	**22**

Professional Elective - I

21CS641	Agile Technology	21IS643	Data Mining and Data warehousing
21CS642	Advanced JAVA Programming	21CS644	Data science and Visualization

Open Electives – I offered by the Department to other Department students

21CS651	Introduction to Data Structures	21CS653	Introduction to Cyber Security
21CS652	Introduction to Database Management Systems	21CS654	Programming in JAVA

Note: HSMC: Humanity and Social Science & Management Courses, **IPCC:** Integrated Professional Core Course, **PCC:** Professional Core Course, **PEC:** Professional Elective Courses, OEC–Open Elective Course, **MP** –Mini Project, INT –Internship.
L –Lecture, T – Tutorial, P - Practical / Drawing, S – Self Study Component, CIE: Continuous Internal Evaluation, SEE: Semester End Examination.

Integrated Professional Core Course (IPCC): Refers to Professional Theory Core Course Integrated with Practical of the same course. Credit for IPCC can be 04 and its Teaching – Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by CIE only and there shall be no SEE. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (BE/B.Tech) 2021-22 may be referred.

Professional Elective Courses (PEC):
A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an option to select one course out of five courses. The minimum students' strength for offering professional electives is 10. However, this conditional shall not be applicable to cases where the admission to the programme is less than 10.

Open Elective Courses:
Students belonging to a particular stream of Engineering and Technology are not entitled for the open electives offered by their parent Department. However, they can opt an elective offered by other Departments, provided they satisfy the prerequisite condition if any. Registration to open electives shall be documented under the guidance of the Program Coordinator/ Advisor/Mentor.
Selection of an open elective shall **not be allowed** if,

(i) The candidate has studied the same course during the previous semesters of the program.
(ii) The syllabus content of open electives is similar to that of the Departmental core courses or professional electives.
(iii) A similar course, under any category, is prescribed in the higher semesters of the program.

In case, any college is desirous of offering a course (not included in the Open Elective List of the University) from streams such as Law, Business (MBA), Medicine, Arts, Commerce, etc., can seek permission, at least one month before the commencement of the semester, from the University by

submitting a copy of the syllabus along with the details of expertise available to teach the same in the college.
The minimum students' strength for offering open electives is 10. However, this conditional shall not be applicable to cases where the admission to the programme is less than 10.

Mini-project work: Mini Project is a laboratory-oriented course which will provide a platform to students to enhance their practical knowledge and skills by the development of small systems/applications.
Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary Mini- project can be assigned to an individual student or to a group having not more than 4 students.
CIE procedure for Mini-project:
(i) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two faculty members of the Department, one of them being the Guide. The CIE marks awarded for the Mini-project work shall be based on the evaluation of project report, project presentation skill, and question and answer session in the ratio of 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.
(ii) Interdisciplinary: Continuous Internal Evaluation shall be group-wise at the college level with the participation of all the guides of the project.
The CIE marks awarded for the Mini-project, shall be based on the evaluation of project report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.
No SEE component for Mini-Project.

VII semester Classwork and Research Internship /Industry Internship (21INT82)

Swapping Facility
Institutions can swap VII and VIII Semester Scheme of Teaching and Examinations to accommodate research internship/ industry internship after the VI semester**.**
(2) Credits earned for the courses of VII and VIII Semester Scheme of Teaching and Examinations shall be counted against the corresponding semesters whether VII or VIII semester is completed during the beginning of IV year or later part of IV year of the program.
Elucidation:
At the beginning of IV year of the programme i.e., after VI semester, VII semester classwork and VIII semester Research Internship /Industrial Internship shall be permitted to be operated simultaneously by the University so that students have ample opportunity for internship. In other words, a good percentage of the class shall attend VII semester classwork and similar percentage of others shall attend to Research Internship or Industrial Internship.
Research/Industrial Internship shall be carried out at an Industry, NGO, MSME, Innovation centre, Incubation centre, Start-up, Centers of Excellence (CoE), Study Centre established in the parent institute and /or at reputed research organizations / institutes. The internship can also be rural internship.
The mandatory Research internship /Industry internship is for 24 weeks. The internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take up/complete the internship shall be declared fail and shall have to complete during the subsequent University examination after satisfying the internship requirements.

INT21INT82 Research Internship/ Industry Internship/Rural Internship
Research internship: A research internship is intended to offer the flavour of current research going on in the research field. It helps students get familiarized with the field and imparts the skill required for carrying out research.
Industry internship: Is an extended period of work experience undertaken by students to supplement their degree for professional development. It also helps them learn to overcome unexpected obstacles and successfully navigate organizations, perspectives, and cultures. Dealing with contingencies helps students recognize, appreciate, and adapt to organizational realities by tempering their knowledge with practical constraints.
Rural internship: A long-term goal, as proposed under the AICTE rural internship programme, shall be counted as rural internship activity.
The student can take up Interdisciplinary Research Internship or Industry Internship.
The faculty coordinator or mentor has to monitor the students' internship progress and interact with them to guide for the successful completion of the internship.
The students are permitted to carry out the internship anywhere in India or abroad. University shall not bear any expenses incurred in respect of internship.

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Swappable VII and VIII SEMESTER

VII SEMESTER

Sl. No	Course and Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
				Theory Lecture L	Tutorial T	Practical/ Drawing P	Self -Study S	Duration in hours	CIE Marks	SEE Marks	Total Marks	
1	PCC 21IS71	Cryptography and Network Security	Any CS Board Department	3	0	0		3	50	50	100	3
2	PCC 21CS72	Cloud Computing		2	0	0		3	50	50	100	2
3	PEC 21XX73X	Professional elective Course-II		3	0	0		3	50	50	100	3
4	PEC 21XX74X	Professional elective Course-III		3	0	0		3	50	50	100	3
5	OEC 21XX75X	Open elective Course-II	Concerned Department	3	0	0		3	50	50	100	3
6	Project 21ISP76	Project work		Two contact hours /week for interaction between the faculty and students.				3	100	100	200	10
								Total	**350**	**350**	**700**	**24**

VIII SEMESTER

Sl. No	Course and Course Code	Course Title	Teaching Department	Teaching Hours /Week				Examination				Credits
				Theory Lecture L	Tutorial T	Practical/ Drawing P	Self -Study S	Duration in hours	CIE Marks	SEE Marks	Total Marks	
1	Seminar 21IS81	Technical Seminar		One contact hour /week for interaction between the faculty and students.				--	100	--	100	01
2	INT 21INT82	Research Internship/ Industry Internship		Two contact hours /week for interaction between the faculty and students.				03 (Batch wise)	100	100	200	15
3	NCMC 21NS83	National Service Scheme (NSS)	NSS	Completed during the intervening period of III semester to VIII semester.				--	50	50	100	0
	NCMC 21PE83	Physical Education (PE) (Sports and Athletics)	PE									
	NCMC 21YO83	Yoga	Yoga									
								Total	**250**	**150**	**400**	**16**

Professional Elective - II

21CS731	Object oriented Modelling and Design	21CS734	Blockchain Technology
21CS732	Digital Image Processing	21CS735	Internet of Things
21IS733	User Interface Design		

Professional Elective - III

21CS741	Software Architecture and Design Patterns	21CS744	Robotic Process Automation Design and Development
21IS742	File structures	21CS745	NOSQL Database
21CS743	Deep Learning		

Open Electives - II offered by the Department to other Department students			
21CS751	Programming in Python	21CS754	Introduction to Data Science
21CS752	Introduction to AI and ML	21CS755	
21CS753	Introduction to BigData		

Note: PCC: Professional Core Course, **PEC:** Professional Elective Courses, **OEC**–Open Elective Course, **AEC** –Ability Enhancement Courses.
L –Lecture, T – Tutorial, P- Practical / Drawing, S – Self Study Component, CIE: Continuous Internal Evaluation, SEE: Semester End Examination.

Note: VII and VIII semesters of IV year of the programme

(1) Institutions can swap VII and VIII Semester Scheme of Teaching and Examinations to accommodate research internship/ industry internship after the VI semester**.**

(2) Credits earned for the courses of VII and VIII Semester Scheme of Teaching and Examinations shall be counted against the corresponding semesters whether VII or VIII semester is completed during the beginning of IV year or later part of IV year of the programme.

PROJECT WORK (21XXP76): The objective of the Project work is

- **(i)** To encourage independent learning and the innovative attitude of the students.
- **(ii)** To develop interactive attitude, communication skills, organization, time management, and presentation skills.
- **(iii)** To impart flexibility and adaptability.
- **(iv)** To inspire team working.
- **(v)** To expand intellectual capacity, credibility, judgment and intuition.
- **(vi)** To adhere to punctuality, setting and meeting deadlines.
- **(vii)** To instil responsibilities to oneself and others.
- **(viii)**To train students to present the topic of project work in a seminar without any fear, face the audience confidently, enhance communication skills, involve in group discussion to present and exchange ideas.

CIE procedure for Project Work:

(1) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide.

The CIE marks awarded for the project work, shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

(2) Interdisciplinary: Continuous Internal Evaluation shall be group-wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable. The CIE marks awarded for the project work, shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

SEE procedure for Project Work: SEE for project work will be conducted by the two examiners appointed by the University. The SEE marks awarded for the project work, shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25.

TECHNICAL SEMINAR (21XXS81): The objective of the seminar is to inculcate self-learning, present the seminar topic confidently, enhance communication skill, involve in group discussion for exchange of ideas. Each student, under the guidance of a Faculty, shall choose, preferably, a recent topic of his/her interest relevant to the programme of Specialization.

- **(i)** Carry out literature survey, systematically organize the content.
- **(ii)** Prepare the report with own sentences, avoiding a cut and paste act.
- **(iii)**Type the matter to acquaint with the use of Micro-soft equation and drawing tools or any such facilities.
- **(iv)** Present the seminar topic orally and/or through PowerPoint slides.
- **(v)** Answer the queries and involve in debate/discussion.
- (**vi)** Submit a typed report with a list of references.

The participants shall take part in the discussion to foster a friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident.

Evaluation Procedure:

The CIE marks for the seminar shall be awarded (based on the relevance of the topic, presentation skill, participation in the question and answer session, and quality of report) by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three teachers from the department with the senior-most acting as the Chairman.

Marks distribution for CIE of the course:

Seminar Report:50 marks
Presentation skill:25 marks
Question and Answer: 25 marks. ■ No SEE component for Technical Seminar

Non – credit mandatory courses (NCMC):

National Service Scheme/Physical Education (Sport and Athletics)/ Yoga:

(1) Securing 40 % or more in CIE,35 % or more marks in SEE and 40 % or more in the sum total of CIE + SEE leads to successful completion of the registered course.

(2) In case, students fail to secure 35 % marks in SEE, they has to appear for SEE during the subsequent examinations conducted by the University.

(3) In case, any student fails to register for NSS, PE or Yoga/fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have not completed the requirements of the course. In such a case, the student has to fulfill the course requirements during subsequently to earn the qualifying CIE marks subject to the maximum programme period.

(4) Successful completion of the course shall be indicated as satisfactory in the grade card. Non-completion of the course shall be indicated as Unsatisfactory.

(5) These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses shall be mandatory for the award of degree.

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III SEMESTER

Sl. No	Course and Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
				Theory Lecture	Tutorial	Practical /	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
				L	T	P	S					
1	BSC 21MAT31	Transform Calculus, Fourier Series And Numerical Techniques	Maths	2	2	0	0	03	50	50	100	3
2	IPCC 21ME32	Metal casting, Forming and Joining Processes	TD: ME PSB: ME	3	0	2	0	03	50	50	100	4
3	IPCC 21ME33	Material Science and Engineering	TD: ME PSB ME	3	0	2	0	03	50	50	100	4
4	PCC 21ME34	Thermodynamics	TD: ME PSB ME	2	2	0	0	03	50	50	100	3
5	PCC 21MEL35	Machine Drawing and GD & T	TD: ME PSB ME	0	0	2	0	03	50	50	100	1
6	UHV 21UH36	Social Connect and Responsibility	Any Department	0	0	1	0	01	50	50	100	1
7	HSMC 21KSK37/47	Samskrutika Kannada	TD and PSB: HSMC	1	0	0	0	01	50	50	100	1
	HSMC 21KBK37/47	Balake Kannada										
	OR											
	HSMC 21CIP37/47	Constitution of India and Professional Ethics										
8	AEC 21ME38X	Ability Enhancement Course – III	TD: Concerned department PSB: Concerned Board	If offered as Theory Course				01	50	50	100	1
				0	2	0						
				If offered as lab. course				02				
				0	0	2						
								Total	**400**	**400**	**800**	**18**

Sl. No		Course Code	Course Title		
9	Scheduled activities for III to VIII semesters	NMDC 21NS83	National Service Scheme (NSS)	NSS	All students have to register for any one of the course namely National Service Scheme, Physical Education (PE)(Sports and Athletics) and Yoga with the concerned coordinator of the course during the first week of III semester.The activities shall be carried out from (for 5 semesters) between III semester to VIII semester. SEE in the above courses shall be conducted during VIII semester examinations and the accumulated CIE marks shall be added to the SEE marks. Successful completion of the registered course is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the colander prepared for
		NMDC 21PE83	Physical Education (PE)(Sports and Athletics)	PE	
		NMDC 21YO83	Yoga	Yoga	

					the NSS, PE and Yoga activities.							
Course prescribed to lateral entry Diploma holders admitted to III semester B.E./B.Tech programs												
1	NCMC 21MATDIP31	Additional Mathematics - I	Maths	02	02	--	--	---	100	---	100	0

Note:BSC: Basic Science Course, **IPCC:** Integrated Professional Core Course, **PCC:** Professional Core Course,**INT** –Internship, **HSMC:** Humanity and Social Science & Management Courses, **AEC**–Ability Enhancement Courses. **UHV:** Universal Human Value Course.

L –Lecture, **T –** Tutorial, P- Practical/ Drawing, **S –** Self Study Component, **CIE:** Continuous Internal Evaluation, **SEE:** Semester End Examination.**TD-** Teaching Department, **PSB**: Paper Setting department

21KSK37/47 Samskrutika Kannada is for students who speak, read and write Kannada and **21KBK37/47** Balake Kannada is for non-Kannada speaking, reading, and writing students.

Integrated Professional Core Course (IPCC): Refers to Professional Theory Core Course Integrated with Practicals of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper.For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (BE/B.Tech.) 2021-22 may be referred.

21INT49 Inter/Intra Institutional Internship: All the students admitted to engineering programs under the lateral entry category shall have to undergo a mandatory 21INT49 Inter/Intra Institutional Internshipof 03 weeks during the intervening period of III and IV semesters. The internship shall be slated for CIE only and will not have SEE. The letter grade earned through CIE shall be included in the IV semester grade card.The internship shall be considered as a head of passing and shall be considered for vertical progression and for the award of degree. Those, who do not take up / complete the internship shall be declared fail and shall have to complete during subsequently after satisfying the internship requirements. The faculty coordinator or mentor shall monitor the students' internship progress and interact with them for the successful completion of the internship.

Non–credit mandatory courses (NCMC):

(A)Additional Mathematics I and II:

(1) These courses are prescribed for III and IV semesters respectively to lateral entry Diploma holders admitted to III semester of B.E./B.Tech., programs. They shall attend the classes during the respective semesters to complete all the formalities of the course and appear for the Continuous Internal Evaluation (CIE). In case, any student fails to register for the said course/fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have secured an F grade. In such a case, the student has to fulfill the course requirements during subsequent semester/s to earn the qualifying CIE marks. These courses are slated for CIE only and has no SEE.

(2) Additional Mathematics I and II shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses shall be mandatory for the award of degree.

(3) Successful completion of the coursesAdditional Mathematics I and IIshall be indicated as satisfactory in the grade card. Non-completion of the courses. Additional Mathematics I and IIshall be indicated as Unsatisfactory.

(B) National Service Scheme/Physical Education (Sport and Athletics)/ Yoga:

(1) Securing 40 % or more in CIE,35 % or more marks in SEE and 40 % or more in the sum total of CIE + SEE leads to successful completion of the registered course.

(2) In case, students fail to secure 35 % marks in SEE, they has to appear for SEE during the subsequent examinations conducted by the University.

(3) In case, any student fails to register for NSS, PE or Yoga/fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have not completed the requirements of the course. In such a case, the student has to fulfill the course requirements during subsequent semester/s to earn the qualifying CIE marks.

(4) Successful completion of the course shall be indicated as satisfactory in the grade card. Non-completion of the course shall be indicated as Unsatisfactory.

(5) These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses shall be mandatory for the award of degree.

Ability Enhancement Course – III			
21ME381	Introduction to PYTHON (0-0-2-0)	21ME383	Digital Society(0-2-0-0)
21ME382	Fundamentals of Virtual Reality (0-2-0-0)		

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IV SEMESTER

Sl. No	Course and Course Code	Course Title	Teaching Department (TD) and Question Paper Setting	Teaching Hours /Week				Examination				Credits
				Theory Lecture	Tutorial	Practical /	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
				L	T	P	S					
1	BSC 21ME41	Complex Analysis, Probability and Linear Programming.	Maths	2	2	0	0	03	50	50	100	3
2	IPCC 21ME42	Machining Science and Jigs & Fixtures	TD: ME PSB: ME	3	0	2	0	03	50	50	100	4
3	IPCC 21ME43	Fluid Mechanics	TD: ME PSB: ME	3	0	2	0	03	50	50	100	4
4	PCC 21ME44	Mechanics of Materials	TD: ME PSB: ME	2	2	0	0	03	50	50	100	3
5	AEC 21BE45	Biology For Engineers	BT, CHE, PHY	2	0	0	0	02	50	50	100	2
6	PCC 21MEL46	Mechanical Measurements and Metrology Lab	TD: ME PSB: ME	0	0	2	0	03	50	50	100	1
7	HSMC 21KSK37/47	Samskrutika Kannada	HSMC	1	0	0	0	01	50	50	100	1
	HSMC 21KBK37/47	Balake Kannada										
	OR											
	HSMC 21CIP37/47	Constitution of India & Professional Ethics										
8	AEC 21XX48X	Ability Enhancement Course- IV	TD and PSB: Concerned department	If offered as theory Course				01	50	50	100	1
				0	2	0						
				If offered as lab. Course				02				
				0	0	2						
9	UHV 21UH49	UniversalHumanValues	Any Department	1	0	0		01	50	50	100	1
10	INT 21INT49	Inter/Intra Institutional Internship	Evaluation By the appropriate authorities	Completed during the intervening period ofII and III semesters by students admitted to first year of BE./B.Tech and during the intervening period of III and IV semesters by Lateral entry students admitted to III				3	100	--	100	2

				semester.								
								Total	**550**	**450**	**1000**	**22**
Course prescribed to lateral entry Diploma holders admitted to III semester of Engineering programs												
1	NCMC 21MATDIP41	Additional Mathematics – II	Maths	02	02	--	--	--	100	--	100	0

Note: BSC: Basic Science Course, IPCC: Integrated Professional Core Course, PCC: Professional Core Course, AEC –Ability Enhancement Courses, HSMC: Humanity and Social Science and Management Courses, UHV- Universal Human Value Courses.
L –Lecture, T – Tutorial, P- Practical/ Drawing, S – Self Study Component, CIE: Continuous Internal Evaluation, SEE: Semester End Examination.

21KSK37/47 Samskrutika Kannada is for students who speak, read and write Kannada and 21KBK37/47 Balake Kannada is for non-Kannada speaking, reading, and writing students.

Integrated Professional Core Course (IPCC): Refers to Professional Theory Core Course Integrated with Practicals of the same course. Credit for IPCC can be 04 and its Teaching – Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from practical part of IPCCshall be included in the SEE question paper.For more details the regulation governing the Degree of Bachelor of Engineering /Technology (BE/B.Tech.) 2021-22 may be referred.

Non – credit mandatory course (NCMC):
Additional Mathematics - II:
(1) Lateral entry Diploma holders admitted to III semester of B.E./B.Tech., shall attend the classes during the IV semester to complete all the formalities of the course and appear for the Continuous Internal Evaluation (CIE). In case, any student fails to register for the said course/fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have secured an F grade. In such a case, the student has to fulfill the course requirements during subsequent semester/s to earn the qualifying CIE marks. These courses are slated for CIE only and has no SEE.
(2) Additional Mathematics I and II shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses shall be mandatory for the award of degree.
(3) Successful completion of the course Additional Mathematics IIshall be indicated as satisfactory in the grade card. Non-completion of the coursesAdditional Mathematics IIshall be indicated as Unsatisfactory.

Ability Enhancement Course – IV			
21ME481	Spread Sheets for Engineers (0-0-2-0)	21ME483	Fundamentals of Augmented Reality (0-2-0-0)
21ME482	Introduction to AI and ML (0-2-0-0)		

Internship of 04 weeks during the intervening period of IV and V semesters; 21INT68Innovation/ Entrepreneurship/ Societalbased Internship.
(1) All the students shall have to undergo a mandatory internship of 04 weeks during the intervening period of IV and V semesters. The internship shall be slated for CIE only and will not have SEE. The letter grade earned through CIE shall be included in the VI semester grade card.The internship shall be considered as a head of passing and shall be considered for vertical progression and for the award of degree. Those, who do not take up / complete the internship shall be considered under F (fail) grade and shall have to complete during subsequently after satisfying the internship requirements.
(2) Innovation/ Entrepreneurship Internshipshall be carried out at industry, State and Central Government /Non-government organizations (NGOs), micro, small and medium enterprise (MSME), Innovation centers or Incubation centers. Innovation need not be a single major breakthrough, it can also be a series of small or incremental changes.Innovation of any kind can also happen outside of the business world.
Entrepreneurship internships offers a chance to gain hands on experience in the world of entrepreneurship and helps to learn what it takes to run a small entrepreneurial business by performing intern duties with an established company. This experience can then be applied to future business endeavours.Start-ups and small companies are a preferred place to learn the business tack ticks for future entrepreneurs as learning how a small business operates will serve the intern well when he/she manages his/her own company. Entrepreneurship acts as a catalyst to open the minds to creativity and innovation.Entrepreneurship internship can be from several sectors, including technology, small and medium-sized, and the service sector.
(3) Societal or social internship.

Urbanization is increasing on a global scale; and yet, half the world's population still resides in rural areas and is devoid of many things that urban population enjoy. Rural internship, is a work-based activity in which students will have a chance to solve/reduce the problems of the rural place for better living. As proposed under the AICTE rural internship programme, activities under Societal or social internship, particularly in rural areas, shall be considered for 40 points under AICTE activity point programme.

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V SEMESTER

Sl. No	Course and Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
				Theory Lecture	Tutorial	Practical /	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
				L	T	P	S					
1	BSC 21ME51	Theory of Machines	TD: ME PSB: ME	2	2	0	0	03	50	50	100	3
2	IPCC 21ME52	Thermo-fluids Engineering	TD: ME PSB: ME	3	0	2	0	03	50	50	100	4
3	PCC 21ME53	Finite Element Analysis	TD: ME PSB: ME	2	0	2	0	03	50	50	100	3
4	PCC 21ME54	Modern Mobility and Automotive Mechanics	TD: ME PSB: ME	3	0	0	0	03	50	50	100	3
5	PCC 21MEL55	Design lab	TD: ME PSB: ME	0	0	2	0	03	50	50	100	1
6	AEC 21XX56	Research Methodology & Intellectual Property Rights	TD: Any Department PSB: As identified by University	2	0	0	0	02	50	50	100	2
7	HSMC 21CIV57	Environmental Studies	TD: Civil/ Environmental /Chemistry/ Biotech. PSB: Civil Engg	2	0	0	0	1	50	50	100	1
8	AEC 21ME58X	Ability Enhancement Course-V	Concerned Board	If offered as Theory courses				01	50	50	100	1
				0	2	0						
				If offered as lab.Courses				02				
				0	0	2						
								Total	**400**	**400**	**800**	**18**

Ability Enhancement Course – IV

21ME581	Basics of MATLAB(0-0-2-0)	21ME583	VFX – Visual Effects (0-2-0-0)
21ME582	Digital Marketing (0-2-0-0)		

Note: BSC: Basic Science Course, PCC: Professional Core Course, IPCC: Integrated Professional Core Course, AEC –Ability Enhancement Course INT –Internship, HSMC: Humanity and Social Science & Management Courses.
L –Lecture, T – Tutorial, P- Practical/ Drawing, S – Self Study Component, CIE: Continuous Internal Evaluation, SEE: Semester End Examination.

Integrated Professional Core Course (IPCC): refers to Professional Theory Core Course Integrated with Practical of the same course. Credit for IPCC can be 04 and its Teaching – Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). Theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by CIE only and there shall be no SEE. For more details the regulation governing the Degree of Bachelor of Engineering /Technology (BE/B.Tech.) 2021-22 may be referred.

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VI SEMESTER

Sl. No	Course and Course Code	Course Title	Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination					Credits
				Theory Lecture	Tutorial	Practical / Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks		
				L	T	P	S						
1	HSMC 21ME61	Production and Operations Management	TD: ME PSB: ME	3	0	0	0	03	50	50	100		3
2	IPCC 21ME62	Heat Transfer	TD: ME PSB: ME	3	0	2	0	03	50	50	100		4
3	PCC 21ME63	Machine design	TD: ME PSB: ME	2	2	0	0	03	50	50	100		3
4	PEC 21ME64x	ProfessionalElective Course-I	TD: ME PSB: ME	3	0	0	0	03	50	50	100		3
5	OEC 21ME65x	OpenElective Course-I	TD: ME PSB: ME	3	0	0	0	03	50	50	100		3
6	PCC 21MEL66	CNC Programming and 3-D Printing Lab	TD: ME PSB: ME	0	0	2	0	03	50	50	100		1
7	MP 21MEMP67	Mini Project		Two contact hours /week for interaction between the faculty and students.				--	100	--	100		2
8	INT 21INT68	Innovation/Entrepreneurship /Societal Internship	Completed during the intervening period of IV and V semesters.					--	100	--	100		3
								Total	**500**	**300**	**800**		**22**

Professional Elective – I

21ME641	Supply Chain Management & Introduction to SAP	21ME643	Autonomous vehicles
21ME642	Mechatronic System Design	21ME644	Internet of Things (IoT) (2-0-2-0)

Open Electives – I offered by the Department to other Department students

21ME651	Project Management	21ME653	Mechatronics
21ME652	Renewable Energy Power Plants	21ME654	Modern Mobility

Note: HSMC: Humanity and Social Science & Management Courses, **IPCC:** Integrated Professional Core Course, **PCC:** Professional Core Course, **PEC:** Professional Elective Courses, O**EC**–Open Elective Course, **MP** –Mini Project, INT – Internship.
L –Lecture, T – Tutorial, P - Practical / Drawing, S – Self Study Component, CIE: Continuous Internal Evaluation, SEE: Semester End Examination.

Integrated Professional Core Course (IPCC): Refers to Professional Theory Core Course Integrated with Practical of the same course. Credit for IPCC can be 04 and its Teaching – Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by CIE only and there shall be no SEE. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (BE/B.Tech) 2021-22 may be referred.

Professional Elective Courses(PEC):
A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the

Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an option to select one course out of five course. The minimum students' strength for offering professional electives is 10. However, this conditional shall not be applicable to cases where the admission to the programme is less than 10.

Open Elective Courses:

Students belonging to a particular stream of Engineering and Technology are not entitled for the open electives offered by their parent Department. However, they can opt an elective offered by other Departments, provided they satisfy the prerequisite condition if any. Registration to open electives shall be documented under the guidance of the Program Coordinator/ Advisor/Mentor.

Selection of an open elective shall **not be allowed** if,

(i) The candidate has studied the same course during the previous semesters of the program.

(ii) The syllabus content of open electives is similar to that of the Departmental core courses or professional electives.

(iii) A similar course, under any category, is prescribed in the higher semesters of the program.

In case, any college is desirous of offering a course (not included in the Open Elective List of the University) from streams such as Law, Business (MBA), Medicine, Arts, Commerce, etc., can seek permission, at least one month before the commencement of the semester, from the University by submitting a copy of the syllabus along with the details of expertise available to teach the same in the college.

The minimum students' strength for offering open electives is 10. However, this conditional shall not be applicable to cases where the admission to the programme is less than 10.

Mini-project work: Mini Project is a laboratory-oriented course which will provide a platform to students to enhance their practical knowledge and skills by the development of small systems/applications.

Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary Mini- project can be assigned to an individual student or to a group having not more than 4 students.

CIE procedure for Mini-project:

(i) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two faculty members of the Department, one of them being the Guide. The CIE marks awarded for the Mini-project work shall be based on the evaluation of project report, project presentation skill, and question and answer session in the ratio of 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

(ii) Interdisciplinary: Continuous Internal Evaluation shall be group-wise at the college level with the participation of all the guides of the project.

The CIE marks awarded for the Mini-project, shall be based on the evaluation of project report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

No SEE component for Mini-Project.

VII semester Classwork and Research Internship /Industry Internship (21INT82)

Swapping Facility

Institutions can swap VII and VIII Semester Scheme of Teaching and Examinations to accommodate research internship/ industry internship after the VI semester**.**

(2) Credits earned for the courses of VII and VIII Semester Scheme of Teaching and Examinations shall be counted against the corresponding semesters whether VII or VIII semester is completed during the beginning of IV year or later part of IV year of the program.

Elucidation:

At the beginning of IV year of the programme i.e., after VI semester, VII semester classwork and VIII semester Research Internship /Industrial Internship shall be permitted to be operated simultaneously by the University so that students have ample opportunity for internship. In other words, a good percentage of the class shall attend VII semester classwork and similar percentage of others shall attend to Research Internship or Industrial Internship.

Research/Industrial Internship shall be carried out at an Industry, NGO, MSME, Innovation centre, Incubation centre, Start-up, Centers of Excellence (CoE), Study Centre established in the parent institute and /or at reputed research organizations / institutes. The intership can also be rural internship.

The mandatory Research internship /Industry internship is for 24 weeks. The internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take up/complete the internship shall be declared fail and shall have to complete during the subsequent University examination after satisfying the internship

requirements.
INT21INT82 Research Internship/ Industry Internship/Rural Internship **Research internship:** A research internship is intended to offer the flavour of current research going on in the research field. It helps students get familiarized with the field and imparts the skill required for carrying out research. **Industry internship:** Is an extended period of work experience undertaken by students to supplement their degree for professional development. It also helps them learn to overcome unexpected obstacles and successfully navigate organizations, perspectives, and cultures. Dealing with contingencies helps students recognize, appreciate, and adapt to organizational realities by tempering their knowledge with practical constraints. **Rural internship:** A long-term goal, as proposed under the AICTE rural internship programme, shall be counted as rural internship activity. The student can take up Interdisciplinary Research Internship or Industry Internship. The faculty coordinator or mentor has to monitor the students' internship progress and interact with them to guide for the successful completion of the internship. The students are permitted to carry out the internship anywhere in India or abroad. University shall not bear any expenses incurred in respect of internship.

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Swappable VII and VIII SEMESTER

VII SEMESTER

Sl. No	Course and Course Code	Course Title	Department (TD) and Question Paper Setting Board	Teaching Hours /Week: Theory Lecture (L)	Tutorial (T)	Practical / (P)	Self -Study (S)	Examination: Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
1	PCC 21ME71	Automation and Robotics	TD: ME PSB: ME	3	0	0	0	3	50	50	100	3
2	PCC 21ME72	Control Engg	TD: ME PSB: ME	3	0	0	0	3	50	50	100	2
3	PEC 21ME73X	Professional elective Course-II	TD: ME PSB: ME	3	0	0	0	3	50	50	100	3
4	PEC 21ME74X	Professional elective Course-III	TD: ME PSB: ME	3	0	0	0	3	50	50	100	3
5	OEC 21ME75X	Open elective Course-II	TD: ME PSB: ME	3	0	0	0	3	50	50	100	3
6	Project 21MEP76	Project work		Two contact hours /week for interaction between the faculty and students.				3	100	100	200	10
								Total	**350**	**350**	**700**	**24**

VIII SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department	Teaching Hours /Week: Theory Lecture (L)	Tutorial (T)	Practical / (P)	Self -Study (S)	Examination: Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
1	Seminar 21XX81		Technical Seminar		One contact hour /week for interaction between the faculty and students.				--	100	--	100	01
2	INT 21INT82		Research Internship/ Industry Internship		Two contact hours /week for interaction between the faculty and students.				03 (Batch wise)	100	100	200	15
3	NCMC	21NS83	National Service Scheme (NSS)	NSS	Completed during the intervening period of III semester to VIII semester.				--	50	50	100	0
		21PE83	Physical Education (PE) (Sports and Athletics)	PE									
		21YO83	Yoga	Yoga									
									Total	**250**	**150**	**400**	**16**

Professional Elective – II

21ME731	Additive Manufacturing	21ME734	MEMS and Microsystem Technology
21ME732	Total Quality Management	21ME735	Design for Manufacturing and Assembly
21ME733	Refrigeration and Air conditioning		
Professional Elective – III			
21ME741	Advanced Vibrations and Condition Monitoring	21ME744	Product Design and Ergonomics
21ME742	Theory and Design of IC Engines		
21ME743	Advanced Turbomachines		

Open Electives - II offered by the Department to other Department students			
21ME751	Non-traditional Machining	21ME7533	Operations Research
21ME752	Hydraulics and Pneumatics		

Note: PCC: Professional Core Course, **PEC:** Professional Elective Courses, **OEC**–Open Elective Course, **AEC** –Ability Enhancement Courses.

L –Lecture, T – Tutorial, P- Practical / Drawing, S – Self Study Component, CIE: Continuous Internal Evaluation, SEE: Semester End Examination.

Note: VII and VIII semesters of IV year of the programme

(1) Institutions can swap VII and VIII Semester Scheme of Teaching and Examinations to accommodate research internship/ industry internship after the VI semester**.**

(2) Credits earned for the courses of VII and VIII Semester Scheme of Teaching and Examinations shall be counted against

PROJECT WORK (21XXP75): The objective of the Project work is

(i) To encourage independent learning and the innovative attitude of the students.
(ii) To develop interactive attitude, communication skills, organization, time management, and presentation skills.
(iii) To impart flexibility and adaptability.
(iv) To inspire team working.
(v) To expand intellectual capacity, credibility, judgment and intuition.
(vi) To adhere to punctuality, setting and meeting deadlines.
(vii) To instill responsibilities to oneself and others.
(viii) To train students to present the topic of project work in a seminar without any fear, face the audience confidently, enhance communication skills, involve in group discussion to present and exchange ideas.

CIE procedure for Project Work:

(1) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide.

The CIE marks awarded for the project work, shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

(2) Interdisciplinary: Continuous Internal Evaluation shall be group-wise at the college level with the participation of all

TECHNICAL SEMINAR (21XXS81): The objective of the seminar is to inculcate self-learning, present the seminar topic confidently, enhance communication skill, involve in group discussion for exchange of ideas. Each student, under the guidance of a Faculty, shall choose, preferably, a recent topic of his/her interest relevant to the programme of Specialization.

(i) Carry out literature survey, systematically organize the content.
(ii) Prepare the report with own sentences, avoiding a cut and paste act.
(iii) Type the matter to acquaint with the use of Micro-soft equation and drawing tools or any such facilities.
(iv) Present the seminar topic orally and/or through PowerPoint slides.
(v) Answer the queries and involve in debate/discussion.
(**vi)** Submit a typed report with a list of references.

The participants shall take part in the discussion to foster a friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident.

Evaluation Procedure:

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III SEMESTER

Sl. No	Course and Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination			
				Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks
				L	T	P	S				
1	BSC 21MAT31	Transform Calculus, Fourier Series and Numerical Techniques	Maths	2	2	0	0	03	50	50	100
2	IPCC 21MT32	Analog and Digital Electronics	TD: MT PSB: MT	3	0	2	1	03	50	50	100
3	IPCC 21MT33	Material Science and Manufacturing Technology	TD: MT PSB: MT	3	0	2	0	03	50	50	100
4	PCC 21MT34	Mechanics of solids and fluids	TD: MT PSB: MT	2	2	0	0	03	50	50	100
5	PCC 21MTL35	Machine Drawing and GD & T	TD: MT PSB: MT	0	0	2	0	03	50	50	100
6	UHV 21UH36	Social Connect and Responsibility	Any Department	0	0	1	0	01	50	50	100
7	HSMC 21KSK37/47	Samskrutika Kannada	TD and PSB: HSMC	1	0	0		01	50	50	100
	HSMC 21KBK37/47	Balake Kannada									
	OR										
	HSMC 21CIP37/47	Constitution of India and Professional Ethics									
8	AEC 21MT38X	Ability Enhancement Course – III	TD: Concerned department PSB: Concerned Board	If offered as Theory Course				01	50	50	100
				0	2	0					
				If offered as lab. course				02			
				0	0	2					
								Total	**400**	**400**	**800**

9	**Scheduled activities for III to VIII semesters**	NMDC 21NS83	National Service Scheme (NSS)	NSS	All students have to register for any one of the course namely Service Scheme, Physical Education (PE)(Sports and Athletics) ar with the concerned coordinator of the course during the first we semester.The activities shall be carried out from (for 5 semesters) III semester to VIII semester. SEE in the above courses shall be co during VIII semester examinations and the accumulated CIE marks added to the SEE marks. Successful completion of the registered mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and t shall be reflected in the colander prepared for the NSS, PE a activities.
		NMDC 21PE83	Physical Education (PE)(Sports and Athletics)	PE	
		NMDC 21YO83	Yoga	Yoga	

Course prescribed to lateral entry Diploma holders admitted to III semester B.E./B.Tech programs

				L	T	P	S	Duration	CIE	SEE	Total
1	NCMC 21MATDIP31	Additional Mathematics – I	Maths	02	02	--	--	---	100	---	100

Note:BSC: Basic Science Course, **IPCC:** Integrated Professional Core Course, **PCC:** Professional Core Course,**INT** –Internship, **HSMC:** Humanity and Social Sc Management Courses, **AEC**–Ability Enhancement Courses. **UHV:** Universal Human Value Course.
L –Lecture, **T** – Tutorial, P- Practical/ Drawing, **S** – Self Study Component, **CIE:** Continuous Internal Evaluation, **SEE:** Semester End Examination.**TD-** Teaching Dep
PSB: Paper Setting department

21KSK37/47 Samskrutika Kannada is for students who speak, read and write Kannada and **21KBK37/47**Balake Kannada is for non-Kannada speaking, reading, and students.

Integrated Professional Core Course (IPCC): Refers to Professional Theory Core Course Integrated with Practicals of the same course. Credit for IPCC can be 0 Teaching–Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical p be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper.For more details, the re governing the Degree of Bachelor of Engineering /Technology (BE/B.Tech.) 2021-22 may be referred.

21INT49 Inter/Intra Institutional Internship: All the students admitted to engineering programs under the lateral entry category shall have to undergo a ma 21INT49 Inter/Intra Institutional Internshipof 03 weeks during the intervening period of III and IV semesters. The internship shall be slated for CIE only and will

SEE. The letter grade earned through CIE shall be included in the IV semester grade card.The internship shall be considered as a head of passing and shall be consic vertical progression and for the award of degree. Those, who do not take up / complete the internship shall be declared fail and shall have to complet subsequently after satisfying the internship requirements. The faculty coordinator or mentor shall monitor the students' internship progress and interact with ther successful completion of the internship.

Non–credit mandatory courses (NCMC):

(A)Additional Mathematics I and II:

(1) These courses are prescribed for III and IV semesters respectively to lateral entry Diploma holders admitted to III semester of B.E./B.Tech., programs. They shal the classes during the respective semesters to complete all the formalities of the course and appear for the Continuous Internal Evaluation (CIE). In case, any stud to register for the said course/fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have secured an F grade. In such a c student has to fulfill the course requirements during subsequent semester/s to earn the qualifying CIE marks. These courses are slated for CIE only and has no SEE

(2) Additional Mathematics I and II shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses sl mandatory for the award of degree.

(3) Successful completion of the coursesAdditional Mathematics I and IIshall be indicated as satisfactory in the grade card. Non-completion of the coursesAdditiona Mathematics I and IIshall be indicated as Unsatisfactory.

(B) National Service Scheme/Physical Education (Sport and Athletics)/ Yoga:

(1) Securing 40 % or more in CIE,35 % or more marks in SEE and 40 % or more in the sum total of CIE + SEE leads to successful completion of the registered course.

(2) In case, students fail to secure 35 % marks in SEE, they has to appear for SEE during the subsequent examinations conducted by the University.

(3) In case, any student fails to register for NSS, PE or Yoga/fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have not co the requirements of the course. In such a case, the student has to fulfill the course requirements during subsequent semester/s to earn the qualifying CIE marks.

(4) Successful completion of the course shall be indicated as satisfactory in the grade card. Non-completion of the course shall be indicated as Unsatisfactory.

(5) These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses shall be mandator award of degree.

Ability Enhancement Course – III			
21MT381	Programming in C++	21MT383	Mechatronics Ecosystem
21MT382	Trends in Digital Manufacturing	21MT384	Robotics Ecosystem

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IV SEMESTER

Sl. No	Course and Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination			
				Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks
				L	T	P	S				
1	BSC 21MATCS41	Mathematical Foundations for Computing, Probability & Statistics	Maths	2	2	0		03	50	50	100
2	IPCC 21MT42	Electrical Drives and Control	TD: MT PSB: MT	3	0	2		03	50	50	100
3	IPCC 21MT43	Hydraulics and Pneumatics	TD: MT PSB: MT	3	0	2		03	50	50	100
4	PCC 21MT44	Microcontrollers and applications	TD: MT PSB: MT	3	0	0		03	50	50	100
5	AEC 21BE45	Biology For Engineers	BT, CHE, PHY	2	0	0		02	50	50	100
6	PCC 21MTL46	Mechatronics Lab	TD: MT PSB: MT	0	0	2		03	50	50	100
7	HSMC 21KSK37/47	Samskrutika Kannada	HSMC	1	0	0		01	50	50	100
	HSMC 21KBK37/47	Balake Kannada									
	OR										
	HSMC 21CIP37/47	Constitution of India & Professional Ethics									
8	AEC 21MT48X	Ability Enhancement Course- IV	TD and PSB: Concerned department	If offered as theory Course					50	50	100
				1	0	0		01			
				If offered as lab. course							
				0	0	2		02			
9	UHV 21UH49	UniversalHuman Values	Any Department	1	0	0		01	50	50	100
10	INT 21INT49	Inter/Intra Institutional Internship	Evaluation By the appropriate authorities	Completed during the intervening period ofII and III semesters by students admitted to first year of BE./B.Tech and during the intervening period of III and IV semesters by Lateral entry students admitted to III semester.				3	100	--	100
								Total	**550**	**450**	**1000**

Course prescribed to lateral entry Diploma holders admitted to III semester of Engineering programs

Sl. No	Course and Course Code	Course Title	TD/PSB	L	T	P	S	Duration in hours	CIE Marks	SEE Marks	Total Marks
1	NCMC 21MATDIP41	Additional Mathematics - II	Maths	02	02	--	--	--	100	--	100

Note: BSC: Basic Science Course, IPCC: Integrated Professional Core Course, PCC: Professional Core Course, AEC –Ability Enhancement Courses, HSMC: Humanity a Science and Management Courses, UHV- Universal Human Value Courses.
L –Lecture, T – Tutorial, P- Practical/ Drawing, S – Self Study Component, CIE: Continuous Internal Evaluation, SEE: Semester End Examination.

21KSK37/47 Samskrutika Kannada is for students who speak, read and write Kannada and 21KBK37/47 Balake Kannada is for non-Kannada speaking, reading, an students.

Integrated Professional Core Course (IPCC): Refers to Professional Theory Core Course Integrated with Practicals of the same course. Credit for IPCC can be 0 Teaching – Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical be evaluated by only CIE (no SEE). However, questions from practical part of IPCCshall be included in the SEE question paper.For more details the regulation g the Degree of Bachelor of Engineering /Technology (BE/B.Tech.) 2021-22 may be referred.

Non – credit mandatory course (NCMC):
Additional Mathematics - II:
(1) Lateral entry Diploma holders admitted to III semester of B.E./B.Tech., shall attend the classes during the IV semester to complete all the formalities of the co appear for the Continuous Internal Evaluation (CIE). In case, any student fails to register for the said course/fails to secure the minimum 40 % of the prescribed C he/she shall be deemed to have secured an F grade. In such a case, the student has to fulfill the course requirements during subsequent semester/s to earn the q

CIE marks. These courses are slated for CIE only and has no SEE.
(2) Additional Mathematics I and II shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses
mandatory for the award of degree.
(3) Successful completion of the course Additional Mathematics IIshall be indicated as satisfactory in the grade card. Non-completion of the coursesAdditional Matl
IIshall be indicated as Unsatisfactory.

Ability Enhancement Course - IV			
21MT481	Programming in Python (0-0-2)	21MT483	CNC programming and simulation (0-0-2)
21MT482	3-D Printing Technology (0-0-2)	21MT484	IoT (0-0-2)

Internship of 04 weeks during the intervening period of IV and V semesters; 21INT68 Innovation/ Entrepreneurship/ Societal based Internship.
(1) All the students shall have to undergo a mandatory internship of 04 weeks during the intervening period of IV and V semesters. The internship shall be slate only and will not have SEE. The letter grade earned through CIE shall be included in the VI semester grade card.The internship shall be considered as a head of pas shall be considered for vertical progression and for the award of degree. Those, who do not take up / complete the internship shall be considered under F (fail) g shall have to complete during subsequently after satisfying the internship requirements.
(2) Innovation/ Entrepreneurship Internship shall be carried out at industry, State and Central Government /Non-government organizations (NGOs), micro, s medium enterprise (MSME), Innovation centers or Incubation centers. Innovation need not be a single major breakthrough, it can also be a series of small or inc changes.Innovation of any kind can also happen outside of the business world.
Entrepreneurship internships offers a chance to gain hands on experience in the world of entrepreneurship and helps to learn what it takes to run a small entrep business by performing intern duties with an established company. This experience can then be applied to future business endeavours.Start-ups and small compar preferred place to learn the business tack ticks for future entrepreneurs as learning how a small business operates will serve the intern well when he/she his/her own company. Entrepreneurship acts as a catalyst to open the minds to creativity and innovation.Entrepreneurship internship can be from several including technology, small and medium-sized, and the service sector.
(3) Societal or social internship.
Urbanization is increasing on a global scale; and yet, half the world's population still resides in rural areas and is devoid of many things that urban population enj internship, is a work-based activity in which students will have a chance to solve/reduce the problems of the rural place for better living.
As proposed under the AICTE rural internship programme, activities under Societal or social internship, particularly in rural areas, shall be considered for 40 poin AICTE activity point programme.

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V SEMESTER

Sl. No	Course and Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination			
				Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks
				L	T	P	S				
1	BSC 21MT51	Theory of Machines and Machine Design	TD: MT PSB: MT	3	0	0		03	50	50	100
2	IPCC 21MT52	Micro and Smart System Technology	TD: MT PSB: MT	3	0	2		03	50	50	100
3	PCC 21MT53	Industrial Automation	TD: MT PSB: MT	3	0	2		03	50	50	100
4	PCC 21MT54	Control Theory and Virtual Instrumentation	TD: MT PSB: MT	3	0	0		03	50	50	100
5	PCC 21MTL55	Virtual Instrumentation Lab	TD: MT PSB: MT	0	0	2		03	50	50	100
6	AEC 21MT56	Research Methodology & Intellectual Property Rights	TD: Any Department PSB: As identified by university	2	0	0		02	50	50	100
7	HSMC 21CIV57	Environmental Studies	TD: Civil/ Environmental /Chemistry/ Biotech. PSB: Civil Engg	1	0	0		1	50	50	100
8	AEC 21MT58X	Ability Enhancement Course-V	Concerned Board	If offered as Theory courses				01	50	50	100
				1	0	0					
				If offered as lab. courses				02			
				0	0	2					
								Total	**400**	**400**	**800**

Ability Enhancement Course - IV

21MT581	MATLAB for Mechatronics (0-0-2)	21MT583	Finite Element Modelling and Analysis (0-0-2)
21MT582	Embedded systems (0-0-2)	21MT584	AI and ML (0-0-2)

Note: BSC: Basic Science Course, PCC: Professional Core Course, IPCC: Integrated Professional Core Course, AEC –Ability Enhancement Course INT –Internship, HS Humanity and Social Science & Management Courses.
L –Lecture, T – Tutorial, P- Practical/ Drawing, S – Self Study Component, CIE: Continuous Internal Evaluation, SEE: Semester End Examination.

Integrated Professional Core Course (IPCC): refers to Professional Theory Core Course Integrated with Practical of the same course. Credit for IPCC can be 0 Teaching – Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). Theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part evaluated by CIE only and there shall be no SEE. For more details the regulation governing the Degree of Bachelor of Engineering /Technology (BE/B.Tech.) 2021 be referred.

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VI SEMESTER

Sl. No	Course and Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination			
				Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks
				L	T	P	S				
1	HSMC 21MT61	Condition Monitoring and Maintenance Management	Any Department	3	0	0		03	50	50	100
2	IPCC 21MT62	Programmable Logic Controller and SCADA Technology	TD: MT PSB: MT	3	0	2		03	50	50	100
3	PCC 21MT63	Industrial Robotics	TD: MT PSB: MT	3	0	0		03	50	50	100
4	PEC 21MT64x	Professional Elective Course-I	TD: MT PSB: MT	3	0	0		03	50	50	100
5	OEC 21XX65x	Open Elective Course-I	Concerned Department	3	0	0		03	50	50	100
6	PCC 21MTL66	Robotics Lab	TD: MT PSB: MT	0	0	2		03	50	50	100
7	MP 21MTMP67	Mini Project		Two contact hours /week for interaction between the faculty and students.				--	100	--	100
8	INT 21INT68	Innovation/Entrepreneurship /Societal Internship	Completed during the intervening period of IV and V semesters.					--	100	--	100
								Total	**500**	**300**	**800**

Professional Elective – I			
21MT641	Power Electronics	21MT643	Automotive Electronics and Hybrid Vehicles
21MT642	Smart Factory and Industry 4.0	21MT644	Signal Processing

Open Electives – I offered by the Department to other Department students			
21MT651	Automation in Manufacturing	21MT653	Mechatronics Engineering
21MT652	Electric and Hybrid Vehicles	21MT654	Micro Electro-Mechanical Systems

Note: HSMC: Humanity and Social Science & Management Courses, **IPCC:** Integrated Professional Core Course, **PCC:** Professional Core Course, **PEC:** Professional Courses, O**EC**–Open Elective Course, **MP** –Mini Project, INT –Internship.
L –Lecture, T – Tutorial, P - Practical / Drawing, S – Self Study Component, CIE: Continuous Internal Evaluation, SEE: Semester End Examination.

Integrated Professional Core Course (IPCC): Refers to Professional Theory Core Course Integrated with Practical of the same course. Credit for IPCC can be 0 Teaching – Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical p be evaluated by CIE only and there shall be no SEE. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (BE/B.Tech) may be referred.

Professional Elective Courses(PEC):
A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology cu Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an o select one course out of five course. The minimum students' strength for offering professional electives is 10. However, this conditional shall not be applicable where the admission to the programme is less than 10.

Open Elective Courses:
Students belonging to a particular stream of Engineering and Technology are not entitled for the open electives offered by their parent Department. However, opt an elective offered by other Departments, provided they satisfy the prerequisite condition if any. Registration to open electives shall be documented u guidance of the Program Coordinator/ Advisor/Mentor.
Selection of an open elective shall **not be allowed** if,

- **(i)** The candidate has studied the same course during the previous semesters of the program.
- **(ii)** The syllabus content of open electives is similar to that of the Departmental core courses or professional electives.
- **(iii)** A similar course, under any category, is prescribed in the higher semesters of the program.

In case, any college is desirous of offering a course (not included in the Open Elective List of the University) from streams such as Law, Business (MBA), Medici Commerce, etc., can seek permission, at least one month before the commencement of the semester, from the University by submitting a copy of the syllabus al

the details of expertise available to teach the same in the college.
The minimum students' strength for offering open electives is 10. However, this conditional shall not be applicable to cases where the admission to the programm than 10.

Mini-project work: Mini Project is a laboratory-oriented course which will provide a platform to students to enhance their practical knowledge and skill development of small systems/applications.
Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary Mini- project can be assigned to an i student or to a group having not more than 4 students.
CIE procedure for Mini-project:
(i) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two faculty members of the Dep one of them being the Guide. The CIE marks awarded for the Mini-project work shall be based on the evaluation of project report, project presentation skill, and and answer session in the ratio of 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.
(ii) Interdisciplinary: Continuous Internal Evaluation shall be group-wise at the college level with the participation of all the guides of the project.
The CIE marks awarded for the Mini-project, shall be based on the evaluation of project report, project presentation skill, and question and answer session in 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.
No SEE component for Mini-Project.

VII semester Classwork and Research Internship /Industry Internship (21INT82)

Swapping Facility
Institutions can swap VII and VIII Semester Scheme of Teaching and Examinations to accommodate research internship/ industry internship after the VI semester.
(2) Credits earned for the courses of VII and VIII Semester Scheme of Teaching and Examinations shall be counted against the corresponding semesters whether semester is completed during the beginning of IV year or later part of IV year of the program.
Elucidation:
At the beginning of IV year of the programme i.e., after VI semester, VII semester classwork and VIII semester Research Internship /Industrial Internship shall be p to be operated simultaneously by the University so that students have ample opportunity for internship. In other words, a good percentage of the class shall a semester classwork and similar percentage of others shall attend to Research Internship or Industrial Internship.
Research/Industrial Internship shall be carried out at an Industry, NGO, MSME, Innovation centre, Incubation centre, Start-up, Centers of Excellence (CoE), Stud established in the parent institute and /or at reputed research organizations / institutes. The intership can also be rural internship.
The mandatory Research internship /Industry internship is for 24 weeks. The internship shall be considered as a head of passing and shall be considered for the degree. Those, who do not take up/complete the internship shall be declared fail and shall have to complete during the subsequent University examination after the internship requirements.

INT21INT82 Research Internship/ Industry Internship/Rural Internship
Research internship: A research internship is intended to offer the flavour of current research going on in the research field. It helps students get familiarized with and imparts the skill required for carrying out research.
Industry internship: Is an extended period of work experience undertaken by students to supplement their degree for professional development. It a them learn to overcome unexpected obstacles and successfully navigate organizations, perspectives, and cultures. Dealing with contingencies helps students re appreciate, and adapt to organizational realities by tempering their knowledge with practical constraints.
Rural internship: A long-term goal, as proposed under the AICTE rural internship programme, shall be counted as rural internship activity.
The student can take up Interdisciplinary Research Internship or Industry Internship.
The faculty coordinator or mentor has to monitor the students' internship progress and interact with them to guide for the successful completion of the internship
The students are permitted to carry out the internship anywhere in India or abroad. University shall not bear any expenses incurred in respect of internship.

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Swappable VII and VIII SEMESTER

VII SEMESTER

Sl. No	Course and Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
				Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
				L	T	P	S					
1	PCC 21MT71	Thermal Engineering	TD: MT PSB: MT	3	0	0		3	50	50	100	3
2	PCC 21MT72	Communication systems	TD: MT PSB: MT	2	0	0		3	50	50	100	2
3	PEC 21MT73X	Professional elective Course-II	TD: MT PSB: MT	3	0	0		3	50	50	100	3
4	PEC 21MT74X	Professional elective Course-III	TD: MT PSB: MT	3	0	0		3	50	50	100	3
5	OEC 21MT75X	Open elective Course-II	Concerned Department	3	0	0		3	50	50	100	3
6	Project **21MTP76**	Project work		Two contact hours /week for interaction between the faculty and students.				3	100	100	200	10
								Total	**350**	**350**	**700**	**24**

VIII SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	Seminar 21MT81		Technical Seminar		One contact hour /week for interaction between the faculty and students.				--	100	--	100	01
2	INT 21INT82		Research Internship/ Industry Internship		Two contact hours /week for interaction between the faculty and students.				03 (Batch wise)	100	100	200	15
3	NCMC	21N S83	National Service Scheme (NSS)	NSS	Completed during the intervening period of III semester toVIII semester.				--	50	50	100	0
		21P E83	Physical Education (PE) (Sports and Athletics)	PE									
		21Y O83	Yoga	Yoga									
									Total	**250**	**150**	**400**	**16**

Professional Elective - II

21MT731	Digital Image Processing and Robot Vision	21MT734	Control Systems and Engineering
21MT732	Digital Controllers	21MT735	Additive Manufacturing
21MT733	Artificial Intelligence for Mechatronics		

Professional Elective – III

21MT741	VLSI (202)	21MT744	Computer Integrated Manufacturing
21MT742	Product Life Cycle Management and Concurrent Engineering	21MT745	Operations Research
21MT743	Mechatronics System Design		

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI.

Scheme of Teaching and Examinations and Syllabus

M. Tech in Artificial Intelligence and Machine Learning (SAM)

(Effective from the Academic year 2022-23)

Registrar,
Visvesvaraya Technological University
Jnana Sangam, Machhe, Belagavi-590018
eMail: registrar@vtu.ac.in
contact: 0831-2498112

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
Scheme of Teaching and Examinations – 2022
M. Tech in Artificial Intelligence and Machine Learning (SAM)
Choice Based Credit System (CBCS) and Outcome-Based Education(OBE)

I SEMESTER

Sl. No	Course	Course Code	Course Title	Teaching Hours per Week			Examination				Credits
				Theory	Practical/Seminar	Skill Development Activities (Hours are for Interaction between faculty and students)	Duration in hours	CIE Marks	SEE Marks	Total Marks	
				L	P	SDA					
1	BSC	22SAM11	Mathematics Course Stream	03	00	00	03	50	50	100	3
2	IPCC	22SAM12	Fundamentals of Data Sciences	03	02	00	03	50	50	100	4
3	PCC	22SAM13	Artificial Intelligence and Machine Learning	03	00	02	03	50	50	100	4
4	PCC	22SAM14	Cloud Computing	02	00	02	03	50	50	100	3
5	PCC	22SAM15	Big Data Analytics	02	00	02	03	50	50	100	3
6	MCC	22RMI16	Research Methodology and IPR	03	00	00	03	50	50	100	3
7	PCCL	22SAML17	Artificial Intelligence and Machine Learning Laboratory	01	02	00	03	50	50	100	2
8	AUD/AEC	22AUD18/ 22AEC27	BOS recommended ONLINE courses	Classes and evaluation procedures are as per the policy of the online course providers.							PP
			TOTAL	**17**	**04**	**06**	**21**	**350**	**350**	**700**	**22**

Note: BSC-Basic Science Courses, PCC: Professional core. IPCC-Integrated Professional Core Courses, MCC- MandatoryCredit Course, AUD/AEC –Audit Course / Ability Enhancement Course(A pass in AUD/AEC is mandatory for the award of the degree)

Integrated Professional Core Course (IPCC): **Integrated Professional Core Course (IPCC)**: Refers to Professional Theory Core Course Integrated with practical of the same course. The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper.

Audit Courses /Ability Enhancement Courses Suggested by BOS (ONLINE courses): Audit Courses: These are prerequisite courses suggested by the concerned Board of Studies. Ability Enhancement Courses will be suggested by the BoS if prerequisite courses are not required for the programs. **Ability Enhancement Courses**:

- These courses are prescribed to help students to enhance their skills in in fields connected to the field of specialisation as well allied fields that leads toemployable skills. Involving in learning such courses are impetus to lifelong learning.
- The courses under this category are online courses published in advance and approved by the concerned Board of Studies.
- Registration to Audit /Ability Enhancement Course shall be done in consultation with the mentor and is compulsory during the concerned semester.
- In case a candidate fails to appear for the proctored examination or fails to pass the selected online course, he/she can register and appear for the same course if offered during the next session or register for a new course offered during that session, in consultation with the mentor.
- The Audit Ability Enhancement Course carries no credit and is not counted for vertical progression. However, a pass in such a course is mandatory for the award of the degree.

Skill development activities:Under Skill development activities in a concerning course, the students should

1. Interact with industry (small, medium, and large).
2. Involve in research/testing/projects to understand their problems and help creative and innovative methods to solve the problem.
3. Involve in case studies and field visits/ fieldwork.
4. Accustom to the use of standards/codes etc., to narrow the gap between academia and industry.
5. Handle advanced instruments to enhance technical talent.
6. Gain confidence in modelling of systems and algorithms for transient and steady-state operations, thermal study, etc.
7. Work on different software/s (tools) to simulate, analyze and authenticate the output to interpret and conclude.

All activities should enhance student’s abilities to employment and/or self-employment opportunities, management skills, Statistical analysis, fiscal expertise, etc.

Students and the course instructor/s to involve either individually or in groups to interact together to enhance the learning and application skills of the study they have undertaken. The students with the help of the course teacher can take up relevant technical –activities which will enhance their skill. The prepared report shall be evaluated for CIE marks.

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II SEMESTER

Sl. No	Course	Course Code	Course Title	Teaching Hours /Week			Examination				Credits
				Theory	Practical/Seminar	Skill Development Activities (Hours are for Interaction between faculty and students)	Duration in hours	CIE Marks	SEE Marks	Total Marks	
				L	P	SDA					
1	PCC	22SAM21	Data and Web Mining	02	00	02	03	50	50	100	3
2	IPCC	22SAM22	Deep Learning	03	02	00	03	50	50	100	4
3	PEC	22SAM23x	Professional Elective 1	02	00	02	03	50	50	100	3
4	PEC	22SAM24x	Professional Elective 2	02	00	02	03	50	50	100	3
5	MPS	22SAM25	Mini Project with Seminar	00	04	02	--	100	--	100	3
6	PCCL	22SAML26	Data and Web Mining Laboratory	01	02	00	03	50	50	100	02
7	AUD/ AEC	22AUD27	Suggested ONLINE courses	Classes and evaluation procedures are as per the policy of the online course providers.							PP
TOTAL				**10**	**08**	**08**	**15**	**350**	**250**	**600**	**18**

Note: PCC: Professional core courses,PEC: Professional Elective Courses, IPCC-Integrated Professional Core Courses. MPS-Mini Project With Seminar; AUD/AEC; Audit Courses / Ability Enhancement Courses (Mandatory)

Professional Elective 1	Professional Elective 2

Course Code under 22SAM23X	Course title	Course Code under 22SAM24X	Course title
22SAM231	Computer Vision	22SAM241	Natural Language Processing
22SAM232	Artificial Intelligence in Cyber Security	22SAM242	Pattern Recognition
22SAM233	Predictive Analysis	22SAM243	Blockchain Technology
22SAM234	Cyber Security and Cyber law	22SAM244	Agile Technologies
22SAM235	Human Computer Interaction	22SAM245	Virtual Reality

Note:

1 Mini Project with Seminar: This may be hands-on practice**,** survey report, data collection and analysis, coding, mobile app development, field visit and report preparation, modelling of system, simulation, analysing and authenticating, case studies, etc.
CIE marks shall be awarded by a committee comprising of HoD as Chairman, Guide/co-guide, if any, and a senior faculty of the department. Students can present the seminar based on the completed mini-project. Participation in the seminar by all postgraduate students of the program shall be mandatory.
The CIE marks awarded for Mini-Project work and Seminar, shall be based on the evaluation of Mini Project work and Report, Presentation skill and performance in Question and Answer session in the ratio 50:25:25. Mini-Project with Seminar shall be considered as a head of passing and shall be considered for vertical progression as well as for the award of degree. Those, who do not take-up/complete the Mini Project and Seminar shall be declared as fail in that course and have to complete the same during the subsequent semester. There is no SEE for this course.

2. Internship: All the students shall have to undergo a mandatory internship of **06 weeks** during the vacation of II and III semesters. A University examination shall be conducted during III semester and the prescribed internship credit shall be counted in the same semester. The internship shall be considered as a head of passing and shall be considered for vertical progression as well asfor the award of degree. Those, who do not take-up/complete the internship shall be declared as fail in the internship course and have to complete the same during the subsequent University examination after satisfying the internship requirements.

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III SEMESTER

Sl. No	Course	Course Code	Course Title	Teaching Hours /Week			Examination				Credits
				Theory	Practical/ Mini–Project/ Internship	Skill Development Activities(Hours are for Interaction between faculty and students)	Duration in hours	CIE Marks	SEE Marks	Total Marks	
				L	P	SDA					
1	PCC	22SAM31	High Performance Computing	03	00	02	03	50	50	100	4
2	PEC	22SAM32X	Professional Elective 3	03	00	00	03	50	50	100	3
3	OEC	22SAM33X	Professional Elective 4	03	00	00	03	50	50	100	3
4	PROJ	22SAM34	Project Work phase -1	00	06	00	--	100	--	100	3
5	SP	22SAM35	Societal Project	00	06	00	--	100	--	100	3
6	INT	22SAMI36	Internship	(06 weeks Internship Completed during the intervening vacation of II and III semesters.)			03	50	50	100	6

TOTAL	**09**	**12**	**03**	**12**	**400**	**200**	**600**	**22**
Note: PCC: Professional core Courses, PEC: Professional Elective Courses. PROJ-Project Work, INT-Internship, OEC Open Elective Courses, SP- Societal Project								

Professional Elective 3		**Professional Elective 4**	
Course Code under 22SAM32X	**Course title**	**Course Code under 22SAM33X**	**Course title**
22SAM321	Soft and Evolutionary Computing	22SAM331	Financial Data Analytics
22SAM322	Decision Support Systems	22SAM332	Business Intelligence and Analytics
22SAM323	Speech Processing	22SAM333	Human Computer Interface
22SAM324	Internet of Things and Applications	22SAM334	Advanced Data Structures
22SAM325	Cloud Security	22SAM335	Object Oriented Design

Note:

1. Project Work Phase-1: The project work shall be carried out individually. However, in case a disciplinary or interdisciplinary project requires more participants, then a group consisting of not more than three shall be permitted.

Students in consultation with the guide/co-guide (if any) in disciplinary project or guides/co-guides (if any) of all departments in case of multidisciplinary projects, shall pursue a literature survey and complete the preliminary requirements of the selected Project work. Each student shall prepare a relevant introductory project document, and present a seminar.

CIE marks shall be awarded by a committee comprising of HoD as Chairman, all Guide/s and co-guide/s (if any) and a senior faculty of the concerned departments. The CIE marks awarded for project work phase -1, shall be based on the evaluation of Project Report, Project Presentation skill, and performance in the Question and Answer session in the ratio of 50:25:25.

2. Societal Project: Students in consultation with the internal guide as well as with external guide (much preferable) shall involve in applying technology toworkout/proposing viable solutions for societal problems.

CIE marks shall be awarded by a committee comprising of HoD as Chairman, Guide/co-guide if any, and a senior faculty of the department. The CIE marks awarded, shall be based on the evaluation of Project Report, Project Presentation skill, and performance in the Question and Answer session in the ratio of 50:25:25.

Those, who have not pursued /completed the Societal Project, shall be declared as fail in the course and have to complete the same during subsequent semester/s after satisfying the Societal Project requirements. There is no SEE (University examination) for this course.

3. Internship: Those, who have not pursued /completed the internship, shall be declared as fail in the internship course and have to complete the same during subsequent University examinations after satisfying the internship requirements. Internship SEE (University examination) shall be as per the University norms.

CIE marks shall be awarded by a committee comprising of HoD as Chairman, Guide/co-guide if any, and a senior faculty of the department. The CIE marks awarded for project work phase -1, shall be based on the evaluation of Project Report, Project Presentation skill, and performance in the Question and Answer session in the ratio of 50:25:25.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
Scheme of Teaching and Examinations – 2022
M. Tech in Artificial Intelligence and Machine Learning (SAM)
Choice Based Credit System (CBCS) and Outcome Based Education(OBE)

IV SEMESTER

Sl. No	Course	Course Code	Course Title	Teaching Hours /Week		Examination				Credits
				Theory	Practical/ Field work	Duration in hours	CIE Marks	SEE Marks Viva voce	Total Marks	
				L	P					
1	Project	22SAM41	Project work phase -2	--	08	03	100	100	200	18
			TOTAL	**--**	**08**	**03**	**100**	**100**	**200**	**18**

Note:

1. Project Work Phase-2:

Students in consultation with the guide/co-guide (if any) in disciplinary project or guides/co-guides (if any) of all departments in case of multidisciplinary projects, shall continue to work of Project Work phase -1to complete the Project work. Each student / batch of students shall prepare project document, and present a seminar.

CIE marks shall be awarded by a committee comprising of HoD as Chairman, all Guide/s and co-guide/s (if any) and a senior faculty of the concerned departments. The CIE marks awarded for project work phase -1, shall be based on the evaluation of Project Report, Project Presentation skill, and performance in the Question and Answer session in the ratio of 50:25:25.

SEE shall be at the end of IV semester. Project work evaluation and Viva-Voce examination (SEE), after satisfying the plagiarism check, shall be as per the University norms.

Total Credits 22+18+22+18 =**80**

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI.

Scheme of Teaching and Examinations and Syllabus
M. Tech in CYBER SECURITY(SCR)
(Effective from the Academic year 2022-23)

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
Scheme of Teaching and Examinations – 2022
M. Tech in CYBER SECURITY(SCR)
Choice Based Credit System (CBCS) and Outcome-Based Education(OBE)

I SEMESTER

Sl. No	Course	Course Code	Course Title	Teaching Hours per Week			Examination				Credits
				Theory	Practical/Seminar	Skill Development Activities (Hours are for Interaction between faculty and students)	Duration in hours	CIE Marks	SEE Marks	Total Marks	
				L	P	SDA					
1	BSC	22SCR11	Mathematics Course Stream	03	00	00	03	50	50	100	3
2	IPCC	22SCR12	Fundamentals of Data Sciences	03	02	00	03	50	50	100	4
3	PCC	22SCR13	Cyber Security and Cyber Law	03	00	02	03	50	50	100	4
4	PCC	22SCR14	Network and Cloud Security	02	00	02	03	50	50	100	3
5	PCC	22SCR15	Ethical Hacking	02	00	02	03	50	50	100	3
6	MCC	22RMI16	Research Methodology and IPR	03	00	00	03	50	50	100	3
7	PCCL	22SCRL17	Ethical Hacking Laboratory	01	02	00	03	50	50	100	2
8	AUD/AEC	22AUD18/ 22AEC27	BOS recommended ONLINE courses	Classes and evaluation procedures are as per the policy of the online course providers.							PP
			TOTAL	**17**	**04**	**06**	**21**	**350**	**350**	**700**	**22**

Note: BSC-Basic Science Courses, PCC: Professional core. IPCC-Integrated Professional Core Courses, MCC- Mandatory Credit Course,
AUD/AEC –Audit Course / Ability Enhancement Course(A pass in AUD/AEC is mandatory for the award of the degree)

Integrated Professional Core Course (IPCC): Integrated Professional Core Course (IPCC): Refers to Professional Theory Core Course Integrated with practical of the same course. The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper.
Audit Courses /Ability Enhancement Courses Suggested by BOS (ONLINE courses): Audit Courses:These are prerequisite courses suggested by the concerned Board of Studies. Ability

Enhancement Courses will be suggested by the BoS if prerequisite courses are not required for the programs. Ability Enhancement Courses:

- These courses are prescribed to help students to enhance their skills in in fields connected to the field of specialisation as well allied fields that leads toemployable skills. Involving in learning such courses are impetus to lifelong learning.
- The courses under this category are online courses published in advance and approved by the concerned Board of Studies.
- Registration to Audit /Ability Enhancement Course shall be done in consultation with the mentor and is compulsory during the concerned semester.
- In case a candidate fails to appear for the proctored examination or fails to pass the selected online course, he/she can register and appear for the same course if offered during the next session or register for a new course offered during that session, in consultation with the mentor.
- The Audit Ability Enhancement Course carries no credit and is not counted for vertical progression. However, a pass in such a course is mandatory for the award of the degree.

Skill development activities:Under Skill development activities in a concerning course, the students should

1. Interact with industry (small, medium, and large).
2. Involve in research/testing/projects to understand their problems and help creative and innovative methods to solve the problem.
3. Involve in case studies and field visits/ fieldwork.
4. Accustom to the use of standards/codes etc., to narrow the gap between academia and industry.
5. Handle advanced instruments to enhance technical talent.
6. Gain confidence in modelling of systems and algorithms for transient and steady-state operations, thermal study, etc.
7. Work on different software/s (tools) to simulate, analyze and authenticate the output to interpret and conclude.

All activities should enhance student’s abilities to employment and/or self-employment opportunities, management skills, Statistical analysis, fiscal expertise, etc.

Students and the course instructor/s to involve either individually or in groups to interact together to enhance the learning and application skills of the study they have undertaken. The students with the help of the course teacher can take up relevant technical –activities which will enhance their skill. The prepared report shall be evaluated for CIE marks.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
Scheme of Teaching and Examinations – 2022
M. Tech in CYBER SECURITY(SCR)
Choice Based Credit System (CBCS) and Outcome Based Education(OBE)

II SEMESTER

Sl. No	Course	Course Code	Course Title	Teaching Hours /Week			Examination				Credits
				Theory	Practical/ Seminar	Skill Development Activities (Hours are for Interaction between faculty and students)	Duration in hours	CIE Marks	SEE Marks	Total Marks	
				L	P	SDA					
1	PCC	22SCR21	Web Application and Database Security	02	00	02	03	50	50	100	3
2	IPCC	22SCR22	Defensive Security	03	02	00	03	50	50	100	4
3	PEC	22SCR23x	Professional Elective 1	02	00	02	03	50	50	100	3
4	PEC	22SCR24X	Professional Elective 2	02	00	02	03	50	50	100	3
5	MPS	22SCR25	Mini Project with Seminar	00	04	02	--	100	--	100	3
6	PCCL	22SCRL26	Web Application and Database Security Laboratory	01	02	00	03	50	50	100	02
7	AUD/AEC	22AUD27	Suggested ONLINE courses	Classes and evaluation procedures are as per the policy of the online course providers.							PP
TOTAL				**10**	**08**	**08**	**15**	**350**	**250**	**600**	**18**

Note: PCC: Professional core courses,PEC: Professional Elective Courses, IPCC-Integrated Professional Core Courses. MPS-Mini Project With Seminar; AUD/AEC; Audit Courses / Ability Enhancement Courses (Mandatory)

Professional Elective 1		**Professional Elective 2**	
Course Code under 22SCR23X	**Course title**	**Course Code under 22SCR24X**	**Course title**
22SCR231	Security Architecture Design	22SCR241	Deep Learning
22SCR232	Security Assessment And Audit	22SCR242	Natural Language Processing
22SCR233	Blockchain Technology	22SCR243	Managing Big Data

22SCR234	Information Security Policies in Industry	22SCR244	Malware Analysis and Reverse Engineering
22SCR235	Cyber Threat Simulation Management	22SCR245	Secure Programming

Note:

1 Mini Project with Seminar: This may be hands-on practice**,** survey report, data collection and analysis, coding, mobile app development, field visit and report preparation, modelling of system, simulation, analysing and authenticating, case studies, etc.

CIE marks shall be awarded by a committee comprising of HoD as Chairman, Guide/co-guide, if any, and a senior faculty of the department. Students can present the seminar based on the completed mini-project. Participation in the seminar by all postgraduate students of the program shall be mandatory.

The CIE marks awarded for Mini-Project work and Seminar, shall be based on the evaluation of Mini Project work and Report, Presentation skill and performance in Question and Answer session in the ratio 50:25:25. Mini-Project with Seminar shall be considered as a head of passing and shall be considered for vertical progression as well as for the award of degree. Those, who do not take-up/complete the Mini Project and Seminar shall be declared as fail in that course and have to complete the same during the subsequent semester. There is no SEE for this course.

2. Internship: All the students shall have to undergo a mandatory internship of **06 weeks** during the vacation of II and III semesters. A University examination shall be conducted during III semester and the prescribed internship credit shall be counted in the same semester. The internship shall be considered as a head of passing and shall be considered for vertical progression as well asfor the award of degree. Those, who do not take-up/complete the internship shall be declared as fail in the internship course and have to complete the same during the subsequent University examination after satisfying the internship requirements.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
Scheme of Teaching and Examinations – 2022
M. Tech in CYBER SECURITY(SCR)
Choice Based Credit System (CBCS) and Outcome Based Education(OBE)

III SEMESTER

Sl. No	Course	Course Code	Course Title	Teaching Hours /Week			Examination				Credits
				Theory	Practical/Seminar	Skill Development Activities (Hours are for Interaction between faculty and students)	Duration in hours	CIE Marks	SEE Marks	Total Marks	
				L	P	SDA					
1	PCC	22SCR31	Digital Forensics	03	00	02	03	50	50	100	4
2	PEC	22SCR32X	Professional Elective 3	03	00	00	03	50	50	100	3
3	OEC	22SCR33X	Professional Elective 4	03	00	00	03	50	50	100	3
4	PROJ	22SCR34	Project Work phase -1	00	06	00	--	100	--	100	3
5	SP	22SCR35	Societal Project	00	06	00	--	100	--	100	3
6	INT	22SCRI36	Internship	(06 weeks Internship Completed during the intervening vacation of II and III semesters.)			03	50	50	100	6
			TOTAL	**09**	**12**	**03**	**12**	**400**	**200**	**600**	**22**

Note: PCC: Professional core Courses, PEC: Professional Elective Courses. PROJ-Project Work, INT-Internship, OEC Open Elective Courses, SP- Societal Project

Professional Elective 3		**Professional Elective 4**	
Course Code under 22SCR32X	**Course title**	**Course Code under 22SCR33X**	**Course title**
22SCR321	Advanced Cryptography	22SCR331	Cyber Security and Cyber Law

22SCR322	Operating System Security	22SCR332	Security Threats and Vulnerabilities
22SCR323	Threat Hunting	22SCR333	Preserving and Recovering Digital Evidence
22SCR324	Incident Response	22SCR334	File System Forensic Analysis
22SCR325	Software Metrics and Quality Assurance	22SCR335	Biometric Security

Note:

1. Project Work Phase-1: The project work shall be carried out individually. However, in case a disciplinary or interdisciplinary project requires more participants, then a group consisting of not more than three shall be permitted.

Students in consultation with the guide/co-guide (if any) in disciplinary project or guides/co-guides (if any) of all departments in case of multidisciplinary projects, shall pursue a literature survey and complete the preliminary requirements of the selected Project work. Each student shall prepare a relevant introductory project document, and present a seminar.

CIE marks shall be awarded by a committee comprising of HoD as Chairman, all Guide/s and co-guide/s (if any) and a senior faculty of the concerned departments. The CIE marks awarded for project work phase -1, shall be based on the evaluation of Project Report, Project Presentation skill, and performance in the Question and Answer session in the ratio of 50:25:25.

2. Societal Project: Students in consultation with the internal guide as well as with external guide (much preferable) shall involve in applying technology toworkout/proposing viable solutions for societal problems.

CIE marks shall be awarded by a committee comprising of HoD as Chairman, Guide/co-guide if any, and a senior faculty of the department. The CIE marks awarded, shall be based on the evaluation of Project Report, Project Presentation skill, and performance in the Question and Answer session in the ratio of 50:25:25.

Those, who have not pursued /completed the Societal Project, shall be declared as fail in the course and have to complete the same during subsequent semester/s after satisfying the Societal Project requirements. There is no SEE (University examination) for this course.

3. Internship: Those, who have not pursued /completed the internship, shall be declared as fail in the internship course and have to complete the same during subsequent University examinations after satisfying the internship requirements. Internship SEE (University examination) shall be as per the University norms.

CIE marks shall be awarded by a committee comprising of HoD as Chairman, Guide/co-guide if any, and a senior faculty of the department. The CIE marks awarded for project work phase -1, shall be based on the evaluation of Project Report, Project Presentation skill, and performance in the Question and Answer session in the ratio of 50:25:25.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
Scheme of Teaching and Examinations – 2022
M. Tech in CYBER SECURITY(SCR)
Choice Based Credit System (CBCS) and Outcome Based Education(OBE)

IV SEMESTER

Sl. No	Course	Course Code	Course Title	Teaching Hours /Week		Examination				Credits
				Theory	Practical/ Field work	Duration in hours	CIE Marks	SEE Marks Viva voce	Total Marks	
				L	P					
1	Project	22SCR41	Project work phase -2	--	08	03	100	100	200	18
			TOTAL	**--**	**08**	**03**	**100**	**100**	**200**	**18**

Note:
1. Project Work Phase-2:
Students in consultation with the guide/co-guide (if any) in disciplinary project or guides/co-guides (if any) of all departments in case of multidisciplinary projects, shall continue to work of Project Work phase -1to complete the Project work. Each student / batch of students shall prepare project document, and present a seminar.
CIE marks shall be awarded by a committee comprising of HoD as Chairman, all Guide/s and co-guide/s (if any) and a senior faculty of the concerned departments.

The CIE marks awarded for project work phase -1, shall be based on the evaluation of Project Report, Project Presentation skill, and performance in the Question and Answer session in the ratio of 50:25:25. SEE shall be at the end of IV semester. Project work evaluation and Viva-Voce examination (SEE), after satisfying the plagiarism check, shall be as per the University norms.

Total Credits 22+18+22+18 =**80**

B.E. in Artificial Intelligence and Machine Learning

Scheme of Teaching and Examinations2022

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

V SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical / Drawing	SDA	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	PCC	BCS501	Software Engineering & Project Management	TD: CS PSB : CS	4	0	0		03	50	50	100	4
2	IPCC	BCS502	Computer Networks	TD : AI PSB : AI	3	0	2		03	50	50	100	4
3	PCC	BCS503	Theory of Computation	TD : AI PSB : AI	3	2	0		03	50	50	100	4
4	PCCL	BAIL504	Data Visualization Lab	TD : AI PSB : AI	0	0	2		03	50	50	100	1
5	PEC	BXX515x	Professional Elective Course	TD : AI PSB : AI	3	0	0		03	50	50	100	3
6	PROJ	BAI586	Mini Project	TD : AI PSB : AI	0	0	4		03	100		100	2
7	AEC	BRMK557	Research Methodology and IPR	TD: HSM PSB : HSM	2	2	0		02	50	50	100	3
8	HSMS	BCS508	Environmental Studies and E-waste Management	TD: HSM PSB : HSM	1	0	0		01	50	50	100	1
9	MC	BNSK559	National Service Scheme (NSS)	NSS coordinator	0	0	2			100		100	0
		BPEK559	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		BYOK559	Yoga	Yoga Teacher									
									Total	**500**	**300**	**800**	**22**

Professional Elective Course

BAI515A	Computer Vision	BCS515C	Unix System Programming
BAI515B	Information Retrieval	BCS515D	Distributed Systems
		BAI515E	Exploratory Data Analysis

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **UHV**: Universal Human Value Course, **MC**: Mandatory Course (Non-credit), **AEC**: Ability Enhancement Course, **SEC**: Skill Enhancement Course, **L:** Lecture, **T**: Tutorial, **P**: Practical **S= SDA**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SAI**: Semester End Evaluation. **K :** The letter in the course code indicates common to al the stream of engineering. **PROJ**: Project /Mini Project. **PEC**: Professional Elective Course
Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practicals of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (B.E./B.Tech.) 2022-23 **National Service Scheme /Physical Education/Yoga:** All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), and Yoga(YOG) with the concerned coordinator of the course during the first week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree.
Mini-project work: Mini Project is a laboratory-oriented/hands on course that will provide a platform to students to enhance their practical knowledge and skills by the development of small systems/applications etc. Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary Mini- project can be assigned to an individual student or to a group having not more than 4 students. **CIE procedure for Mini-project:** **(i) Single discipline:** The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two faculty members of the Department, one of them being the Guide. The CIE marks awarded for the Mini-project work shall be based on the evaluation of the project report, project presentation skill, and question and answer session in the ratio of 50:25:25. The marks awarded for the project report shall be the same for all the batches mates. **(ii) Interdisciplinary:** Continuous Internal Evaluation shall be group-wise at the college level with the participation of all the guides of the project. The CIE marks awarded for the Mini-project, shall be based on the evaluation of the project report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates. **No SEE component for Mini-Project.**
Professional Elective Courses (PEC): A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an option to select one course. The minimum number of students' strengths for offering a professional elective is 10. However, this conditional shall not be applicable to cases where the admission to the program is less than 10.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

B.E. in Computer Science and Engineering

B.E. in the title of the program

Scheme of Teaching and Examinations 2022

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2023-24)

V SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical / Drawing	SDA	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	PCC	BCS501	Software Engineering & Project Management	TD: CS PSB : CS	4	0	0		03	50	50	100	4
2	IPCC	BCS502	Computer Networks	TD: CS PSB : CS	3	0	2		03	50	50	100	4
3	PCC	BCS503	Theory of Computation	TD: CS PSB : CS	3	2	0		03	50	50	100	4
4	PCCL	BCSL504	Web Technology Lab	TD: CS PSB : CS	0	0	2		03	50	50	100	1
5	PEC	BCS515x	Professional Elective Course	TD: CS PSB : CS	3	0	0		03	50	50	100	3
6	PROJ	BCS586	Mini Project	TD: CS PSB : CS	0	0	4		03	100		100	2
7	AEC	BRMK557	Research Methodology and IPR	TD: HSM PSB : HSM	2	2	0		02	50	50	100	3
8	HSMS	BCS508	Environmental Studies and E-waste Management	TD: HSM PSB : HSM	1	0	0		01	50	50	100	1
9	MC	BNSK559	National Service Scheme (NSS)	NSS coordinator	0	0	2			100		100	0
		BPEK559	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		BYOK559	Yoga	Yoga Teacher									
									Total	**500**	**300**	**800**	**22**

Professional Elective Course

BCS515A	Computer Graphics	BCS515C	Unix System Programming
BCS515B	Artificial Intelligence	BCS515D	Distributed Systems

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **UHV**: Universal Human Value Course, **MC**: Mandatory Course (Non-credit), **AEC**: Ability Enhancement Course, **SEC**: Skill Enhancement Course, **L:** Lecture, **T**: Tutorial, **P**: Practical **S= SDA**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SCS**: Semester End Evaluation. **K :** The letter in the course code indicates common to all the streams of engineering. **PROJ**: Project /Mini Project. **PEC**: Professional Elective Course

Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practicals of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (B.E./B.Tech.) 2022-23

National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), and Yoga(YOG) with the concerned coordinator of the course during the first week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree.

Mini-project work: Mini Project is a laboratory-oriented/hands on course that will provide a platform to students to enhance their practical knowledge and skills by the development of small systems/applications etc. Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary Mini- project can be assigned to an individual student or to a group having not more than 4 students.

CIE procedure for Mini-project:

(i) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two faculty members of the Department, one of them being the Guide. The CIE marks awarded for the Mini-project work shall be based on the evaluation of the project report, project presentation skill, and question and answer session in the ratio of 50:25:25. The marks awarded for the project report shall be the same for all the batches mates.

(ii) Interdisciplinary: Continuous Internal Evaluation shall be group-wise at the college level with the participation of all the guides of the project.

The CIE marks awarded for the Mini-project, shall be based on the evaluation of the project report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

No SEE component for Mini-Project.

Professional Elective Courses (PEC): A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an option to select one course. The minimum number of students' strengths for offering a professional elective is 10. However, this conditional shall not be applicable to cases where the admission to the program is less than 10.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

B.E. in Artificial Intelligence and Machine Learning

Scheme of Teaching and Examinations 2022

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2023-24)

VI SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical / Drawing	SDA	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	IPCC	BAI601	Natural Language Processing	TD : AI PSB : AI	3	0	2		03	50	50	100	4
2	PCC	BAI602	Machine Learning -I	TD : AI PSB : AI	4	0	0		03	50	50	100	4
3	PEC	BXX613x	Professional Elective Course	TD : AI PSB : AI	3	0	0		03	50	50	100	3
4	OEC	BXX654x	Open Elective Course	TD : AI PSB : AI	3	0	0		03	50	50	100	3
5	PROJ	BAI685	Project Phase I	TD : AI PSB : AI	0	0	4		03	100	--	100	2
6	PCCL	BAIL606	Machine Learning lab	TD : AI PSB : AI	0	0	2		03	50	50	100	1
7	AEC/SDC	BXX657x	Ability Enhancement Course/Skill Development Course V	TD and PSB: Concerned department	If the course is offered as a Theory				01	50	50	100	1
					1	0	0						
					If course is offered as a practical								
					0	0	2						
8	MC	BNSK658	National Service Scheme (NSS)	NSS coordinator	0	0	2			100	---	100	0
		BPEK658	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		BYOK658	Yoga	Yoga Teacher									
9	MC	BIKS609	Indian Knowledge System		1	0	0		01	100	---	100	0
									Total	**500**	**300**	**800**	**18**

Professional Elective Course

BAI613A	Human-Centred AI	BCS613A	Blockchain Technology

BIS613D	Cloud Computing and Security	BAI613D	Time Series Analysis
Open Elective Course			
BCS654A	Introduction to Data Structures	BIS654C	Mobile Application Development
BCS654B	Fundamentals of Operating Systems	BAI654D	Introduction to Artificial Intelligence
Ability Enhancement Course / Skill Enhancement Course-V			
BCGL657A	Mobile Application Development with Flutter	BAIL657C	Generative AI
BADL657B	UI/UX	BCSL657D	Devops

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **UHV**: Universal Human Value Course, **MC**: Mandatory Course (Non-credit), **AEC**: Ability Enhancement Course, **SEC**: Skill Enhancement Course, **L:** Lecture, **T**: Tutorial, **P**: Practical **S= SDA**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation. **K :** The letter in the course code indicates common to al the stream of engineering. **PROJ**: Project /Mini Project. **PEC**: Professional Elective Course. **PROJ**: Project Phase -I, **OEC**: Open Elective Course

Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practicals of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (B.E./B.Tech.) 2022-23

National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), and Yoga(YOG) with the concerned coordinator of the course during the first week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree.

Professional Elective Courses (PEC): A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an option to select one course. The minimum number of students' strengths for offering professional electives is 10. However, this conditional shall not be applicable to cases where the admission to the program is less than 10.

Open Elective Courses:

Students belonging to a particular stream of Engineering and Technology are not entitled to the open electives offered by their parent Department. However, they can opt for an elective offered by other Departments, provided they satisfy the prerequisite condition if any. Registration to open electives shall be documented under the guidance of the Program Coordinator/ Advisor/Mentor. The minimum numbers of students' strength for offering Open Elective Course is 10. However, this condition shall not be applicable to class where the admission to the program is less than 10.

Project Phase-I : Students have to discuss with the mentor /guide and with their helphe/she has to complete the literature survey and prepare the report and finally

define the problem statement for the project work.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

B.E. in Computer Science and Engineering

Scheme of Teaching and Examinations2022

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2023-24)

VI SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical / Drawing	SDA	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	IPCC	BCS601	Cloud Computing (Open Stack /Google)	TD: CS PSB : CS	3	0	2		03	50	50	100	4
2	PCC	BCS602	Machine Learning	TD: CS PSB : CS	4	0	0		03	50	50	100	4
3	PEC	BXX613x	Professional Elective Course	TD: CS PSB : CS	3	0	0		03	50	50	100	3
4	OEC	BXX654x	Open Elective Course	TD: CS PSB : CS	3	0	0		03	50	50	100	3
5	PROJ	BCS685	Project Phase I	TD: CS PSB : CS	0	0	4		03	100	--	100	2
6	PCCL	BCSL606	Machine Learning lab	TD: CS PSB : CS	0	0	2		03	50	50	100	1
7	AEC/SDC	BXX657x	Ability Enhancement Course/Skill Development Course V	TD and PSB: Concerned department	If the course is offered as a Theory				01	50	50	100	1
					1	0	0						
					If course is offered as a practical								
					0	0	2						
8	MC	BNSK658	National Service Scheme (NSS)	NSS coordinator	0	0	2			100	---	100	0
		BPEK658	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		BYOK658	Yoga	Yoga Teacher									
9	MC	BIKS609	Indian Knowledge System		1	0	0		01	100	---	100	0
									Total	**500**	**300**	**800**	**18**

Professional Elective Course

BCS613A	Blockchain Technology	BCS613C	Compiler Design

BCS613B	Computer Vision	BCS613D	Advanced Java
Open Elective Course			
BCS654A	Introduction to Data Structures	BIS654C	Mobile Application Development
BCS654B	Fundamentals of Operating Systems	BAI654D	Introduction to Artificial Intelligence
Ability Enhancement Course / Skill Enhancement Course-V			
BISL657A	Tosca – Automated Software testing	BAIL657C	Generative AI
BCSL657B	React	BCSL657D	Devops

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **UHV**: Universal Human Value Course, **MC**: Mandatory Course (Non-credit), **AEC**: Ability Enhancement Course, **SEC**: Skill Enhancement Course, **L:** Lecture, **T**: Tutorial, **P**: Practical **S= SDA**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation. **K :** The letter in the course code indicates common to al the stream of engineering. **PROJ**: Project /Mini Project. **PEC**: Professional Elective Course. **PROJ**: Project Phase -I, **OEC**: Open Elective Course

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National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), and Yoga(YOG) with the concerned coordinator of the course during the first week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree.

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Open Elective Courses:

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Project Phase-I : Students have to discuss with the mentor /guide and with their helphe/she has to complete the literature survey and prepare the report and finally define the problem statement for the project work.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

B.E. in Electronics and Communication Engineering

Scheme of Teaching and Examinations2022

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2023-24)

VI SEMESTER (SCHEME-A)

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	SDA	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	IPCC	BEC601	Embedded System Design		3	0	2		03	50	50	100	4
2	PCC	BEC602	**VLSI Design and Testing**		4	0	0		03	50	50	100	4
3	PEC	BEC613x	Professional Elective Course		3	0	0		03	50	50	100	3
4	OEC	BXX654x	Open Elective Course		3	0	0		03	50	50	100	3
5	PROJ	BXX685	Project Phase I		0	0	4		03	100	--	100	2
6	PCCL	BXXL606	VLSI Design and Testing Lab		0	0	2		03	50	50	100	1
7	AEC/SDC	BXX657x	Ability Enhancement Course/Skill Development Course V		If the course is a Theory				01	50	50	100	1
					1	0	0						
					If course is a practical								
					0	0	2						
8	MC	BNSK658	National Service Scheme (NSS)	NSS coordinator	0	0	2			100	---	100	PP
		BPEK658	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		BYOK658	Yoga	Yoga Teacher									
9	MC	BIKS609	Indian Knowledge System		1	0	0			100	0	100	PP
									Total	**500**	**300**	**800**	**18**

Professional Elective Course

BEC613A	**Multimedia Communication**	BEC613C	**Digital Image Processing**
BEC613B	**Data Security**	BEC613D	FPGA Based System design Using Verilog

Open Elective Course

BEC654A	Digital System Design using Verilog	BEC654C	Electronics Communication System

BEC654B	Consumer Electronics	BEC654D	Basic VLSI Design
Ability Enhancement Course / Skill Enhancement Course-V			
BECL657A(L:T:P)	FPGA system design Lab using Verilog	BECL657C(L:T:P)	IoT Laboratory
BECL657B(L:T:P)	System Modeling using Simulink	BECL657D(L:T:P)	Pythan Programing for Machine Learning Applications

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **UHV**: Universal Human Value Course, **MC**: Mandatory Course (Non-credit), **AEC**: Ability Enhancement Course, **SEC**: Skill Enhancement Course, **L:** Lecture, **T**: Tutorial, **P**: Practical **S= SDA**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation. **K :** The letter in the course code indicates common to al the stream of engineering. **PROJ**: Project /Mini Project. **PEC**: Professional Elective Course. **PROJ**: Project Phase -I, **OEC**: Open Elective Course

Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practicals of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (B.E./B.Tech.) 2022-23

National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), and Yoga(YOG) with the concerned coordinator of the course during the first week of III/IV/V/VI semesters. Colleges are required to submit the Continuous Internal Evaluation (CIE) marks for the activities completed by students under selected course each semester. The students should be allowed to engage in different activities/courses each semester. For example, a student who participates in sports in the 3rd semester could choose to undertake NSS in the next semester and Yoga in another semester. This approach aligns with the student-centric focus of the National Education Policy (NEP) 2022 and helps distribute the workload related Physical Education/NSS/Yoga of more evenly across different departments.Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree.

Professional Elective Courses (PEC): A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an option to select one course. The minimum number of students' strengths for offering professional electives is 10. However, this conditional shall not be applicable to cases where the admission to the program is less than 10.

Open Elective Courses: Students belonging to a particular stream of Engineering and Technology are not entitled to the open electives offered by their parent

Department. However, they can opt for an elective offered by other Departments, provided they satisfy the prerequisite condition if any. Registration to open electives shall be documented under the guidance of the Program Coordinator/ Advisor/Mentor. The minimum number of students' strength for offering Open Elective Course is 10. However, this condition shall not be applicable to class where the admission to the program is less than 10.
Project Phase-I : Students have to discuss with the mentor /guide and with their helphe/she has to complete the literature survey and prepare the report and finally define the problem statement for the project work.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

B.E. in Information Science and Engineering

Scheme of Teaching and Examinations2022

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2023-24)

VI SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical / Drawing	SDA	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	IPCC	BIS601	Full Stack Development	TD: IS PSB: IS	3	0	2		03	50	50	100	4
2	PCC	BCS602	Machine Learning	TD: IS PSB: IS	4	0	0		03	50	50	100	4
3	PEC	BXX613x	Professional Elective Course	TD: IS PSB: IS	3	0	0		03	50	50	100	3
4	OEC	BXX654x	Open Elective Course	TD: IS PSB: IS	3	0	0		03	50	50	100	3
5	PROJ	BIS685	Project Phase I	TD: IS PSB: IS	0	0	4		03	100	--	100	2
6	PCCL	BCSL606	Machine Learning lab	TD: IS PSB: IS	0	0	2		03	50	50	100	1
7	AEC/SDC	BXX657x	Ability Enhancement Course/Skill Development Course V	TD and PSB: Concerned department	If the course is offered as a Theory				01	50	50	100	1
					1	0	0						
					If course is offered as a practical								
					0	0	2						
8	MC	BNSK658	National Service Scheme (NSS)	NSS coordinator	0	0	2			100	---	100	0
		BPEK658	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		BYOK658	Yoga	Yoga Teacher									
9	MC	BIKS609	Indian Knowledge System		1	0	0		01	100	---	100	0
									Total	**500**	**300**	**800**	**18**

Professional Elective Course

BCS613A	Blockchain Technology	BCS613C	Compiler Design
BIS613B	Internet of Things	BIS613D	Cloud Computing and Security

Open Elective Course			
BCS654A	Introduction to Data Structures	BIS654C	Mobile Application Development
BCS654B	Fundamentals of Operating Systems	BAI654D	Introduction to Artificial Intelligence
Ability Enhancement Course / Skill Enhancement Course-V			
BISL657A	Tosca – Automated Software testing	BAIL657C	Generative AI
BCSL657B	React	BCSL657D	Devops

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **UHV**: Universal Human Value Course, **MC**: Mandatory Course (Non-credit), **AEC**: Ability Enhancement Course, **SEC**: Skill Enhancement Course, **L:** Lecture, **T**: Tutorial, **P**: Practical **S= SDA**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation. **K :** The letter in the course code indicates common to al the stream of engineering. **PROJ**: Project /Mini Project. **PEC**: Professional Elective Course. **PROJ**: Project Phase -I, **OEC**: Open Elective Course

Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practicals of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (B.E./B.Tech.) 2022-23

National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), and Yoga(YOG) with the concerned coordinator of the course during the first week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree.

Professional Elective Courses (PEC): A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an option to select one course. The minimum number of students' strengths for offering professional electives is 10. However, this conditional shall not be applicable to cases where the admission to the program is less than 10.

Open Elective Courses:

Students belonging to a particular stream of Engineering and Technology are not entitled to the open electives offered by their parent Department. However, they can opt for an elective offered by other Departments, provided they satisfy the prerequisite condition if any. Registration to open electives shall be documented under the guidance of the Program Coordinator/ Advisor/Mentor. The minimum numbers of students' strength for offering Open Elective Course is 10. However, this condition shall not be applicable to class where the admission to the program is less than 10.

Project Phase-I : Students have to discuss with the mentor /guide and with their helphe/she has to complete the literature survey and prepare the report and finally define the problem statement for the project work.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI **B.E. in Artificial Intelligence and Machine Learning** **Scheme of Teaching and Examinations 2022** Outcome Based Education (OBE) and Choice Based Credit System (CBCS) (Effective from the academic year 2023-24)														
VII SEMESTER (Swappable VII and VIII SEMESTER)														
Sl. No	**Course and Course Code**		**Course Title**	**Teaching Department (TD) and Question Paper Setting Board (PSB)**	**Teaching Hours /Week**				**Examination**					**Credits**
					Theory Lecture	**Tutorial**	**Practical / Drawing**	**SDA**	**Duration in hours**	**CIE Marks**	**SEE Marks**	**Total Marks**	
					L	**T**	**P**	**S**					
1	IPCC	BAI701	Deep Learning & Reinforcement Learning	TD : AI PSB : AI	3	0	2		03	50	50	100	4
2	IPCC	BAI702	Machine Learning -II	TD : AI PSB : AI	3	0	2		03	50	50	100	4
3	PCC	BAD703	Data Security & Privacy	TD : AI PSB : AI	4	0	0		03	50	50	100	4
4	PEC	BAI714x	**Professional Elective Course**	TD : AI PSB : AI	3	0	0		03	50	50	100	3
5	OEC	BAI755x	**Open Elective Course**	TD : AI PSB : AI	3	0	0		01	50	50	100	3
6	PROJ	BAI786	**Major Project Phase-II**	TD : AI PSB : AI	0	0	12		03	100	100	200	6
										400	**300**	**700**	**24**

Professional Elective Course			
BAD714D	Social Network Analysis	BAD714C	Data Engineering & MLOps
BAD714B	Business Analytics	BCS714D	Big Data Analytics
Open Elective Course			
BAI755A	Introduction to DBMS	BAI755C	Software Engineering
BAI755B	Introduction to Algorithms	BAI755D	

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **PEC**: Professional Elective Course, **OEC**: Open Elective Course PR: Project Work, **L:** Lecture, **T**: Tutorial, **P**: Practical **S= SDA**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation. **TD-** Teaching Department, **PSB**: Paper Setting department, **OEC**: Open Elective Course, **PEC**: Professional Elective Course. **PROJ**: Project work

Note: VII and VIII semesters of IV years of the program

(1) Institutions can swap the VII and VIII Semester Schemes of Teaching and Examinations to accommodate research internships/ industry internships after the VI semester**.**

(2) Credits earned for the courses of VII and VIII Semester Scheme of Teaching and Examinations shall be counted against the corresponding semesters whether the VII or VIII semesters is completed during the beginning of the IV year or the later part of IV years of the program.

Professional Elective Courses (PEC): A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an option to select one course. The minimum number of students' strengths for offering professional electives is 10. However, this conditional shall not be applicable to cases where the admission to the program is less than 10.

Open Elective Courses:

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PROJECT WORK (21AIP75): The objective of the Project work is

- **(i)** To encourage independent learning and the innovative attitude of the students.
- **(ii)** To develop interactive attitude, communication skills, organization, time management, and presentation skills.
- **(iii)** To impart flexibility and adaptability.
- **(iv)** To inspire team working.
- **(v)** To expand intellectual capacity, credibility, judgment and intuition.
- **(vi)** To adhere to punctuality, setting and meeting deadlines.
- **(vii)** To install responsibilities to oneself and others.
- **(viii)**To train students to present the topic of project work in a seminar without any fear, face the audience confidently, enhance communication skills, involve in group discussion to present and exchange ideas.

CIE procedure for Project Work:

(1) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide.

The CIE marks awarded for the project work, shall be based on the evaluation of the project work Report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

B.E. in Computer Science and Engineering

Scheme of Teaching and Examinations2022

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2023-24)

VII SEMESTER (Swappable VII and VIII SEMESTER)

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical / Drawing	SDA	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	IPCC	BCS701	Internet of Things	TD: CS PSB : CS	3	0	2		03	50	50	100	4
2	IPCC	BCS702	Parallel Computing	TD: CS PSB : CS	3	0	2		03	50	50	100	4
3	PCC	BCS703	Cryptography & Network Security	TD: CS PSB : CS	4	0	0		03	50	50	100	4
4	PEC	BCS714x	**Professional Elective Course**	TD: CS PSB : CS	3	0	0		03	50	50	100	3
5	OEC	BCS755x	**Open Elective Course**	TD: CS PSB : CS	3	0	0		01	50	50	100	3
6	PROJ	BCS786	**Major Project Phase-II**	TD: CS PSB : CS	0	0	12		03	100	100	200	6
										400	**300**	**700**	**24**

Professional Elective Course

BCS714A	Deep Learning	BCS714C	Program Verification
BCS714B	Natural Language Processing	BCS714D	Big Data Analytics

Open Elective Course

BCS755A	Introduction to DBMS	BCS755C	Software Engineering
BCS755B	Introduction to Algorithms	BCS755D	

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Note: VII and VIII semesters of IV years of the program

(1) Institutions can swap the VII and VIII Semester Schemes of Teaching and Examinations to accommodate research internships/ industry internships after the VI semester**.**

(2) Credits earned for the courses of VII and VIII Semester Scheme of Teaching and Examinations shall be counted against the corresponding semesters whether the VII or VIII semesters is completed during the beginning of the IV year or the later part of IV years of the program.

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Open Elective Courses:

Students belonging to a particular stream of Engineering and Technology are not entitled to the open electives offered by their parent Department. However, they can opt for an elective offered by other Departments, provided they satisfy the prerequisite condition if any. Registration to open electives shall be documented under the guidance of the Program Coordinator/ Advisor/Mentor. The minimum numbers of students' strength for offering Open Elective Course is 10. However, this condition shall not be applicable to class where the admission to the program is less than 10.

PROJECT WORK (21CSP75): The objective of the Project work is

(i) To encourage independent learning and the innovative attitude of the students.
(ii) To develop interactive attitude, communication skills, organization, time management, and presentation skills.
(iii) To impart flexibility and adaptability.
(iv) To inspire team working.
(v) To expand intellectual capacity, credibility, judgment and intuition.
(vi) To adhere to punctuality, setting and meeting deadlines.
(vii) To install responsibilities to oneself and others.
(viii) To train students to present the topic of project work in a seminar without any fear, face the audience confidently, enhance communication skills, involve in group discussion to present and exchange ideas.

CIE procedure for Project Work:

(1) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide.

The CIE marks awarded for the project work, shall be based on the evaluation of the project work Report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

VISVESVARAYATECHNOLOGICALUNIVERSITY,BELAGAVI

B.E.inElectronicsandCommunicationEngineeringSchemeof TeachingandExaminations2022

OutcomeBasedEducation(OBE)andChoiceBasedCreditSystem(CBCS)

(Effectivefromtheacademic year2023-24)

VIISEMESTER(SwappableVIIandVIIISEMESTER)

Sl. No	Course andCourseCode		CourseTitle	TeachingDepartment (TD)and QuestionPaper SettingBoard(PSB)	TeachingHours/Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	SDA	Duration inhours	CIEMarks	SEEMarks	TotalMarks	
					L	T	P	S					
1	IPCC	BEC701	MicrowaveEngineeringandAntennaTheory		3	0	2		03	50	50	100	4
2	IPCC	BEC702	ComputerNetworksandProtocols		3	0	2		03	50	50	100	4
3	PCC	BEC703	WirelessCommunicationSystems		4	0	0		03	50	50	100	4
4	PEC	BEC714x	**ProfessionalElectiveCourse**		3	0	0		03	50	50	100	3
5	OEC	BEC755x	**OpenElectiveCourse**		3	0	0		01	50	50	100	3
6	PROJ	BEC786	**MajorProjectPhase-II**		0	0	12		03	100	100	200	6
										350	**350**	**700**	**24**

ProfessionalElectiveCourse

BEC714A	ApplicationSpecificIntegratedCircuit	BEC714C	AutomativeElectronics
BEC714B	Computer and Network Security.	BEC714D	RadarCommunication

OpenElectiveCourse

BEC755A	E-wasteManagement	BTE755C	EmbeddedSystemApplications
BEC755B	AutomativeEngineering	BEC755D	SensorsandActuators

PCC:ProfessionalCoreCourse,**PCCL**:ProfessionalCoreCourselaboratory,**PEC**:ProfessionalElectiveCourse,**OEC**:OpenElectiveCoursePR:ProjectWork,**L:**Lecture,**T**:Tutorial,**P**: Practical**S= SDA**:Skill DevelopmentActivity, **CIE**:Continuous InternalEvaluation,**SEE**:SemesterEnd Evaluation.**TD-**Teaching Department,**PSB**:PaperSetting department,**OEC**:OpenElectiveCourse,**PEC**:ProfessionalElectiveCourse.**PROJ**:Projectwork

Note:VIIandVIIIsemesters ofIVyearsofthe program

(1) InstitutionscanswaptheVIIandVIIISemesterSchemesofTeachingandExaminationstoaccommodateresearchinternships/industryinternshipsaftertheVIsemester.

(2) CreditsearnedforthecoursesofVIIandVIIISemesterSchemeofTeachingandExaminationsshallbecountedagainstthecorrespondingsemesterswhethertheVII orVIIIsemestersiscompletedduringthe beginningoftheIVyearorthelaterpart ofIVyearsofthe program.

Professional Elective Courses (PEC): A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering andTechnology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of engineering. Eachgroupwillprovideanoptiontoselectonecourse.Theminimumnumberofstudents'strengthsforofferingprofessionalelectivesis10.However,thisconditionalshall notbeapplicableto caseswheretheadmissionto theprogramislessthan10.
OpenElectiveCourses: Students belonging to a particular stream of Engineering and Technology are not entitled to the open electives offered by their parent Department. However, they canopt for an elective offered by other Departments, provided they satisfy the prerequisite condition if any. Registration to open electives shall be documented under theguidanceof the ProgramCoordinator/Advisor/Mentor. The minimum numbers of students' strength for offering Open Elective Course is 10. However, this conditionshallnot be applicabletoclass where the admissiontothe programis lessthan10.
PROJECTWORK(21XXP75): TheobjectiveoftheProjectwork is **(i)** Toencourageindependentlearningandtheinnovativeattitudeofthestudents. **(ii)** Todevelopinteractiveattitude,communicationskills,organization,timemanagement,andpresentationskills. **(iii)** Toimpartflexibilityandadaptability. **(iv)** Toinspireteamworking. **(v)** Toexpandintellectualcapacity,credibility,judgmentandintuition. **(vi)** Toadheretopunctuality,settingandmeetingdeadlines. **(vii)** Toinstallresponsibilitiestooneselfandothers. **(viii)**Totrainstudentstopresentthetopicofprojectworkinaseminarwithoutanyfear,facetheaudienceconfidently,enhancecommunicationskills,involveingroupdiscussionto present and exchange ideas. **CIEprocedureforProjectWork:** **(1) Single discipline:** The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of theDepartment,oneofwhomshallbe theGuide. The CIE marks awarded for the project work, shall be based on the evaluation of the project work Report, project presentation skill, and question and answer session intheratio50:25:25.Themarks awardedfortheprojectreportshall bethesamefor allthe batchmates. **(2) Interdisciplinary:** Continuous Internal Evaluation shall be group-wise at the college level with the participation of all guides of the college. Participation of externalguide/s, if any, is desirable. The CIE marks awarded for the project work, shall be based on the evaluation of project work Report, project presentation skill, and questionandanswer sessionintheratio50:25:25.Themarks awarded for theprojectreport shallbe the sameforallthe batchmates. **SEEprocedureforProjectWork:**SEEforprojectwork willbeconductedbythetwoexaminersappointedbytheUniversity.TheSEEmarksawardedfortheprojectwork shallbebasedontheevaluationofprojectworkReport, projectpresentationskill, andquestionandanswersessionintheratio50:25:25.

VISVESVARAYATECHNOLOGICALUNIVERSITY,BELAGAVI

B.E.inElectronicandCommunicationEngineeringSchemeof TeachingandExaminations2022

OutcomeBasedEducation(OBE)andChoiceBasedCreditSystem(CBCS)
(Effectivefromtheacademic year2023-24)

VIIISEMESTER(SwappableVIIandVIIISEMESTER)

Sl. No	Course andCourseCode		CourseTitle	TeachingDepartment (TD)and QuestionPaper SettingBoard(PSB)	TeachingHours/Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	SDA	Duration inhours	CIEMarks	SEEMarks	TotalMarks	
					L	T	P	S					
1	PEC	BEC801x	**ProfessionalElective (OnlineCourses)**		3	0	0		03	50	50	100	3
2	OEC	BEC802x	**OpenElective(OnlineCourses)**		3	0	0		01	50	50	100	3
3	INT	BEC803	**Internship(Industry/Research)(14-20weeks)**		0	0	12		03	100	100	200	10
										200	**200**	**400**	**16**

ProfessionalElectiveCourse(Onlinecourses)

BEC801A	BOSRecommendedCourse	BEC801C	BOSRecommendedCourse
BEC801B	BOSRecommendedCourse	BEC801D	BOSRecommendedCourse

OpenElectiveCourses(OnlineCourses)

BEC802A	BOSRecommendedCourse	BEC802C	BOSRecommendedCourse
BEC802B	BOSRecommendedCourse	BEC802D	BOSRecommendedCourse

L:Lecture,**T**:Tutorial,**P**:Practical**S=SDA**:Skill DevelopmentActivity,**CIE**:ContinuousInternal Evaluation,**SEE**:SemesterEnd Evaluation.**TD-**Teaching Department,**PSB**: PaperSettingdepartment,**OEC**:OpenElectiveCourse,**PEC**:ProfessionalElectiveCourse.**PROJ**:Projectwork,**INT**:IndustryInternship/ResearchInternship/RuralInternship

Note: VII and VIII semesters of IV years of the programSwapping Facility

- Institutions can swap VII and VIII Semester Scheme of Teaching and Examinations to accommodate **research internships/ industry internships/Rural Internship** aftertheVIsemester**.**
- CreditsearnedforthecoursesofVIIandVIIISemesterSchemeofTeachingandExaminationsshallbecountedagainstthecorrespondingsemesterswhetherVIIorVIIIsemester iscompletedduringthebeginningofIVyearorlater part ofIVyearoftheprogram.

Elucidation:

At the beginning of IV years of the program i.e., after VI semester, VII semester classwork and VIII semester **Research Internship /Industrial Internship / Rural Internship**shall be permitted to be operated simultaneously by the University so that students have ample opportunity for an internship. In other words, a good percentage of theclassshall attendVIIsemester classwork andasimilarpercentageofothersshallattendto ResearchInternshipor IndustrialInternshipor Rural Internship.

Research/Industrial /Rural Internship shall be carried out at an Industry, NGO, MSME, Innovation center, Incubation centre, Start-up, centre of Excellence (CoE), StudyCentreestablished inthe parent institute and/or at reputedresearchorganizations/institutes.

The mandatory Research internship /Industry internship / Rural Internshipis for 14 to 20 weeks. The internship shall be considered as a head of passing and shall beconsidered for the award of a degree. Those, who do not take up/complete the internship shall be declared to fail and shall have to complete it during the subsequentUniversityexaminationafter satisfyingtheinternshiprequirements.

Research internship: A research internship is intended tooffer the flavor of current research going on in theresearch field. It helps students getfamiliarized with thefieldandimpartstheskill requiredforcarryingout research.

Industry internship: Is an extended periodofworkexperienceundertakenbystudents tosupplementtheirdegreeforprofessional development. It also helpsthem learn to overcome unexpected obstacles and successfully navigate organizations, perspectives, and cultures. Dealing with contingencies helps students recognize,appreciate,andadapt toorganizational realities bytemperingtheirknowledgewithpractical constraints.

Rural Internship: Rural development internship is an initiative of Unnat Bharat Abhiyan Cell, RGIT in association with AICTE to involve students of all departmentsstudyingindifferentacademicyearsforexploringvariousopportunities intechno-socialfields,to connectandworkwithRuralIndiafor their upliftment.

The faculty coordinator or mentor has to monitor the student’s internship progress and interact with them to guide for the successful completion of the internship.Thestudentsarepermitted tocarryouttheinternshipanywhere inIndiaorabroad.Universityshallnotbearanyexpensesincurred inrespectoftheinternship.

WiththeconsentoftheinternalguideandPrincipaloftheInstitution,studentsshallbeallowedtocarryouttheinternshipattheirhometown(**withinoroutsidethe state or abroad**), provided favorable facilities are available for the internship and the student remains regularly in contact with the internal guide. **University shall notbearany costinvolvedincarryingout theinternshipby students.**However,students canreceiveany financialassistanceextended bytheorganization.

ProfessionalElective/OpenElectiveCourse: TheseareONLINEcoursessuggested bythe respectiveBoardofStudies.Detailsofthesecourses shall bemadeavailableforstudentsontheVTUwebportal.

VISVESVARAYATECHNOLOGICALUNIVERSITY,BELAGAVI **B.E. in the title of the programSchemeofTeachingandExaminations2022** OutcomeBasedEducation(OBE)andChoiceBasedCreditSystem(CBCS) (Effectivefromtheacademic year2023-24)														
VISEMESTER														
Sl. No	**Course andCourseCode**		**CourseTitle**	**TeachingDepartment (TD)and QuestionPaper SettingBoard(PSB)**	**TeachingHours/Week**				**Examination**				**Credits**
					Theory Lecture	**Tutorial**	**Practical/ Drawing**	**SDA**	**Duration inhours**	**CIEMarks**	**SEEMarks**	**TotalMarks**	
					L	**T**	**P**	**S**					
1	IPCC	BXX601	EmbeddedSystemDesign		3	0	2		03	50	50	100	4
2	PCC	BXX602	MicrowaveandAntennaTheory		4	0	0		03	50	50	100	4
3	PEC	BXX613x	ProfessionalElectiveCourse		3	0	0		03	50	50	100	3
4	OEC	BXX654x	OpenElectiveCourse		3	0	0		03	50	50	100	3
5	PCCL	BXXL606	Labcomponent		0	0	2		03	50	50	100	1
6	AEC/SDC	BXX657x	AbilityEnhancementCourse/SkillDevelopmentCourseV		IfthecourseisofferedasaTheory 1 / 0 / 0 Ifcourseisofferedasa practical 0 / 0 / 2				01	50	50	100	1
7	MC	BNSK658	NationalServiceScheme(NSS)	NSScoordinator	0	0	2			100	---	100	0
		BPEK658	PhysicalEducation(PE)(SportsandAthletics)	PhysicalEducation Director									
		BYOK658	Yoga	YogaTeacher									
8	IKS	BIKS609	IndianKnowledgeSystem		1	0	0		01	100	---	100	0
									Total	**500**	**300**	**800**	**16**

ProfessionalElectiveCourse			
BEC613A	IntelligentSystemsandMachineLearningAlgorithms	BEC613C	DigitalImageProcessing
BEC613B	ComputerandDataSecurity	BEC613D	FPGASystemDesignusingVerilog
OpenElectiveCourse			
BEC654A	DigitalSystemDesignusingVerilog	BEC654C	ElectronicCommunicationSystems

BEC654B	ConsumerElectronics	BEC654D	BasicVLSIDesign
AbilityEnhancementCourse/SkillEnhancementCourse-V			
BEC657A	FPGASystemDesignusingVerilogLAB	BEC657C	IOTLab
BEC657B	SystemModellingusingSimulink	BEC657D	PythonProgrammingforMachineLearningApplications

VISVESVARAYATECHNOLOGICALUNIVERSITY,BELAGAVI

B.E. in the title of the programSchemeofTeachingandExaminations2022

OutcomeBasedEducation(OBE)andChoiceBasedCreditSystem(CBCS)

(Effectivefromtheacademic year2023-24)

VIIandVIIIsemesterforwhoseeksinternshipwithprojectwork

Sl. No	Course andCourseCode		CourseTitle	TeachingDepartment (TD)and QuestionPaper SettingBoard(PSB)	TeachingHours/Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	SDA	Duration inhours	CIEMarks	SEEMarks	TotalMarks	
					L	T	P	S					
1	PCC	BXX701	Tobecompletedin5th/6thsemester		3	0	2		03	50	50	100	4
2	PCC	BXX702	Tobecompletedin5th/6thsemester		3	0	2		03	50	50	100	4
3	PCC	BXX703	Tobecompletedin5th/6thsemester		4	0	0		03	50	50	100	3
4	PEC	BXX714x	ProfessionalElectiveCourse(MOOCCourses)		3	0	0		03	50	50	100	3
5	OEC	BXX755x	OpenElectiveCourses(MOOCcourses)		3	0	0		01	50	50	100	3
1	PEC	Bxx801x	ProfessionalElective(OnlineCourses)		3	0	0		03	50	50	100	3
2	OEC	Bxx802x	OpenElective(OnlineCourses)		3	0	0		01	50	50	100	3
3	PROJ	BXX883	ProjectWorkOutcomeofTraining		0	0	12		03	100	100	200	9
4	INT	Bxx804	Internship(Industry/Research)(Twosemesters)		0	0	12		03	100	100	200	10
									Total	**200**	**200**	**400**	**42**

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

B.E. in Information Science and Engineering

Scheme of Teaching and Examinations2022

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2023-24)

VIISEMESTER (Swappable VII and VIII SEMESTER)

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical / Drawing	SDA	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	IPCC	BIS701	Big Data Analytics	TD: IS PSB: IS	3	0	2		03	50	50	100	4
2	IPCC	BCS702	Parallel Computing	TD: IS PSB: IS	3	0	2		03	50	50	100	4
3	PCC	BIS703	Information & Network Security	TD: IS PSB: IS	4	0	0		03	50	50	100	4
4	PEC	BIS714x	**Professional Elective Course**	TD: IS PSB: IS	3	0	0		03	50	50	100	3
5	OEC	BIS755x	**Open Elective Course**	TD: IS PSB: IS	3	0	0		01	50	50	100	3
6	PROJ	BIS786	**Major Project Phase-II**	TD: IS PSB: IS	0	0	12		03	100	100	200	6
										400	**300**	**700**	**24**

Professional Elective Course

BCS714A	Deep Learning	BIS714C	Embedded Systems
BIS714B	Software Quality Assurance	BAD714C	Social Network Analysis

Open Elective Course

BIS755A	Introduction to DBMS	BIS755C	Software Engineering
BIS755B	Introduction to Algorithms	BIS755D	

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **PEC**: Professional Elective Course, **OEC**: Open Elective Course PR: Project Work, **L:** Lecture, **T**: Tutorial, **P**: Practical **S= SDA**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation. **TD-** Teaching Department, **PSB**: Paper Setting department, **OEC**: Open Elective Course, **PEC**: Professional Elective Course. **PROJ**: Project work

Note: VII and VIII semesters of IV years of the program

(1) Institutions can swap the VII and VIII Semester Schemes of Teaching and Examinations to accommodate research internships/ industry internships after the VI semester**.**

(2) Credits earned for the courses of VII and VIII Semester Scheme of Teaching and Examinations shall be counted against the corresponding semesters whether the VII or VIII semesters is completed during the beginning of the IV year or the later part of IV years of the program.

Professional Elective Courses (PEC): A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an option to select one course. The minimum number of students' strengths for offering professional electives is 10. However, this conditional shall not be applicable to cases where the admission to the program is less than 10.

Open Elective Courses:

Students belonging to a particular stream of Engineering and Technology are not entitled to the open electives offered by their parent Department. However, they can opt for an elective offered by other Departments, provided they satisfy the prerequisite condition if any. Registration to open electives shall be documented under the guidance of the Program Coordinator/ Advisor/Mentor. The minimum numbers of students' strength for offering Open Elective Course is 10. However, this condition shall not be applicable to class where the admission to the program is less than 10.

PROJECT WORK (21ISP75): The objective of the Project work is

- **(i)** To encourage independent learning and the innovative attitude of the students.
- **(ii)** To develop interactive attitude, communication skills, organization, time management, and presentation skills.
- **(iii)** To impart flexibility and adaptability.
- **(iv)** To inspire team working.
- **(v)** To expand intellectual capacity, credibility, judgment and intuition.
- **(vi)** To adhere to punctuality, setting and meeting deadlines.
- **(vii)** To install responsibilities to oneself and others.
- **(viii)**To train students to present the topic of project work in a seminar without any fear, face the audience confidently, enhance communication skills, involve in group discussion to present and exchange ideas.

CIE procedure for Project Work:

(1) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide.

The CIE marks awarded for the project work, shall be based on the evaluation of the project work Report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

B.E. in Electrical & Electronics Engineering

Scheme of Teaching and Examinations2022

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2023-24)

III SEMESTER

Sl. No	Course	Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week: Theory Lecture	Tutorial	Practical/ Drawing	SDA	Examination: Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
					L	T	P	S					
1	PCC	BEE301	Engineering Mathematics for EEE	Maths	3	0	0		03	50	50	100	3
2	IPCC	BEE302	Electric Circuit Analysis	EEE	3	0	2		03	50	50	100	4
3	IPCC	BEE303	Analog Electronic Circuits	EEE	3	0	2		03	50	50	100	4
4	PCC	BEE304	Transformers and Generators	EEE	3	0	0		03	50	50	100	3
5	PCCL	BEEL305	Transformers and Generators lab	EEE	0	0	2		03	50	50	100	1
6	ESC	BEE306x	ESC/ETC/PLC	EEE	3	0	0		03	50	50	100	3
7	UHV	BSCK307	Social Connect and Responsibility	Any Department	0	0	2		01	100	---	100	1
8	AEC/ SEC	BEE358x	Ability Enhancement Course/Skill Enhancement Course - III	EEE	If the course is a Theory				01	50	50	100	1
					1	0	0						
					If a course is a laboratory				02				
					0	0	2						
9	MC	BNSK359	National Service Scheme (NSS)	NSS coordinator	0	0	2			100	---	100	0
		BPEK359	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		BYOK359	Yoga	Yoga Teacher									
									Total	**550**	**350**	**900**	**20**

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **UHV**: Universal Human Value Course, **MC**: Mandatory Course (Non-credit), **AEC**: Ability Enhancement Course, **SEC**: Skill Enhancement Course, **L:** Lecture, **T**: Tutorial, **P**: Practical **S= SDA**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation. K : This letter in the course code indicates common to all the stream of engineering. ESC: Engineering Science Course, ETC: Emerging Technology Course, PLC: Programming Language Course

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Engineering Science Course (ESC/ETC/PLC)			
BEE306A	Digital Logic Circuits	BEE306C	Electromagnetic Field Theory
BEE306B	Electrical Measurements and Instrumentation	BEE306D	Physics of Electronic Devices
Ability Enhancement Course – III			
BEEL358A	SCI LAB/MATLAB for Transformers and Generators	BEEL358B	555 IC Laboratory
BEEL358C	Circuit Laboratory using P Spice	BEEL358D	Electrical Hardware Laboratory

Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practicals of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (B.E./B.Tech.) 2022-23 may please be referred.

National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), and Yoga(YOG) with the concerned coordinator of the course during the first week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree.

VARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

B.E. in Electrical & Electronics Engineering

Scheme of Teaching and Examinations2022

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2023-24)

IV SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	PCC	BEE401	Electric Motors	EEE	3	0	0		03	50	50	100	3
2	PCC	BEE402	Transmission and Distribution	EEE	4	0	0		03	50	50	100	4
3	IPCC	BEE403	Microcontrollers	EEE	3	0	2		03	50	50	100	4
4	PCCL	BEEL404	Electric Motors lab	EEE	0	0	2		03	50	50	100	1
5	ESC	BEE405x	ESC/ETC/PLC	EEE	3	0	0		03	50	50	100	3
6	AEC/ SEC	BEE456x	Ability Enhancement Course/Skill Enhancement Course- IV	EEE	If the course is Theory				01	50	50	100	1
					1	0	0						
					If the course is a lab				02				
					0	0	2						
7	BSC	BBOK407	Biology For Engineers	TD / PSB: BT, CHE,	3	0	0		03	50	50	100	3
8	UHV	BUHK408	Universal human values course	Any Department	1	0	0		01	50	50	100	1
9	MC	BNSK459	National Service Scheme (NSS)	NSS coordinator	0	0	2			100	---	100	0
		BPEK459	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		BYOK459	Yoga	Yoga Teacher									
									Total	**500**	**400**	**900**	**20**

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **UHV**: Universal Human Value Course, **MC**: Mandatory Course (Non-credit), **AEC**: Ability Enhancement Course, **SEC**: Skill Enhancement Course, **L:** Lecture, **T**: Tutorial, **P**: Practical **S= SDA**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation. K : This letter in the course code indicates common to all the stream of engineering.

Ability Enhancement Course / Skill Enhancement Course - IV			
BEEL456A	Basics of VHDL Lab	BEEL456B	Sci Lab / MATLAB for Electrical and Electronic Measurements
BEEL456C	PCB Design Laboratory	BEEL456D	Aurdino & Rasberry PI Based Projects
Engineering Science Course (ESC/ETC/PLC)			
BEE405A	Electrical Power Generation and Economics	BEE405C	Engineering Materials
BEE405B	Op-Amp and LIC	BEE405D	Object Oriented Programming

Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practical of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (B.E./B.Tech.) 2022-23.

National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), and Yoga(YOG) with the concerned coordinator of the course during the first week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses is mandatory for the award of degree.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

B.E. in Mechatronics Engineering

Scheme of Teaching and Examinations2022

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2023-24)

III SEMESTER

Sl. No	Course	Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	SDA	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	BSC	BMT301	Mechanics of Solids and Fluids	TD: Mechatronics PSB: Mechatronics	2	2	0		03	50	50	100	3
2	IPCC	BMT302	Analog and Digital Electronics	TD: Mechatronics PSB: Mechatronics	3	0	2		03	50	50	100	4
3	IPCC	BMT303	Material Science and Manufacturing Technology	TD: Mechatronics PSB: Mechatronics	3	0	2		03	50	50	100	4
4	PCC	BMT304	Computer Organization and Architecture	TD: Mechatronics PSB: Mechatronics	3	0	0		03	50	50	100	3
5	PCCL	BMT305	Computer Aided Machine Drawing	TD: Mechatronics PSB: Mechatronics	0	0	2		03	50	50	100	1
6	ESC	BMT306x	ESC/ETC/PLC	TD: Mechatronics PSB: Mechatronics	3	0	0		03	50	50	100	3
7	UHV	BSCK307	**Social Connect and Responsibility**	Any Department	0	0	2		01	100	---	100	1
8	AEC/ SEC	BMT358x	Ability Enhancement Course/Skill Enhancement Course - III	TD: Mechatronics PSB: Mechatronics	If the course is a Theory				01	50	50	100	1
					1	0	0						
					If a course is a laboratory				02				
					0	0	2						
9	MC	BNSK359	National Service Scheme (NSS)	NSS coordinator	0	0	2			100	---	100	0
		BPEK359	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		BYOK359	Yoga	Yoga Teacher									
									Total	**550**	**350**	**900**	**20**

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **UHV**: Universal Human Value Course, **MC**: Mandatory Course (Non-credit), **AEC**: Ability Enhancement Course, **SEC**: Skill Enhancement Course, **L:** Lecture, **T**: Tutorial, **P**: Practical **S= SDA**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SEE**:

Semester End Evaluation. K : This letter in the course code indicates common to all the stream of engineering. ESC: Engineering Science Course, ETC: Emerging Technology Course, PLC: Programming Language Course			
.			
Engineering Science Course (ESC/ETC/PLC)			
BMT306A	Analog Communication Systems	BMT306C	Python Programming
BMT306B	Signals and Systems	BMT306D	Product Life Cycle Management
Ability Enhancement Course – III			
BMT358A	Programming in Python (002)	BMT358C	PCB Design Technology (002)
BMT358B	Trends in Digital Manufacturing	BMT358D	Robotics Ecosystem

VARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

B.E. in Mechatronics Engineering

Scheme of Teaching and Examinations2022

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2023-24)

IV SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	PCC	BMT401	Microcontrollers and applications	TD: Mechatronics PSB: Mechatronics	3	0	0		03	50	50	100	3
2	IPCC	BMT402	Electrical Drives and Control	TD: Mechatronics PSB: Mechatronics	3	0	2		03	50	50	100	4
3	IPCC	BMT403	Hydraulics and Pneumatics	TD: Mechatronics PSB: Mechatronics	4	0	0		03	50	50	100	4
4	PCCL	BMT404	Mechatronics Lab	TD: Mechatronics PSB: Mechatronics	0	0	2		03	50	50	100	1
5	ESC	BMT405x	ESC/ETC/PLC	TD: Mechatronics PSB: Mechatronics	3	0	0		03	50	50	100	3
6	AEC/ SEC	BMT456x	Ability Enhancement Course/Skill Enhancement Course- IV	TD: Mechatronics PSB: Mechatronics	If the course is Theory				01	50	50	100	1
					1	0	0						
					If the course is a lab				02				
					0	0	2						
7	BSC	BBOK407	Biology For Engineers	TD / PSB: BT, CHE,	3	0	0		03	50	50	100	3
8	UHV	BUHK408	Universal human values course	Any Department	1	0	0		01	50	50	100	1
9	MC	BNSK459	National Service Scheme (NSS)	NSS coordinator	0	0	2			100	---	100	0
		BPEK459	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		BYOK459	Yoga	Yoga Teacher									
									Total	**500**	**400**	**900**	**20**

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **UHV**: Universal Human Value Course, **MC**: Mandatory Course (Non-credit), **AEC**: Ability Enhancement Course, **SEC**: Skill Enhancement Course, **L:** Lecture, **T**: Tutorial, **P**: Practical **S= SDA**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation. K : This letter in the course code indicates common to all the stream of engineering.			
Ability Enhancement Course / Skill Enhancement Course - IV			
BMT456A	Mechanism Design and Animation (0-0-2)	BMT456C	CNC programming and simulation (0-0-2)
BMT456B	3-D Printing Technology (0-0-2)	BMT456D	IoT (0-0-2)
Engineering Science Course (ESC/ETC/PLC)			
BMT405A	Robot Operating System	BMT405C	Renewable Sources of Energy
BMT405B	IIOT	BMT405D	Operations Research

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

B.E. in Civil Engineering

Scheme of Teaching and Examinations2022

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2023-24)

V SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	HSMS	BCV501	Construction Management and Entrepreneurship	TD: CV PSB: CV	3	0	0		03	50	50	100	3
2	IPCC	BCV502	Geotechnical Engineering	TD: CV PSB: CV	3		2		03	50	50	100	4
3	IPCC	BCV503	Concrete Technology	TD: CV PSB: CV	3	0	2		03	50	50	100	4
4	PCCL	BCV504	Environmental Engineering Lab	TD: CV PSB: CV	0	0	2		03	50	50	100	1
5	PEC	BCV515x	Professional Elective Course	TD: CV PSB: CV	3	0	0		03	50	50	100	3
6	PROJ	BCV586	Mini Project/Extensive Survey Project	TD: CV PSB: CV	0	0	4		03	100		100	2
7	AEC	BRMK557	Research Methodology and IPR		2	2	0		02	50	50	100	3
8	MC	BESK508	Environmental Studies	TD: CV PSB: CV	2	0	0		02	50	50	100	2
9	MC	BNSK559	National Service Scheme (NSS)	NSS coordinator	0	0	2			100		100	0
		BPEK559	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		BYOK559	Yoga	Yoga Teacher									
									Total	**500**	**300**	**800**	**22**

Professional Elective Course

BCV515A	Numerical Methods in Civil Engineering	BCV515C	Solid Waste Management
BCV515B	Occupational Safety and Health Monitoring	BCV515D	Remote Sensing and GIS

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **UHV**: Universal Human Value Course, **MC**: Mandatory Course (Non-credit), **AEC**: Ability Enhancement Course, **SEC**: Skill Enhancement Course, **L:** Lecture, **T**: Tutorial, **P**: Practical **S= SDA**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation. **K :** The letter in the course code indicates common to al the stream of Engineering. **PROJ**: Project /Mini Project. **PEC**: Professional Elective Course

Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practicals of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (B.E./B.Tech.) 2022-23

National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), and Yoga(YOG) with the concerned coordinator of the course during the first Week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the Degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of Degree.

Mini-project work: Mini Project is a laboratory-oriented/hands on course that will provide a platform to students to enhance their practical knowledge and skills by the development of small systems/applications etc. Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary Mini- project can be assigned to an individual student or to a group having not more than 4 students.

CIE procedure for Mini-project:

(i) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two faculty members of the Department, one of them being the Guide. The CIE marks awarded for the Mini-project work shall be based on the evaluation of the project report, project presentation skill, and question and answer session in the ratio of 50:25:25. The marks awarded for the project report shall be the same for all the batches mates.

(ii) Interdisciplinary: Continuous Internal Evaluation shall be group-wise at the college level with the participation of all the guides of the project.

The CIE marks awarded for the Mini-project, shall be based on the evaluation of the project report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

No SEE component for Mini-Project.

Professional Elective Courses (PEC): A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of Engineering. Each group will provide an option to select one course. The minimum number of students' strengths for offering a professional elective is 10. However, this conditional shall not be applicable to cases where the admission to the program is less than 10.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

B.E. in Civil Engineering

Scheme of Teaching and Examinations2022

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2023-24)

VI SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture L	Tutorial T	Practical/ Drawing P	Self -Study S	Duration in hours	CIE Marks	SEE Marks	Total Marks	
1	IPCC	BCV601	Design of RCC Structures		3	0	2		03	50	50	100	4
2	PCC	BCV602	Irrigation Engineering and Hydraulic Structures		3	2	0		03	50	50	100	4
3	PEC	BCV613x	Professional Elective Course		3	0	0		03	50	50	100	3
4	OEC	BCV654x	Open Elective Course		3	0	0		03	50	50	100	3
5	PROJ	BCV685	**Major Project Phase I**		0	0	4		03	100	--	100	2
6	PCCL	BCVL606	Software ApplicationLab		0	0	2		03	50	50	100	1
7	AEC/SDC	BCV657x	Ability Enhancement Course/Skill Development Course V		If the course is offered as a Theory				01	50	50	100	1
					1	0	0						
					If course is offered as a practical								
					0	0	2						
8	MC	BNSK658	National Service Scheme (NSS)	NSS coordinator	0	0	2			100	---	100	0
		BPEK658	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		BYOK658	Yoga	Yoga Teacher									
9	IKS	BIKS609	Indian Knowledge System		1	0	0		01	100	0	100	0
									Total	**500**	**300**	**800**	**18**

Professional Elective Course			
BCV613A	Design of Bridges	BCV613C	Applied Geotechnical Engineering
BCV613B	Design of formwork and scaffolding	BCV613D	Design and Construction of Highway Pavements

Open Elective Course			
BCV654A	Water conservation and Rainwater Harvesting	BCV654C	Integrated Waste Management for a Smart City

BCV654B	Geographic Information Systems	BCV654D	Sustainable Development Goals
Ability Enhancement Course / Skill Enhancement Course-V			
BCV657A	Building Information Modelling - Advanced	BCV657C	Data Analytics for Civil Engineers
BCV657B	Structural Health Monitoring Using Sensors	BCV657D	Quality Control and Quality Assurance

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **UHV**: Universal Human Value Course, **MC**: Mandatory Course (Non-credit), **AEC**: Ability Enhancement Course, **SEC**: Skill Enhancement Course, **L:** Lecture, **T**: Tutorial, **P**: Practical **S= SDA**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation. **K :** The letter in the course code indicates common to al the stream of Engineering. **PROJ**: Project /Mini Project. **PEC**: Professional Elective Course. **PROJ**: Project Phase -I, **OEC**: Open Elective Course

Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practicals of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (B.E./B.Tech.) 2022-23

National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), and Yoga(YOG) with the concerned coordinator of the course during the first Week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the Degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of Degree.

Professional Elective Courses (PEC): A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of Engineering. Each group will provide an option to select one course. The minimum number of students' strengths for offering professional electives is 10. However, this conditional shall not be applicable to cases where the admission to the program is less than 10.

Open Elective Courses:

Students belonging to a particular stream of Engineering and Technology are not entitled to the open electives offered by their parent Department. However, they can opt for an elective offered by other Departments, provided they satisfy the prerequisite condition if any. Registration to open electives shall be documented under the guidance of the Program Coordinator/ Advisor/Mentor. The minimum numbers of students' strength for offering Open Elective Course is 10. However, this condition shall not be applicable to class where the admission to the program is less than 10.

Project Phase-I : Students have to discuss with the mentor /guide and with their helphe/she has to complete the literature survey and prepare the report and finally define the problem statement for the project work.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

B.E. in Civil Engineering

Scheme of Teaching and Examinations2022

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2023-24)

Scheme A- VII SEMESTER (Swappable VII and VIII SEMESTER)

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	IPCC	BCV701	Design of Steel Structures		3	0	2		03	50	50	100	4
2	IPCC	BCV702	Estimation and Contract Management		3	2	0		03	50	50	100	4
3	PCC	BCV703	Prestressed Concrete		3	2	0		03	50	50	100	4
4	PEC	BCV714x	**Professional Elective Course**		3	0	0		03	50	50	100	3
5	OEC	BCV755x	**Open Elective Course**		3	0	0		01	50	50	100	3
6	PROJ	BCV786	**Major Project Phase-II**		0	0	12		03	100	100	200	6
										400	**300**	**700**	**24**

Professional Elective Course

BCV714A	Intelligent Transportation Systems	BCV714C	Design and Execution of Pile Foundations
BCV714B	Earthquake Resistant Structures	BCV714D	Building services-hvac,acoustics and fire safety

Open Elective Course

BCV755A	Road Safety Engineering	BCV755C	Energy Efficiency, Acoustics And Daylighting In Building
BCV755B	Conservation Of Natural Resources	BCV755D	Precast Members – Systems & Construction

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **PEC**: Professional Elective Course, **OEC**: Open Elective Course PR: Project Work, **L:** Lecture, **T**: Tutorial, **P**: Practical **S= SDA**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation. **TD-** Teaching Department, **PSB**: Paper Setting department, **OEC**: Open Elective Course, **PEC**: Professional Elective Course. **PROJ**: Project work

Note: VII and VIII semesters of IV years of the program

(1) Institutions can swap the VII and VIII Semester Schemes of Teaching and Examinations to accommodate research internships/ industry internships after the VI semester.

(2) Credits earned for the courses of VII and VIII Semester Scheme of Teaching and Examinations shall be counted against the corresponding semesters whether the VII

or VIII semesters is completed during the beginning of the IV year or the later part of IV years of the program.
Professional Elective Courses (PEC): A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of Engineering. Each group will provide an option to select one course. The minimum number of students' strengths for offering professional electives is 10. However, this conditional shall not be applicable to cases where the admission to the program is less than 10.
Open Elective Courses: Students belonging to a particular stream of Engineering and Technology are not entitled to the open electives offered by their parent Department. However, they can opt for an elective offered by other Departments, provided they satisfy the prerequisite condition if any. Registration to open electives shall be documented under the guidance of the Program Coordinator/ Advisor/Mentor. The minimum numbers of students' strength for offering Open Elective Course is 10. However, this condition shall not be applicable to class where the admission to the program is less than 10.
PROJECT WORK (21CVP75): The objective of the Project work is **(i)** To encourage independent learning and the innovative attitude of the students. **(ii)** To develop interactive attitude, communication skills, organization, time management, and presentation skills. **(iii)** To impart flexibility and adaptability. **(iv)** To inspire team working. **(v)** To expand intellectual capacity, credibility, judgment and intuition. **(vi)** To adhere to punctuality, setting and meeting deadlines. **(vii)** To install responsibilities to oneself and others. **(viii)**To train students to present the topic of project work in a seminar without any fear, face the audience confidently, enhance communication skills, involve in group discussion to present and exchange ideas. **CIE procedure for Project Work:** **(1) Single discipline:** The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide. The CIE marks awarded for the project work, shall be based on the evaluation of the project work Report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates. **(2) Interdisciplinary:** Continuous Internal Evaluation shall be group-wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable. The CIE marks awarded for the project work, shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates. **SEE procedure for Project Work:** SEE for project work will be conducted by the two examiners appointed by the University. The SEE marks awarded for the project work

shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

B.E. in Civil Engineering

Scheme of Teaching and Examinations2022

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2023-24)

Scheme A- VIIISEMESTER (Swappable VII and VIII SEMESTER)

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	PEC	BCV801x	**Professional Elective (Online Courses)**		3	0	0		03	50	50	100	3
2	OEC	BCV802x	**Open Elective (Online Courses)**		3	0	0		01	50	50	100	3
3	INT	BCV803	**Internship (Industry/Research) (14 - 20 Weeks)**		0	0	12		03	100	100	200	10
										200	**200**	**400**	**16**

Professional Elective Course (Online courses)

BCV801A	Deep Excavation and Tunnels	BCV801C	Project management and finance
BCV801B	Advanced Design of RCC Structures	BCV801D	Metro and Seaports Engineering

Open Elective Courses (Online Courses)

BCV802A	Energy Conservation in Buildings	BCV802C	Green Buildings
BCV802B	Occupational Health and Safety	BCV802D	Integrated Building Services

L: Lecture, **T**: Tutorial, **P**: Practical **S= SDA**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation. **TD-** Teaching Department, **PSB**: Paper Setting department, **OEC**: Open Elective Course, **PEC**: Professional Elective Course. **PROJ**: Project work, **INT**: Industry Internship / Research Internship / Rural Internship

Note: VII and VIII semesters of IV years of the program

Swapping Facility

- Institutions can swap VII and VIII Semester Scheme of Teaching and Examinations to accommodate **research internships/ industry internships/Rural Internship** after the VI semester**.**
- Credits earned for the courses of VII and VIII Semester Scheme of Teaching and Examinations shall be counted against the corresponding semesters whether VII or VIII semester is completed during the beginning of IV year or later part of IV year of the program.

Elucidation:

At the beginning of IV years of the program i.e., after VI semester, VII semester classwork and VIII semester **Research Internship /Industrial Internship / Rural Internship** shall be permitted to be operated simultaneously by the University so that students have ample opportunity for an internship. In other words, a good percentage of the class shall attend VII semester classwork and a similar percentage of others shall attend to Research Internship or Industrial Internship or Rural Internship.

Research/Industrial /Rural Internship shall be carried out at an Industry, NGO, MSME, Innovation center, Incubation center, Start-up, center of Excellence (CoE), Study Centre established in the parent institute and /or at reputed research organizations/institutes.

The mandatory Research internship /Industry internship / Rural Internship is for 14 to 20 Weeks. The internship shall be considered as a head of passing and shall be considered for the award of a Degree. Those, who do not take up/complete the internship shall be declared to fail and shall have to complete it during the subsequent University examination after satisfying the internship requirements.

Research internship: A research internship is intended to offer the flavour of current research going on in the research field. It helps students get familiarized with the field and imparts the skill required for carrying out research.

Industry internship: Is an extended period of work experience undertaken by students to supplement their Degree for professional development. It also helps them learn to overcome unexpected obstacles and successfully navigate organizations, perspectives, and cultures. Dealing with contingencies helps students recognize, appreciate, and adapt to organizational realities by tempering their knowledge with practical constraints.

Rural Internship: Rural development internship is an initiative of Unnat Bharat Abhiyan Cell, RGIT in association with AICTE to involve students of all departments studying in different academic years for exploring various opportunities in techno-social fields, to connect and work with Rural India for their upliftment.

The faculty coordinator or mentor has to monitor the student's internship progress and interact with them to guide for the successful completion of the internship.

The students are permitted to carry out the internship anywhere in India or abroad. University shall not bear any expenses incurred in respect of the internship.

With the consent of the internal guide and Principal of the Institution, students shall be allowed to carry out the internship at their hometown (**within or outside the state or abroad**), provided favorable facilities are available for the internship and the student remains regularly in contact with the internal guide. **University shall not bear any cost involved in carrying out the internship by students.** However, students can receive any financial assistance extended by the organization.

Professional Elective /Open Elective Course: These are ONLINE courses suggested by the respective Board of Studies. Details of these courses shall be made available for students on the VTU web portal.

<table>
<tr><td colspan="16">VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
B.E. in the title of the program
Scheme of Teaching and Examinations2022
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<tr><td colspan="16">**Scheme B-VI SEMESTER for the candidates who seek a two-semester internship with project work /Start-up**</td></tr>
<tr><td rowspan="3">Sl. No</td><td rowspan="3" colspan="2">Course and Course Code</td><td rowspan="3">Course Title</td><td rowspan="3">Teaching Department (TD) and Question Paper Setting Board (PSB)</td><td colspan="4">Teaching Hours /Week</td><td colspan="4">Examination</td><td rowspan="3">Credits</td></tr>
<tr><td>Theory Lecture</td><td>Tutorial</td><td>Practical/ Drawing</td><td>SDA</td><td rowspan="2">Duration in hours</td><td rowspan="2">CIE Marks</td><td rowspan="2">SEE Marks</td><td rowspan="2">Total Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>S</td></tr>
<tr><td>1</td><td>IPCC</td><td>BXX601</td><td></td><td></td><td>3</td><td>0</td><td>2</td><td></td><td>03</td><td>50</td><td>50</td><td>100</td><td>4</td></tr>
<tr><td>2</td><td>PCC</td><td>BXX602</td><td></td><td></td><td>4</td><td>0</td><td>0</td><td></td><td>03</td><td>50</td><td>50</td><td>100</td><td>4</td></tr>
<tr><td>3</td><td>PEC</td><td>BXX613x</td><td>Professional Elective Course</td><td></td><td>3</td><td>0</td><td>0</td><td></td><td>03</td><td>50</td><td>50</td><td>100</td><td>3</td></tr>
<tr><td>4</td><td>OEC</td><td>BXX654x</td><td>Open Elective Course</td><td></td><td>3</td><td>0</td><td>0</td><td></td><td>03</td><td>50</td><td>50</td><td>100</td><td>3</td></tr>
<tr><td>5</td><td>PCCL</td><td>BXXL606</td><td>Lab component</td><td></td><td>0</td><td>0</td><td>2</td><td></td><td>03</td><td>50</td><td>50</td><td>100</td><td>1</td></tr>
<tr><td rowspan="4">6</td><td rowspan="4">AEC/SDC</td><td rowspan="4">BXX657x</td><td rowspan="4">Ability Enhancement Course/Skill Development Course V</td><td rowspan="4"></td><td colspan="4">If the course is offered as a Theory</td><td rowspan="4">01</td><td rowspan="4">50</td><td rowspan="4">50</td><td rowspan="4">100</td><td rowspan="4">1</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td></td></tr>
<tr><td colspan="4">If course is offered as a practical</td></tr>
<tr><td>0</td><td>0</td><td>2</td><td></td></tr>
<tr><td rowspan="3">7</td><td rowspan="3">MC</td><td>BNSK658</td><td>National Service Scheme (NSS)</td><td>NSS coordinator</td><td rowspan="3">0</td><td rowspan="3">0</td><td rowspan="3">2</td><td></td><td></td><td rowspan="3">100</td><td rowspan="3">---</td><td rowspan="3">100</td><td rowspan="3">0</td></tr>
<tr><td>BPEK658</td><td>Physical Education (PE) (Sports and Athletics)</td><td>Physical Education Director</td><td></td><td></td></tr>
<tr><td>BYOK658</td><td>Yoga</td><td>Yoga Teacher</td><td></td><td></td></tr>
<tr><td>8</td><td>IKS</td><td>BIKS609</td><td>Indian Knowledge System</td><td></td><td>1</td><td>0</td><td>0</td><td></td><td>01</td><td>100</td><td>0</td><td>100</td><td>0</td></tr>
<tr><td colspan="9"></td><td>**Total**</td><td>**500**</td><td>**300**</td><td>**800**</td><td>**16**</td></tr>
</table>

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

B.E. in the title of the program

Scheme of Teaching and Examinations2022

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2023-24)

Scheme BVII and VIII semesters for the candidateswho seek an internship with project work

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	SDA	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	IPCC	BXX701	To be completed in 5th/6th semester		3	0	2		03	50	50	100	4
2	IPCC	BXX702	To be completed in 5th /6th semester		3	0	2		03	50	50	100	4
3	PCC	BXX703	To be completed in the 6th semester		4	0	0		03	50	50	100	3
4	PEC	BXX714x	Professional Elective Course (MOOC Courses)		3	0	0		03	50	50	100	3
5	OEC	BXX755x	Open Elective Courses (MOOC courses)		3	0	0		01	50	50	100	3
1	PEC	Bxx801x	Professional Elective (MOOC Courses)		3	0	0		03	50	50	100	3
2	OEC	Bxx802x	Open Elective (MOOC Courses)		3	0	0		01	50	50	100	3
3	PROJ	BXX883	Project - outcome of training		0	0	12		03	100	100	200	9
4	INT	Bxx804	Internship (Industry/Research) (02 semesters)		0	0	12		03	100	100	200	10
										200	**200**	**400**	**42**

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

B.E. in Electrical & Electronics Engineering

Scheme of Teaching and Examinations2022

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2023-24)

V SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	HSMS	BEE501	Engineering Management and Entrepreneurship	Any branch /EEE	3	0	0		03	50	50	100	3
2	IPCC	BEE502	Signals & DSP	EEE	3	0	2		03	50	50	100	4
3	PCC	BEE503	Power Electronics	EEE	4	0	0		03	50	50	100	4
4	PCCL	BEEL504	Power Electronics Lab	EEE	0	0	2		03	50	50	100	1
5	PEC	BEE515x	Professional Elective Course	EEE	3	0	0		03	50	50	100	3
6	PROJ	BEE586	Mini Project	EEE	0	0	4		03	100		100	2
7	AEC	BRMK557	Research Methodology and IPR	Any Department	2	2	0		02	50	50	100	3
8	MC	BESK508	Environmental Studies	TD: Civil/Biotech/Chemistry PSB: As specified by the University	2	0	0		02	50	50	100	2
9	MC	BNSK559	National Service Scheme (NSS)	NSS coordinator	0	0	2			100		100	0
		BPEK559	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		BYOK559	Yoga	Yoga Teacher									
									Total	550	350	900	22

Professional Elective Course			
BEE515A	High Voltage Engineering	BEE515C	Electric Vehicle Fundamentals
BEE515B	Power Electronics for Renewable Energy Systems	BEE515D	Fundamentals of VLSI Design

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **UHV**: Universal Human Value Course, **MC**: Mandatory Course (Non-credit), **AEC**: Ability Enhancement Course, **SEC**: Skill Enhancement Course, **L:** Lecture, **T**: Tutorial, **P**: Practical **S= SDA**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation. **K :** The letter in the course code indicates common to al the stream of engineering. **PROJ**: Project /Mini Project. **PEC**: Professional Elective Course

Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practicals of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (B.E./B.Tech.) 2022-23

National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), and Yoga(YOG) with the concerned coordinator of the course during the first week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree.

Mini-project work: Mini Project is a laboratory-oriented/hands on course that will provide a platform to students to enhance their practical knowledge and skills by the development of small systems/applications etc. Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary Mini- project can be assigned to an individual student or to a group having not more than 4 students.

CIE procedure for Mini-project:

(i) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two faculty members of the Department, one of them being the Guide. The CIE marks awarded for the Mini-project work shall be based on the evaluation of the project report, project presentation skill, and question and answer session in the ratio of 50:25:25. The marks awarded for the project report shall be the same for all the batches mates.

(ii) Interdisciplinary: Continuous Internal Evaluation shall be group-wise at the college level with the participation of all the guides of the project.

The CIE marks awarded for the Mini-project, shall be based on the evaluation of the project report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

No SEE component for Mini-Project.

Professional Elective Courses (PEC): A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an option to select one course. The minimum number of students' strengths for offering a professional elective is 10. However, this conditional shall not be applicable to cases where the admission to the program is less than 10.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

B.E. in Electrical & Electronics Engineering

Scheme of Teaching and Examinations2022

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2023-24)

VI SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week: Theory Lecture (L)	Tutorial (T)	Practical/ Drawing (P)	Self -Study (S)	Examination: Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
1	IPCC	BEE601	Power system Analysis - I	EEE	3	0	2		03	50	50	100	4
2	PCC	BEE602	Control Systems	EEE	3	2	0		03	50	50	100	4
3	PEC	BEE613x	Professional Elective Course	EEE	3	0	0		03	50	50	100	3
4	OEC	BEE654x	Open Elective Course	EEE	3	0	0		03	50	50	100	3
5	PROJ	BEE685	Project Phase I	EEE	0	0	4		03	100	--	100	2
6	PCCL	BEEL606	Control System Lab	EEE	0	0	2		03	50	50	100	1
7	AEC/SDC	BEE657x	Ability Enhancement Course/Skill Development Course - V	EEE	If the course is Theory				01	50	50	100	1
					1	0	0						
					If course is practical				02				
					0	0	2						
8	MC	BNSK658	National Service Scheme (NSS)	NSS coordinator	0	0	2			100	---	100	0
		BPEK658	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		BYOK658	Yoga	Yoga Teacher									
9	MC	IKS	Indian Knowledge System		1	0	0			100	0	100	0
									Total	**500**	**300**	**800**	**18**

Professional Elective Course

BEE613A	Medium Voltage Substation Design	BEE613C	FACTS and HVDC Transmission
BEE613B	Embedded SystemDesign	BEE613D	Electric Motor and Drive Systems for Electric Vehicles

Open Elective Course			
BEE654A	Utilization of Electrical Power	BEE654C	Industrial Servo Control Systems
BEE654B	Technologies of Renewable Energy Sources	BEE654D	Semiconductor Devices
Ability Enhancement Course / Skill Enhancement Course-V			
BEE657A	Energy Management in Electric Vehicles	BEEL657C	Energy Audit Project
BEEL657B	Simulation of Control of Power Electronics Circuits	BEEL657D	Project on Renewable Energy Sources

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **UHV**: Universal Human Value Course, **MC**: Mandatory Course (Non-credit), **AEC**: Ability Enhancement Course, **SEC**: Skill Enhancement Course, **L:** Lecture, **T**: Tutorial, **P**: Practical **S= SDA**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation. **K :** The letter in the course code indicates common to all the stream of engineering. **PROJ**: Project /Mini Project. **PEC**: Professional Elective Course. **PROJ**: Project Phase -I, **OEC**: Open Elective Course

Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practicals of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (B.E./B.Tech.) 2022-23

National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), and Yoga(YOG) with the concerned coordinator of the course during the first week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree.

Professional Elective Courses (PEC): A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an option to select one course. The minimum number of students' strengths for offering professional electives is 10. However, this conditional shall not be applicable to cases where the admission to the program is less than 10. As there are 5 verticals with four courses in each vertical, **Mentors are required to guide students in deciding PEC as per verticals.**

Open Elective Courses:

Students belonging to a particular stream of Engineering and Technology are not entitled to the open electives offered by their parent Department. However, they can opt for an elective offered by other Departments, provided they satisfy the prerequisite condition if any. Registration to open electives shall be documented under the guidance of the Program Coordinator/ Advisor/Mentor. The minimum numbers of students' strength for offering Open Elective Course is 10. However, this condition shall not be applicable to class where the admission to the program is less than 10.

Project Phase-I : Students have to discuss with the mentor /guide and with their help he/she has to complete the literature survey and prepare the report and finally define the problem statement for the project work.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

B.E. in Electrical & Electronics Engineering

Scheme of Teaching and Examinations2022

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2023-24)

SCHEME -A-VII SEMESTER (Swappable VII and VIII SEMESTER)

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	IPCC	BEE701	Switchgear and Protection	EEE	3	0	2		03	50	50	100	4
2	PCC	BEE702	Industrial Drives and Applications	EEE	4	0	0		03	50	50	100	4
3	IPCC	BEE703	Power system analysis- II	EEE	3	0	2		03	50	50	100	4
4	PEC	BEE714x	Professional Elective Course	EEE	3	0	0		03	50	50	100	3
5	OEC	BEE755x	Open Elective Course	EEE	3	0	0		03	50	50	100	3
6	PROJ	BEE786	Major Project Phase-II	EEE	0	0	12		03	100	100	200	6
										350	**350**	**700**	**24**

Professional Elective Course

BEE714A	Power System Operation and Control	BEE714C	Programmable Logic Controllers
BEE714B	AI Techniques for Electric and Hybrid Electric Vehicles	BEE714D	Big Data Analytics in Power Systems

Open Elective Course

BEE755A	Electric Vehicle Technologies	BEE755C	PLC and SCADA
BEE755B	Energy Conservation and Audit	BEE755D	Optimisation Techniques

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **PEC**: Professional Elective Course, **OEC**: Open Elective Course PR: Project Work, **L:** Lecture, **T**: Tutorial, **P**: Practical **S= SDA**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation. **TD-** Teaching Department, **PSB**: Paper Setting department, **OEC**: Open Elective Course, **PEC**: Professional Elective Course. **PROJ**: Project work

Note: VII and VIII semesters of IV years of the program

(1) Institutions can swap the VII and VIII Semester Schemes of Teaching and Examinations to accommodate research internships/ industry internships after the VI semester**.**

(2) Credits earned for the courses of VII and VIII Semester Scheme of Teaching and Examinations shall be counted against the corresponding semesters whether the VII or VIII semesters is completed during the beginning of the IV year or the later part of IV years of the program.

Professional Elective Courses (PEC): A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an option to select one course. The minimum number of students' strengths for offering professional electives is 10. However, this conditional shall not be applicable to cases where the admission to the program is less than 10.
Open Elective Courses: Students belonging to a particular stream of Engineering and Technology are not entitled to the open electives offered by their parent Department. However, they can opt for an elective offered by other Departments, provided they satisfy the prerequisite condition if any. Registration to open electives shall be documented under the guidance of the Program Coordinator/ Advisor/Mentor. The minimum numbers of students' strength for offering Open Elective Course is 10. However, this condition shall not be applicable to class where the admission to the program is less than 10.
PROJECT WORK (21XXP75): The objective of the Project work is **(i)** To encourage independent learning and the innovative attitude of the students. **(ii)** To develop interactive attitude, communication skills, organization, time management, and presentation skills. **(iii)** To impart flexibility and adaptability. **(iv)** To inspire team working. **(v)** To expand intellectual capacity, credibility, judgment and intuition. **(vi)** To adhere to punctuality, setting and meeting deadlines. **(vii)** To install responsibilities to oneself and others. **(viii)**To train students to present the topic of project work in a seminar without any fear, face the audience confidently, enhance communication skills, involve in group discussion to present and exchange ideas. **CIE procedure for Project Work:** **(1) Single discipline:** The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide. The CIE marks awarded for the project work, shall be based on the evaluation of the project work Report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates. **(2) Interdisciplinary:** Continuous Internal Evaluation shall be group-wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable. The CIE marks awarded for the project work, shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates. **SEE procedure for Project Work:** SEE for project work will be conducted by the two examiners appointed by the University. The SEE marks awarded for the project work shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

B.E. in Electrical & Electronics Engineering

Scheme of Teaching and Examinations2022

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2023-24)

SCHEME -AVIIISEMESTER (Swappable VII and VIII SEMESTER)

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	PEC	BEE801x	**Professional Elective (Online Courses)**	EEE	3	0	0		03	50	50	100	3
2	OEC	BEE802x	**Open Elective (Online Courses)**	EEE	0	2	0		01	50	50	100	3
3	INT	BEE803	**Internship (Industry/Research) (14 - 20 weeks)**		0	0	12		03	100	100	200	10
										200	**200**	**400**	**16**

Professional Elective Course (Online courses)

BEE801A	NPTEL /MOOCS	BEE801D	NPTEL /MOOCS
BEE801B	NPTEL /MOOCS	BEE801E	NPTEL /MOOCS
BEE801C	NPTEL /MOOCS		

Open Elective Courses (Online Courses)

BEE802A	Industry suggested course/ MOOCS	BEE802C	NPTEL /MOOCS
BEE802B	Industry suggested course / MOOCS	BEE802D	NPTEL MOOCS

L: Lecture, **T**: Tutorial, **P**: Practical **S= SDA**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation. **TD-** Teaching Department, **PSB**: Paper Setting department, **OEC**: Open Elective Course, **PEC**: Professional Elective Course. **PROJ**: Project work, **INT**: Industry Internship / Research Internship / Rural Internship

Note: VII and VIII semesters of IV years of the program

Swapping Facility

- Institutions can swap VII and VIII Semester Scheme of Teaching and Examinations to accommodate **research internships/ industry internships/Rural Internship** after the VI semester**.**
- Credits earned for the courses of VII and VIII Semester Scheme of Teaching and Examinations shall be counted against the corresponding semesters whether VII or VIII semester is completed during the beginning of IV year or later part of IV year of the program.

Elucidation:

At the beginning of IV years of the program i.e., after VI semester, VII semester class work and VIII semester **Research Internship /Industrial Internship / Rural Internship** shall be permitted to be operated simultaneously by the University so that students have ample opportunity for an internship. In other words, a good percentage of the class shall attend VII semester classwork and a similar percentage of others shall attend to Research Internship or Industrial Internship or Rural Internship.

Research/Industrial /Rural Internship shall be carried out at an Industry, NGO, MSME, Innovation center, Incubation center, Start-up, center of Excellence (CoE), Study Centre established in the parent institute and /or at reputed research organizations/institutes.

The mandatory Research internship /Industry internship / Rural Internship is for 14 to 20 weeks. The internship shall be considered as a head of passing and shall be considered for the award of a degree. Those, who do not take up/complete the internship shall be declared to fail and shall have to complete it during the subsequent University examination after satisfying the internship requirements.

Research internship: A research internship is intended to offer the flavor of current research going on in the research field. It helps students get familiarized with the field and imparts the skill required for carrying out research.

Industry internship: Is an extended period of work experience undertaken by students to supplement their degree for professional development. It also helps them learn to overcome unexpected obstacles and successfully navigate organizations, perspectives, and cultures. Dealing with contingencies helps students recognize, appreciate, and adapt to organizational realities by tempering their knowledge with practical constraints.

Rural Internship: Rural development internship is an initiative of Unnat Bharat Abhiyan Cell, RGIT in association with AICTE to involve students of all departments studying in different academic years for exploring various opportunities in techno-social fields, to connect and work with Rural India for their upliftment.

The faculty coordinator or mentor has to monitor the student's internship progress and interact with them to guide for the successful completion of the internship.

The students are permitted to carry out the internship anywhere in India or abroad. University shall not bear any expenses incurred in respect of the internship.

With the consent of the internal guide and Principal of the Institution, students shall be allowed to carry out the internship at their hometown (**within or outside the state or abroad**), provided favorable facilities are available for the internship and the student remains regularly in contact with the internal guide. **University shall not bear any cost involved in carrying out the internship by students.** However, students can receive any financial assistance extended by the organization.

Professional Elective /Open Elective Course: These are ONLINE courses suggested by the respective Board of Studies. Details of these courses shall be made available for students on the VTU web portal.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

B.E. in the title of the program

Scheme of Teaching and Examinations2022

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2023-24)

Scheme B-**VI SEMESTER for the candidates who seek a two-semester internship with project work /Start-up**

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	SDA	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	IPCC	BXX601	Power system Analysis - I		3	0	2		03	50	50	100	4
2	PCC	BXX602	Control Systems		4	0	0		03	50	50	100	4
3	PEC	BXX613x	Professional Elective Course		3	0	0		03	50	50	100	3
4	OEC	BXX654x	Open Elective Course		3	0	0		03	50	50	100	3
5	PCCL	BXXL606	Control System Lab		0	0	2		03	50	50	100	1
6	AEC/SDC	BXX657x	Ability Enhancement Course/Skill Development Course V		If the course is offered as a Theory				01	50	50	100	1
					1	0	0						
					If course is offered as a practical								
					0	0	2						
7	MC	BNSK658	National Service Scheme (NSS)	NSS coordinator	0	0	2			100	---	100	0
		BPEK658	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		BYOK658	Yoga	Yoga Teacher									
8	IKS	BIKS609	Indian Knowledge System		1	0	0		01	100	0	100	0
									Total	**500**	**300**	**800**	**16**

Professional Elective Course			
BEE613A	Medium Voltage Substation Design	BEE613C	FACTS and HVDC Transmission
BEE613B	Embedded SystemDesign	BEE613D	Electric Motor and Drive Systems for Electric Vehicles
Open Elective Course			
BEE654A	Utilization of Electrical Power	BEE654C	Industrial Servo Control Systems
BEE654B	Technologies of Renewable Energy Sources	BEE654D	Semiconductor Devices

Ability Enhancement Course / Skill Enhancement Course-V			
BEE657A	Energy Management in Electric Vehicles	BEEL657C	Project on Energy Audit
BEEL657B	Simulation of Control of Power Electronics Circuits	BEEL657D	Project on Renewable Energy Sources

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

B.E. in the title of the program

Scheme of Teaching and Examinations2022

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2023-24)

Scheme B VII and VIII semesters for the candidates who seek an internship with project work

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	SDA	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	IPCC	BXX701	To be completed in 5th/6th semester		3	0	2		03	50	50	100	4
2	IPCC	BXX702	To be completed in 5th /6th semester		3	0	2		03	50	50	100	4
3	PCC	BXX703	To be completed in the 6th semester		4	0	0		03	50	50	100	3
4	PEC	BXX714x	Professional Elective Course (MOOC Courses)		3	0	0		03	50	50	100	3
5	OEC	BXX755x	Open Elective Courses (MOOC courses)		3	0	0		01	50	50	100	3
1	PEC	Bxx801x	Professional Elective (MOOC Courses)		3	0	0		03	50	50	100	3
2	OEC	Bxx802x	Open Elective (MOOC Courses)		3	0	0		01	50	50	100	3
3	PROJ	BXX883	Project - outcome of training		0	0	12		03	100	100	200	9
4	INT	Bxx804	Internship (Industry/Research) (02 semesters)		0	0	12		03	100	100	200	10
										200	**200**	**400**	**42**

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

B.E. in Mechatronics Engineering

Scheme of Teaching and Examinations2022

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2023-24)

V SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	HSMS	BMT501	Industrial Management and Entrepreneurship	TD: Mechatronics PSB: Mechatronics	3	0	0		03	50	50	100	3
2	IPCC	BMT502	Micro and Smart System Technology	TD: Mechatronics PSB: Mechatronics	3	0	2		03	50	50	100	4
3	PCC	BMT503	Control Theory and Virtual Instrumentation	TD: Mechatronics PSB: Mechatronics	3	2	0		03	50	50	100	4
4	PCCL	BMT504L	Virtual Instrumentation Lab	TD: Mechatronics PSB: Mechatronics	0	0	2		03	50	50	100	1
5	PEC	BMT515x	Professional Elective Course	TD: Mechatronics PSB: Mechatronics	3	0	0		03	50	50	100	3
6	PROJ	BMT586	Mini Project	TD: Mechatronics PSB: Mechatronics	0	0	4		03	100		100	2
7	AEC	BRMK557	Research Methodology and IPR	TD: Mechatronics PSB: Mechatronics	2	2	0		03	50	50	100	3
8	MC	BESK508	Environmental Studies	TD: CV/Env/Chem PSB:CV	2	0	0		02	50	50	100	2
9	MC	BNSK559	National Service Scheme (NSS)	NSS coordinator	0	0	2			100		100	0
		BPEK559	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		BYOK559	Yoga	Yoga Teacher									
									Total	**500**	**300**	**800**	**22**

PCC: Professional Core Course, PCCL: Professional Core Course laboratory, UHV: Universal Human Value Course, MC: Mandatory Course (Non-credit), AEC: Ability Enhancement Course, SEC: Skill Enhancement Course, L: Lecture, T: Tutorial, P: Practical S= SDA: Skill Development Activity, CIE: Continuous Internal Evaluation, SEE:

Semester End Evaluation.K: This letter in the course code indicates common to all the stream of engineering. ESC: Engineering Science Course, ETC: Emerging Technology Course, PLC: Programming Language Course

Professional Elective Course			
BMT515A	Theory of Machines and Machine Design	BMT515C	Artificial Intelligence for Mechatronics
BMT515B	Computer Integrated Manufacturing	BMT515D	Mechatronics System Design

Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practical's of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (B.E./B.Tech.) 2022-23 may please be referred.

National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), and Yoga(YOG) with the concerned coordinator of the course during the first week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree.

Mini-project work: Mini Project is a laboratory-oriented/hands on course that will provide a platform to students to enhance their practical knowledge and skills by the development of small systems/applications etc. Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary Mini- project can be assigned to an individual student or to a group having not more than 4 students. CIE procedure for Mini-project: (i) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two faculty members of the Department, one of them being the Guide. The CIE marks awarded for the Mini-project work shall be based on the evaluation of the project report, project presentation skill, and question and answer session in the ratio of 50:25:25. The marks awarded for the project report shall be the same for all the batches mates. (ii) Interdisciplinary: Continuous Internal Evaluation shall be group-wise at the college level with the participation of all the guides of the project. The CIE marks awarded for the Mini-project, shall be based on the evaluation of the project report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates. No SEE component for Mini-Project.

Professional Elective Courses (PEC): A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an option to select one course. The minimum number of students' strengths for offering a professional elective is 10. However, this conditional shall not be applicable to cases where the admission to the program is less than 10.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

B.E. in Mechatronics Engineering

Scheme of Teaching and Examinations2022

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2023-24)

VI SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	IPCC	BMT601	Programmable Logic Controller and SCADA Technology	TD: Mechatronics PSB: Mechatronics	3	0	2		03	50	50	100	4
2	PCC	BMT602	Industrial Robotics	TD: Mechatronics PSB: Mechatronics	4	0	0		03	50	50	100	4
3	PEC	BMT613x	Professional Elective Course	TD: Mechatronics PSB: Mechatronics	3	0	0		03	50	50	100	3
4	OEC	BMT654x	Open Elective Course	TD: Mechatronics PSB: Mechatronics	3	0	0		03	50	50	100	3
5	PROJ	BMT685	Project Phase I	TD: Mechatronics PSB: Mechatronics	0	0	4		03	100	--	100	2
6	PCCL	BMT606L	Robotics Lab	TD: Mechatronics PSB: Mechatronics	0	0	2		03	50	50	100	1
7	AEC/SDC	BMT657x	Ability Enhancement Course/Skill Development Course V	TD: Mechatronics PSB: Mechatronics	If the course is offered as a Theory 1	 0	 0		01	50	50	100	1
					If course is offered as a practical 0	 0	 2						
8	MC	BNSK658	National Service Scheme (NSS)	NSS coordinator	0	0	2			100	---	100	0
		BPEK658	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		BYOK658	Yoga	Yoga Teacher									
9	MC	IKS	Indian Knowledge System		1	0	0			100	0	100	0
									Total	**500**	**300**	**800**	**18**

Professional Elective Course

BMT613A	Power Electronics	BMT613C	Automotive Electronics and Hybrid Vehicles

BMT613B	Smart Factory and Industry 4.0	BMT613D	Signal Processing
Open Elective Course			
BMT654A	Automation in Manufacturing	BMT654C	Mechatronics Engineering
BMT654B	Electric and Hybrid Vehicles	BMT654D	Micro Electro-Mechanical Systems
Ability Enhancement Course / Skill Enhancement Course-V			
BMT657A	MATLAB for Mechatronics (0-0-2)	BMT657C	Finite Element Modelling and Analysis (0-0-2)
BMT657B	Embedded systems (0-0-2)	BMT657D	AI and ML (0-0-2)

PCC: Professional Core Course, PCCL: Professional Core Course laboratory, UHV: Universal Human Value Course, MC: Mandatory Course (Non-credit), AEC: Ability Enhancement Course, SEC: Skill Enhancement Course, L: Lecture, T: Tutorial, P: Practical S= SDA: Skill Development Activity, CIE: Continuous Internal Evaluation, SEE: Semester End Evaluation. K : The letter in the course code indicates common to al the stream of engineering. PROJ: Project /Mini Project. PEC: Professional Elective Course. PROJ: Project Phase -I, OEC: Open Elective Course

Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practical of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (B.E./B.Tech.) 2022-23

National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), and Yoga(YOG) with the concerned coordinator of the course during the first week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree.

Professional Elective Courses (PEC): A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an option to select one course. The minimum number of students' strengths for offering professional electives is 10. However, this conditional shall not be applicable to cases where the admission to the program is less than 10.

Open Elective Courses: Students belonging to a particular stream of Engineering and Technology are not entitled to the open electives offered by their parent Department. However, they can opt for an elective offered by other Departments, provided they satisfy the prerequisite condition if any. Registration to open electives shall be documented under the guidance of the Program Coordinator/ Advisor/Mentor. The minimum numbers of students' strength for offering Open Elective Course is 10. However, this condition shall not be applicable to class where the admission to the program is less than 10.

Project Phase-I : Students have to discuss with the mentor /guide and with their help he/she has to complete the literature survey and prepare the report and finally define the problem statement for the project work.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

B.E. in Mechatronics Engineering

Scheme of Teaching and Examinations2022

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2023-24)

Scheme -A- VII SEMESTER (Swappable VII and VIII SEMESTER)

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	IPCC	BMT701	Thermal Engineering	TD: Mechatronics PSB: Mechatronics	3	0	2		03	50	50	100	4
2	IPCC	BMT702	Introduction to HDL	TD: Mechatronics PSB: Mechatronics	3	0	2		03	50	50	100	4
3	PCC	BMT703	Industrial Automation	TD: Mechatronics PSB: Mechatronics	4	0	0		03	50	50	100	4
4	PEC	BMT714x	Professional Elective Course	TD: Mechatronics PSB: Mechatronics	3	0	0		03	50	50	100	3
5	OEC	BMT755x	Open Elective Course	TD: Mechatronics PSB: Mechatronics	3	0	0		03	50	50	100	3
6	PROJ	BMT786	Major Project Phase-II	TD: Mechatronics PSB: Mechatronics	0	0	12		03	100	100	200	6
										400	**300**	**700**	**24**

Professional Elective Course

BMT714A	Digital Image Processing and Robot Vision	BMT714C	Control Systems and Engineering
BMT714B	Digital Controllers	BMT714D	Additive Manufacturing

Open Elective Course

BMT755A	Introduction to Smart Factory and Industry 4.0	BMT755C	Robotics for Industry
BMT755B	Virtual instrumentation	BMT755D	PLC and SCADA Technology

PCC: Professional Core Course, PCCL: Professional Core Course laboratory, PEC: Professional Elective Course, OEC: Open Elective Course PR: Project Work, L: Lecture, T: Tutorial, P: Practical S= SDA: Skill Development Activity, CIE: Continuous Internal Evaluation, SEE: Semester End Evaluation. TD- Teaching Department, PSB: Paper Setting department, OEC: Open Elective Course, PEC: Professional Elective Course. PROJ: Project work

Note: VII and VIII semesters of IV years of the program (1) Institutions can swap the VII and VIII Semester Schemes of Teaching and Examinations to accommodate research internships/ industry internships after the VI semester. (2) Credits earned for the courses of VII and VIII Semester Scheme of Teaching and Examinations shall be counted against the corresponding semesters whether the VII or VIII semesters is completed during the beginning of the IV year or the later part of IV years of the program.
Professional Elective Courses (PEC): A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an option to select one course. The minimum number of students' strengths for offering professional electives is 10. However, this conditional shall not be applicable to cases where the admission to the program is less than 10.
Open Elective Courses: Students belonging to a particular stream of Engineering and Technology are not entitled to the open electives offered by their parent Department. However, they can opt for an elective offered by other Departments, provided they satisfy the prerequisite condition if any. Registration to open electives shall be documented under the guidance of the Program Coordinator/ Advisor/Mentor. The minimum numbers of students' strength for offering Open Elective Course is 10. However, this condition shall not be applicable to class where the admission to the program is less than 10.
PROJECT WORK (21MEP75): The objective of the Project work is (i) To encourage independent learning and the innovative attitude of the students. (ii) To develop interactive attitude, communication skills, organization, time management, and presentation skills. (iii) To impart flexibility and adaptability. (iv) To inspire team working. (v) To expand intellectual capacity, credibility, judgment and intuition. (vi) To adhere to punctuality, setting and meeting deadlines. (vii) To install responsibilities to oneself and others. (viii) To train students to present the topic of project work in a seminar without any fear, face the audience confidently, enhance communication skills, involve in group discussion to present and exchange ideas. **CIE procedure for Project Work:** 1. Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide. The CIE marks awarded for the project work, shall be based on the evaluation of the project work Report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates. 2. Interdisciplinary: Continuous Internal Evaluation shall be group-wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable. The CIE marks awarded for the project work, shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates. SEE procedure for Project

Work: SEE for project work will be conducted by the two examiners appointed by the University. The SEE marks awarded for the project work shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

B.E. in Mechatronics Engineering

Scheme of Teaching and Examinations2022

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2023-24)

Scheme -A- VIII SEMESTER (Swappable VII and VIII SEMESTER)

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	PEC	BMT801x	Professional Elective (Online Courses)	TD: Mechatronics PSB: Mechatronics	3	0	0		03	50	50	100	3
2	OEC	BMT802x	Open Elective (Online Courses)	TD: Mechatronics PSB: Mechatronics	3	0	0		01	50	50	100	3
3	INT	BMT803	Internship (Industry/Research) (14 - 20 weeks)		0	0	12		03	100	100	200	10
										200	**200**	**400**	**16**

Professional Elective Course (Online courses)

BMT801A	Computer Vision (SWAYAM)	BMT801C	Machinery Fault Diagnosis and Signal Processing (NPTEL)
BMT801B	Electronic Systems Design: Hands-on Circuits and PCB Design with CAD Software (SWAYAM)	BMT801D	Mechanics and Control of Robotic Manipulators (NPTEL)

Open Elective Courses (Online Courses)

BMT802A	Transducers for instrumentation (NPTEL)	BMT802C	Computer Integrated Manufacturing (NPTEL)
BMT802B	Mechanics and Control of Robotic Manipulators (NPTEL)	BMT802D	Principles of Hydraulic Machines and System Design (SWAYAM)

L: Lecture, T: Tutorial, P: Practical S= SDA: Skill Development Activity, CIE: Continuous Internal Evaluation, SEE: Semester End Evaluation. TD- Teaching Department, PSB: Paper Setting department, OEC: Open Elective Course, PEC: Professional Elective Course. PROJ: Project work, INT: Industry Internship / Research Internship / Rural Internship

Note: VII and VIII semesters of IV years of the program Swapping Facility • Institutions can swap VII and VIII Semester Scheme of Teaching and Examinations to accommodate research internships/ industry internships/Rural Internship after the VI semester. • Credits earned for the courses of VII and VIII Semester Scheme of

Teaching and Examinations shall be counted against the corresponding semesters whether VII or VIII semester is completed during the beginning of IV year or later part of IV year of the program.
Elucidation: At the beginning of IV years of the program i.e., after VI semester, VII semester classwork and VIII semester Research Internship /Industrial Internship / Rural Internship shall be permitted to be operated simultaneously by the University so that students have ample opportunity for an internship. In other words, a good percentage of the class shall attend VII semester classwork and a similar percentage of others shall attend to Research Internship or Industrial Internship or Rural Internship. Research/Industrial /Rural Internship shall be carried out at an Industry, NGO, MSME, Innovation centre, Incubation centre, Start-up, centre of Excellence (CoE), Study Centre established in the parent institute and /or at reputed research organizations/institutes. The mandatory Research internship /Industry internship / Rural Internship is for 14 to 20 weeks. The internship shall be considered as a head of passing and shall be considered for the award of a degree. Those, who do not take up/complete the internship shall be declared to fail and shall have to complete it during the subsequent University examination after satisfying the internship requirements. Research internship: A research internship is intended to offer the flavour of current research going on in the research field. It helps students get familiarized with the field and imparts the skill required for carrying out research. Industry internship: Is an extended period of work experience undertaken by students to supplement their degree for professional development. It also helps them learn to overcome unexpected obstacles and successfully navigate organizations, perspectives, and cultures. Dealing with contingencies helps students recognize, appreciate, and adapt to organizational realities by tempering their knowledge with practical constraints. Rural Internship: Rural development internship is an initiative of Unnat Bharat Abhiyan Cell, RGIT in association with AICTE to involve students of all departments studying in different academic years for exploring various opportunities in techno-social fields, to connect and work with Rural India for their upliftment. The faculty coordinator or mentor has to monitor the student's internship progress and interact with them to guide for the successful completion of the internship. The students are permitted to carry out the internship anywhere in India or abroad. University shall not bear any expenses incurred in respect of the internship. With the consent of the internal guide and Principal of the Institution, students shall be allowed to carry out the internship at their hometown (within or outside the state or abroad), provided favourable facilities are available for the internship and the student remains regularly in contact with the internal guide. University shall not bear any cost involved in carrying out the internship by students. However, students can receive any financial assistance extended by the organization
Professional Elective /Open Elective Course: These are ONLINE courses suggested by the respective Board of Studies. Details of these courses shall be made available for students on the VTU web portal.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

B.E. in the title of the program

Scheme of Teaching and Examinations2022

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2023-24)

Scheme B-VI SEMESTER for the candidates who seek a two-semester internship with project work /Start-up

<table>
<tr><th rowspan="3">Sl. No</th><th rowspan="3" colspan="2">Course and Course Code</th><th rowspan="3">Course Title</th><th rowspan="3">Teaching Department (TD) and Question Paper Setting Board (PSB)</th><th colspan="4">Teaching Hours /Week</th><th colspan="4">Examination</th><th rowspan="3">Credits</th></tr>
<tr><th>Theory Lecture</th><th>Tutorial</th><th>Practical/ Drawing</th><th>SDA</th><th rowspan="2">Duration in hours</th><th rowspan="2">CIE Marks</th><th rowspan="2">SEE Marks</th><th rowspan="2">Total Marks</th></tr>
<tr><th>L</th><th>T</th><th>P</th><th>S</th></tr>
<tr><td>1</td><td>IPCC</td><td>BXX601</td><td>Programmable Logic Controller and SCADA Technology</td><td></td><td>3</td><td>0</td><td>2</td><td></td><td>03</td><td>50</td><td>50</td><td>100</td><td>4</td></tr>
<tr><td>2</td><td>PCC</td><td>BXX602</td><td>Industrial Robotics</td><td></td><td>4</td><td>0</td><td>0</td><td></td><td>03</td><td>50</td><td>50</td><td>100</td><td>4</td></tr>
<tr><td>3</td><td>PEC</td><td>BXX613x</td><td>Professional Elective Course</td><td></td><td>3</td><td>0</td><td>0</td><td></td><td>03</td><td>50</td><td>50</td><td>100</td><td>3</td></tr>
<tr><td>4</td><td>OEC</td><td>BXX654x</td><td>Open Elective Course</td><td></td><td>3</td><td>0</td><td>0</td><td></td><td>03</td><td>50</td><td>50</td><td>100</td><td>3</td></tr>
<tr><td>5</td><td>PCCL</td><td>BXXL606</td><td>Robotic Lab</td><td></td><td>0</td><td>0</td><td>2</td><td></td><td>03</td><td>50</td><td>50</td><td>100</td><td>1</td></tr>
<tr><td rowspan="4">6</td><td rowspan="4">AEC/SDC</td><td rowspan="4">BXX657x</td><td rowspan="4">Ability Enhancement Course/Skill Development Course V</td><td rowspan="4"></td><td colspan="4">If the course is offered as a Theory</td><td rowspan="4">01</td><td rowspan="4">50</td><td rowspan="4">50</td><td rowspan="4">100</td><td rowspan="4">1</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td></td></tr>
<tr><td colspan="4">If course is offered as a practical</td></tr>
<tr><td>0</td><td>0</td><td>2</td><td></td></tr>
<tr><td rowspan="3">7</td><td rowspan="3">MC</td><td>BNSK658</td><td>National Service Scheme (NSS)</td><td>NSS coordinator</td><td rowspan="3">0</td><td rowspan="3">0</td><td rowspan="3">2</td><td></td><td></td><td rowspan="3">100</td><td rowspan="3">---</td><td rowspan="3">100</td><td rowspan="3">0</td></tr>
<tr><td>BPEK658</td><td>Physical Education (PE) (Sports and Athletics)</td><td>Physical Education Director</td><td></td><td></td></tr>
<tr><td>BYOK658</td><td>Yoga</td><td>Yoga Teacher</td><td></td><td></td></tr>
<tr><td>8</td><td>IKS</td><td>BIKS609</td><td>Indian Knowledge System</td><td></td><td>1</td><td>0</td><td>0</td><td></td><td>01</td><td>100</td><td>0</td><td>100</td><td>0</td></tr>
<tr><td colspan="9"></td><td>Total</td><td>500</td><td>300</td><td>800</td><td>16</td></tr>
</table>

Professional Elective Course			
BMT613A	Power Electronics	BMT613C	Automotive Electronics and Hybrid Vehicles
BMT613B	Smart Factory and Industry 4.0	BMT613D	Signal Processing
Open Elective Course			
BMT654A	Automation in Manufacturing	BMT654C	Mechatronics Engineering

BMT654B	Electric and Hybrid Vehicles	BMT654D	Micro Electro-Mechanical Systems
Ability Enhancement Course / Skill Enhancement Course-V			
BMT657A	MATLAB for Mechatronics (0-0-2)	BMT657C	Finite Element Modelling and Analysis (0-0-2)
BMT657B	Embedded systems (0-0-2)	BMT657D	AI and ML (0-0-2)

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

B.E. in the title of the program

Scheme of Teaching and Examinations2022

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2023-24)

Scheme B VII and VIII semesters for the candidates who seek an internship with project work

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	SDA	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	IPCC	BXX701	To be completed in 5th/6th semester		3	0	2		03	50	50	100	4
2	IPCC	BXX702	To be completed in 5th /6th semester		3	0	2		03	50	50	100	4
3	PCC	BXX703	To be completed in the 6th semester		4	0	0		03	50	50	100	3
4	PEC	BXX714x	Professional Elective Course (MOOC Courses)		3	0	0		03	50	50	100	3
5	OEC	BXX755x	Open Elective Courses (MOOC courses)		3	0	0		01	50	50	100	3
1	PEC	Bxx801x	Professional Elective (MOOC Courses)		3	0	0		03	50	50	100	3
2	OEC	Bxx802x	Open Elective (MOOC Courses)		3	0	0		01	50	50	100	3
3	PROJ	BXX883	Project - outcome of training		0	0	12		03	100	100	200	9
4	INT	Bxx804	Internship (Industry/Research) (02 semesters)		0	0	12		03	100	100	200	10
										200	**200**	**400**	**42**

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

B.E. in Mechanical Engineering

Scheme of Teaching and Examinations2022

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2023-24)

V SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	HSMS	BME501	Industrial Management & Entrepreneurship	TD: ME PSB:ME	3	0	0		03	50	50	100	3
2	IPCC	BME502	Turbo machines	TD: ME PSB:ME	2	2	2		03	50	50	100	4
3	PCC	BME503	Theory of Machines	TD: ME PSB:ME	4	0	0		03	50	50	100	4
4	PCCL	BME504L	CNC Programming and 3-D Printing lab	TD: ME PSB:ME	0	0	2		03	50	50	100	1
5	PEC	BME515x	Professional Elective - I	TD: ME PSB:ME	3	0	0		03	50	50	100	3
6	PROJ	BME586	Mini Project	TD: ME PSB:ME	0	0	4		03	100		100	2
7	AEC	BRMK557	Research Methodology and IPR	Any Department	2	2	0		03	50	50	100	3
8	MC	BESK508	Environmental Studies	TD: CV/Env/Chem PSB:CV	2	0	0		02	50	50	100	2
		BNSK559	National Service Scheme (NSS)	NSS coordinator									
9	MC	BPEK559	Physical Education (PE) (Sports and Athletics)	Physical Education Director	0	0	2			100		100	0
		BYOK559	Yoga	Yoga Teacher									
									Total	**500**	**300**	**800**	**22**

Professional Elective Course

BME515A	Mechatronics	BME515C	Supply chain management & Introduction to SAP
BME515B	Automation in manufacturing	BME515D	Energy Engineering

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **UHV**: Universal Human Value Course, **MC**: Mandatory Course (Non-credit), **AEC**: Ability

Enhancement Course, **SEC**: Skill Enhancement Course, **L:** Lecture, **T**: Tutorial, **P**: Practical **S= SDA**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation. **K :** The letter in the course code indicates common to al the stream of engineering. **PROJ**: Project /Mini Project. **PEC**: Professional Elective Course
Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practical of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (B.E./B.Tech.) 2022-23 **National Service Scheme /Physical Education/Yoga:** All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), and Yoga(YOG) with the concerned coordinator of the course during the first week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree.
Mini-project work: Mini Project is a laboratory-oriented/hands on course that will provide a platform to students to enhance their practical knowledge and skills by the development of small systems/applications etc. Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary Mini- project can be assigned to an individual student or to a group having not more than 4 students. **CIE procedure for Mini-project:** **(i) Single discipline:** The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two faculty members of the Department, one of them being the Guide. The CIE marks awarded for the Mini-project work shall be based on the evaluation of the project report, project presentation skill, and question and answer session in the ratio of 50:25:25. The marks awarded for the project report shall be the same for all the batches mates. **(ii) Interdisciplinary:** Continuous Internal Evaluation shall be group-wise at the college level with the participation of all the guides of the project. The CIE marks awarded for the Mini-project, shall be based on the evaluation of the project report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates. **No SEE component for Mini-Project.**
Professional Elective Courses (PEC): A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an option to select one course. The minimum number of students' strengths for offering a professional elective is 10. However, this conditional shall not be applicable to cases where the admission to the program is less than 10.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

B.E. in Mechanical Engineering

scheme of Teaching and Examinations2022

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2023-24)

VI SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	IPCC	BME601	Heat Transfer	TD: ME PSB:ME	2	2	2		03	50	50	100	4
2	PCC	BME602	Machine Design	TD: ME PSB:ME	3	2	0		03	50	50	100	4
3	PEC	BME613x	Professional Elective - II	TD: ME PSB:ME	3	0	0		03	50	50	100	3
4	OEC	BME654x	Open Elective -I	TD: ME PSB:ME	3	0	0		03	50	50	100	3
5	PROJ	BME685	Major Project Phase - I	TD: ME PSB:ME	0	0	4		03	100	--	100	2
6	PCCL	BMEL606L	Design lab	TD: ME PSB:ME	0	0	2		03	50	50	100	1
7	AEC/SDC	BME657x	Ability Enhancement Course/Skill Development Course V		If the course is offered as a Theory				01	50	50	100	1
					1	0	0						
					If course is offered as a practical								
					0	0	2						
8	MC	BNSK658	National Service Scheme (NSS)	NSS coordinator	0	0	2			100	---	100	0
		BPEK658	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		BYOK658	Yoga	Yoga Teacher									
9	IKS	BIKS609	Indian Knowledge System		1	0	0		01	100	0	100	0
									Total	**500**	**300**	**800**	**18**

Professional Elective Course

BME613A	Total Quality Management	BME613C	MEMS and Microsystem Technology

BME613B	Refrigeration and Air Conditioning	BME613D	Design for Manufacturing and Assembly
Open Elective Course			
BME654A	Project Management	BME654C	Introduction to Mechatronics
BME654B	Renewable Energy Power plants	BME654D	Modern Mobility
Ability Enhancement Course / Skill Enhancement Course-V			
BME657A	Basics of Matlab [0-0-2]	BME657C	Simulation and Analysis using Ansys workbench [0-0-2]
BME657B	Fundamental of Virtual Reality ARP Development	BME657D	Introduction Augmented Reality

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **UHV**: Universal Human Value Course, **MC**: Mandatory Course (Non-credit), **AEC**: Ability Enhancement Course, **SEC**: Skill Enhancement Course, **L:** Lecture, **T**: Tutorial, **P**: Practical **S= SDA**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation. **K :** The letter in the course code indicates common to al the stream of engineering. **PROJ**: Project /Mini Project. **PEC**: Professional Elective Course. **PROJ**: Project Phase -I, **OEC**: Open Elective Course

Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practical of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (B.E./B.Tech.) 2022-23

National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), and Yoga(YOG) with the concerned coordinator of the course during the first week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree.

Professional Elective Courses (PEC): A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an option to select one course. The minimum number of students' strengths for offering professional electives is 10. However, this conditional shall not be applicable to cases where the admission to the program is less than 10.

Open Elective Courses:

Students belonging to a particular stream of Engineering and Technology are not entitled to the open electives offered by their parent Department. However, they can opt for an elective offered by other Departments, provided they satisfy the prerequisite condition if any. Registration to open electives shall be documented under the guidance of the Program Coordinator/ Advisor/Mentor. The minimum numbers of students' strength for offering Open Elective Course is 10. However, this condition shall not be applicable to class where the admission to the program is less than 10.

Project Phase-I : Students have to discuss with the mentor /guide and with their help he/she has to complete the literature survey and prepare the report and finally define the problem statement for the project work.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

B.E. in Mechanical Engineering

Scheme of Teaching and Examinations2022

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2023-24)

Scheme A- VIISEMESTER (Swappable VII and VIII SEMESTER)

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	IPCC	BME701	Finite Element Methods	TD: ME PSB:ME	3	0	2		03	50	50	100	4
2	IPCC	BME702	Hydraulics and Pneumatics	TD: ME PSB:ME	3	0	2		03	50	50	100	4
3	PCC	BME703	Control Engineering	TD: ME PSB:ME	4	0	0		03	50	50	100	4
4	PEC	BME714x	**Professional Elective-III**	TD: ME PSB:ME	3	0	0		03	50	50	100	3
5	OEC	BME755x	**Open Elective- II**	TD: ME PSB:ME	3	0	0		01	50	50	100	3
6	PROJ	BME786	**Major Project Phase-II**		0	0	12		03	100	100	200	6
										400	**300**	**700**	**24**

Professional Elective Course

BME714A	Additive manufacturing	BME714C	IC Engines
BME714B	Product Design and Management	BME714D	Cryogenics

Open Elective Course

BME755A	Introduction to Non-Traditional machining	BME755C	Operations Research
BME755B	Basics of Hydraulics and Pneumatics	BME755D	Non-Conventional Energy Resources

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **PEC**: Professional Elective Course, **OEC**: Open Elective Course PR: Project Work, **L:** Lecture, **T**: Tutorial, **P**: Practical **S= SDA**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation. **TD-** Teaching Department, **PSB**: Paper Setting department, **OEC**: Open Elective Course, **PEC**: Professional Elective Course. **PROJ**: Project work

Note: VII and VIII semesters of IV years of the program

(1) Institutions can swap the VII and VIII Semester Schemes of Teaching and Examinations to accommodate research internships/ industry internships after the VI semester**.**

(2) Credits earned for the courses of VII and VIII Semester Scheme of Teaching and Examinations shall be counted against the corresponding semesters whether the VII or VIII semesters is completed during the beginning of the IV year or the later part of IV years of the program.

Professional Elective Courses (PEC): A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an option to select one course. The minimum number of students' strengths for offering professional electives is 10. However, this conditional shall not be applicable to cases where the admission to the program is less than 10.

Open Elective Courses:

Students belonging to a particular stream of Engineering and Technology are not entitled to the open electives offered by their parent Department. However, they can opt for an elective offered by other Departments, provided they satisfy the prerequisite condition if any. Registration to open electives shall be documented under the guidance of the Program Coordinator/ Advisor/Mentor. The minimum numbers of students' strength for offering Open Elective Course is 10. However, this condition shall not be applicable to class where the admission to the program is less than 10.

PROJECT WORK (21MEP75): The objective of the Project work is

- **(i)** To encourage independent learning and the innovative attitude of the students.
- **(ii)** To develop interactive attitude, communication skills, organization, time management, and presentation skills.
- **(iii)** To impart flexibility and adaptability.
- **(iv)** To inspire team working.
- **(v)** To expand intellectual capacity, credibility, judgment and intuition.
- **(vi)** To adhere to punctuality, setting and meeting deadlines.
- **(vii)** To install responsibilities to oneself and others.
- **(viii)**To train students to present the topic of project work in a seminar without any fear, face the audience confidently, enhance communication skills, involve in group discussion to present and exchange ideas.

CIE procedure for Project Work:

(1) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide.

The CIE marks awarded for the project work, shall be based on the evaluation of the project work Report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

(2) Interdisciplinary: Continuous Internal Evaluation shall be group-wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable. The CIE marks awarded for the project work, shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

SEE procedure for Project Work: SEE for project work will be conducted by the two examiners appointed by the University. The SEE marks awarded for the project work shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

B.E. in Mechanical Engineering

Scheme of Teaching and Examinations2022

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2023-24)

Scheme A- VIIISEMESTER (Swappable VII and VIII SEMESTER)

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	PEC	BME801x	**Professional Elective -IV (Online Courses)**	TD: ME PSB:ME	3	0	0		03	50	50	100	3
2	OEC	BME802x	**Open Elective - III (Online Courses)**	TD: ME PSB:ME	3	0	0		03	50	50	100	3
3	INT	BME803	**Internship (Industry/Research) (14 - 20 weeks)**	TD: ME	0	0	12		03	100	100	200	10
										200	**200**	**400**	**16**

Professional Elective Course (Online courses)

BME801A	Quality Design & Control (Available in NPTEL)	BME801C	Modelling & Analytics for Supply Chain Management (Available in NPTEL)
BME801B	Machinery Fault Diagnosis and Signal Processing (Available in NPTEL)	BME801D	Strategies for Sustainable Design (Available in NPTEL)

Open Elective Courses (Online Courses)

BME802A	Fundamentals of Automotive systems (Available in NPTEL)	BME802C	Computer Integrated Manufacturing (Available in NPTEL)
BME802B	Product Design and Manufacturing (Available in NPTEL)	BME802D	Business Planning & Project Management (Available in Swayam Portal)

L: Lecture, **T**: Tutorial, **P**: Practical **S= SDA**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation. **TD-** Teaching Department, **PSB**: Paper Setting department, **OEC**: Open Elective Course, **PEC**: Professional Elective Course. **PROJ**: Project work, **INT**: Industry Internship / Research Internship / Rural Internship

Note: VII and VIII semesters of IV years of the program

Swapping Facility

- Institutions can swap VII and VIII Semester Scheme of Teaching and Examinations to accommodate **research internships/ industry internships/Rural Internship** after the VI semester.

- Credits earned for the courses of VII and VIII Semester Scheme of Teaching and Examinations shall be counted against the corresponding semesters whether VII or VIII semester is completed during the beginning of IV year or later part of IV year of the program.

Elucidation:

At the beginning of IV years of the program i.e., after VI semester, VII semester classwork and VIII semester **Research Internship /Industrial Internship / Rural Internship** shall be permitted to be operated simultaneously by the University so that students have ample opportunity for an internship. In other words, a good percentage of the class shall attend VII semester classwork and a similar percentage of others shall attend to Research Internship or Industrial Internship or Rural Internship.

Research/Industrial /Rural Internship shall be carried out at an Industry, NGO, MSME, Innovation centre, Incubation centre, Start-up, centre of Excellence (CoE), Study Centre established in the parent institute and /or at reputed research organizations/institutes.

The mandatory Research internship /Industry internship / Rural Internship is for 14 to 20 weeks. The internship shall be considered as a head of passing and shall be considered for the award of a degree. Those, who do not take up/complete the internship shall be declared to fail and shall have to complete it during the subsequent University examination after satisfying the internship requirements.

Research internship: A research internship is intended to offer the flavour of current research going on in the research field. It helps students get familiarized with the field and imparts the skill required for carrying out research.

Industry internship: Is an extended period of work experience undertaken by students to supplement their degree for professional development. It also helps them learn to overcome unexpected obstacles and successfully navigate organizations, perspectives, and cultures. Dealing with contingencies helps students recognize, appreciate, and adapt to organizational realities by tempering their knowledge with practical constraints.

Rural Internship: Rural development internship is an initiative of Unnat Bharat Abhiyan Cell, RGIT in association with AICTE to involve students of all departments studying in different academic years for exploring various opportunities in techno-social fields, to connect and work with Rural India for their upliftment.

The faculty coordinator or mentor has to monitor the student's internship progress and interact with them to guide for the successful completion of the internship.

The students are permitted to carry out the internship anywhere in India or abroad. University shall not bear any expenses incurred in respect of the internship.

With the consent of the internal guide and Principal of the Institution, students shall be allowed to carry out the internship at their hometown (**within or outside the state or abroad**), provided favorable facilities are available for the internship and the student remains regularly in contact with the internal guide. **University shall not bear any cost involved in carrying out the internship by students.** However, students can receive any financial assistance extended by the organization.

Professional Elective /Open Elective Course: These are ONLINE courses suggested by the respective Board of Studies. Details of these courses shall be made available for students on the VTU web portal.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

B.E. in the title of the program

Scheme of Teaching and Examinations2022

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2023-24)

Scheme B-VI SEMESTER for the candidates who seek a two-semester internship with project work /Start-up

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	SDA	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	IPCC	BXX601	Heat Transfer		3	0	2		03	50	50	100	4
2	PCC	BXX602	Machine Design		4	0	0		03	50	50	100	4
3	PEC	BXX613x	Professional Elective Course		3	0	0		03	50	50	100	3
4	OEC	BXX654x	Open Elective Course		3	0	0		03	50	50	100	3
5	PCCL	BXXL606	Machine Design Lab		0	0	2		03	50	50	100	1
6	AEC/SDC	BXX657x	Ability Enhancement Course/Skill Development Course V		If the course is offered as a Theory 1	 0	 0		01	50	50	100	1
					If course is offered as a practical 0	 0	 2						
7	MC	BNSK658	National Service Scheme (NSS)	NSS coordinator									
		BPEK658	Physical Education (PE) (Sports and Athletics)	Physical Education Director	0	0	2			100	---	100	0
		BYOK658	Yoga	Yoga Teacher									
8	IKS	BIKS609	Indian Knowledge System		1	0	0		01	100	0	100	0
									Total	**500**	**300**	**800**	**16**

Professional Elective Course			
BME613A	Total Quality Management	BME613C	MEMS and Microsystem Technology
BME613B	Refrigeration and Air Conditioning	BME613D	Design for Manufacturing and Assembly
Open Elective Course			
BME654A	Project Management	BME654C	Introduction to Mechatronics

BME654B	Renewable Energy Power plants	BME654D	Modern Mobility
Ability Enhancement Course / Skill Enhancement Course-V			
BME657A	Basics of Matlab [0-0-2]	BME657C	Simulation and Analysis using Ansys workbench [0-0-2]
BME657B	Fundamental of Virtual Reality ARP Development	BME657D	Introduction Augmented Reality

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

B.E. in the title of the program

Scheme of Teaching and Examinations2022

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2023-24)

Scheme BVII and VIII semesters for the candidateswho seek an internship with project work

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	SDA	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	IPCC	BXX701	**To be completed in 5th/6th semester**		3	0	2		03	50	50	100	4
2	IPCC	BXX702	**To be completed in 5th /6th semester**		3	0	2		03	50	50	100	4
3	PCC	BXX703	**To be completed in the 6th semester**		4	0	0		03	50	50	100	3
4	PEC	BXX714x	**Professional Elective Course (MOOC Courses)**		3	0	0		03	50	50	100	3
5	OEC	BXX755x	**Open Elective Courses (MOOC courses)**		3	0	0		01	50	50	100	3
1	PEC	Bxx801x	**Professional Elective (MOOC Courses)**		3	0	0		03	50	50	100	3
2	OEC	Bxx802x	**Open Elective (MOOC Courses)**		3	0	0		01	50	50	100	3
3	PROJ	BXX883	**Project - outcome of training**		0	0	12		03	100	100	200	9
4	INT	Bxx804	**Internship (Industry/Research) (02 semesters)**		0	0	12		03	100	100	200	10
										200	**200**	**400**	**42**

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

B.E. in Artificial Intelligence and Machine Learning

Scheme of Teaching and Examinations 2022

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2023-24)

III SEMESTER

Sl. No	Course	Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical / Drawing	SDA	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	PCC/BSC	BCS301	Mathematics for Computer Science	TD : Maths PSB : Maths	3	2	0		03	50	50	100	4
2	IPCC	BCS302	Digital Design & Computer Organization	TD : AI PSB : CS	3	0	2		03	50	50	100	4
3	IPCC	BCS303	Operating Systems	TD : AI PSB : CS	3	0	2		03	50	50	100	4
4	PCC	BCS304	Data Structures and Applications	TD : AI PSB : CS	3	0	0		03	50	50	100	3
5	PCCL	BCSL305	Data Structures Lab	TD : AI PSB : CS	0	0	2		03	50	50	100	1
6	ESC	BXX306x	ESC/ETC/PLC	TD : AI PSB : CS	2	0	2		03	50	50	100	3
7	UHV	BSCK307	**Social Connect and Responsibility**	Any Department	0	0	2		01	100	---	100	1
8	AEC/ SEC	BXX358x	Ability Enhancement Course/Skill Enhancement Course – III	TD and PSB: Concerned department	If the course is a Theory				01	50	50	100	1
					1	0	0						
					If a course is a laboratory				02				
					0	0	2						
9	MC	BNSK359	National Service Scheme (NSS)	NSS coordinator	0	0	2			100	---	100	0
		BPEK359	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		BYOK359	Yoga	Yoga Teacher									
									Total	**550**	**350**	**900**	**21**

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **UHV**: Universal Human Value Course, **MC**: Mandatory Course (Non-credit), **AEC**: Ability Enhancement Course, **SEC**: Skill Enhancement Course, **L:** Lecture, **T**: Tutorial, **P**: Practical **S= SDA**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation.K :This letter in the course code indicates common to all the stream of engineering. ESC: Engineering Science Course, ETC: Emerging Technology Course, PLC: Programming Language Course

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Engineering Science Course (ESC/ETC/PLC) (Note- Student should opt for the course which should not be similar to the course opted in 1st Year)			
BCS306A	Object Oriented Programming with Java	BDS306C	Data Analytics with R
BDS306B	Python Programming for Data Science	BAI306D	
Ability Enhancement Course – III			
BCS358A	Data Analytics with Excel	BCS358C	Project Management with Git
BAI358B	Ethics and Public Policy for AI	BAI358D	PHP Programming

Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practicals of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (B.E./B.Tech.) 2022-23 may please be refered.

National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), and Yoga(YOG) with the concerned coordinator of the course during the first week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree.

VARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

B.E. in Artificial Intelligence and Machine Learning

Scheme of Teaching and Examinations2022

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2023-24)

IV SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical / Drawing	Self - Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	PCC/BSC	BCS401	Analysis & Design of Algorithms	TD : AI PSB : CS	3	0	0		03	50	50	100	3
2	IPCC	BAD402	Artificial Intelligence	TD : AI PSB : CS	3	0	2		03	50	50	100	4
3	IPCC	BCS403	Database Management Systems	TD : AI PSB : CS	3	0	2		03	50	50	100	4
4	PCCL	BCSL404	Analysis & Design of Algorithms Lab	TD : AI PSB : CS	0	0	2		03	50	50	100	1
5	ESC	BXX405x	ESC/ETC/PLC	TD: AI/Maths PSB : CS/Maths	2	2	0		03	50	50	100	3
6	AEC/ SEC	BDS456x	Ability Enhancement Course/Skill Enhancement Course- IV	TD : AI PSB : CS	If the course is Theory: 1	0	0		01	50	50	100	1
					If the course is a lab: 0	0	2		02				
4	BSC	BBOC407	Biology For Computer Engineers	TD / PSB: BT, CHE,	2	0	0		03	50	50	100	2
7	UHV	BUHK408	Universal human values course	Any Department	1	0	0		01	50	50	100	1
9	MC	BNSK459	National Service Scheme (NSS)	NSS coordinator	0	0	2			100	---	100	0
		BPEK459	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		BYOK459	Yoga	Yoga Teacher									
									Total	**500**	**400**	**900**	**19**

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **UHV**: Universal Human Value Course, **MC**: Mandatory Course (Non-credit), **AEC**: Ability Enhancement Course, **SEC**: Skill Enhancement Course, **L:** Lecture, **T**: Tutorial, **P**: Practical **S= SDA**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation. K :This letter in the course code indicates common to all the stream of engineering.

Ability Enhancement Course / Skill Enhancement Course – IV			
BDSL456A	Scala (0:0:2)	BDSL456C	MERN (0:0:2)
BDSL456B	MangoDB (0:0:2)	BDSL456D	Julia (0:0:2)
Engineering Science Course (ESC/ETC/PLC)			
BCS405A	Discrete Mathematical Structures	BCS405C	Optimization Technique
BAI405B	Metric Spaces	BAI405D	Algorithmic Game Theory

Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practical of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (B.E./B.Tech.) 2022-23

National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), and Yoga(YOG) with the concerned coordinator of the course during the first week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses is mandatory for the award of degree.

Civil Engineering and Allied branches(Chemistry group)

Course Title:	**Applied Chemistry for Civil Engineering stream**		
Course Code:	**BCHEC202 /202**	CIE Marks	50
Course Type(Theory/Practical/Integrated)	Integrated	SEE Marks	50
		Total Marks	100
TeachingHours/Week(L:T:P:S)[1]	2:2:2:0	Exam Hours	03
TotalHoursofPedagogy	40hoursTheory+10to12Labslots	Credits	04

Course objectives

- Toenablestudentstoacquireknowledgeonprinciplesofchemistryforengineeringapplications.
- Todevelopanintuitiveunderstandingofchemistrybyemphasizingtherelatedbranchesofengineering.
- Toprovidestudentswithasolidfoundationinanalyticalreasoningrequiredtosolvesocietal problems.

Teaching-LearningProcess

Thesearesamplestrategies,whichteachercanusetoacceleratetheattainmentofthevariouscourseoutcomesandmakeTeaching–Learningmoreeffective

- Tutorial&remedialclassesforneedystudents(notregularT/R)
- ConductingMakeupclasses/Bridgecoursesforneedystudents
- Demonstrationofconceptseitherbybuildingmodelsorbyindustryvisit
- Experimentsinlaboratoriesshallbeexecutedinblendedmode(conventionalornon–conventionalmethods)
- UseofICT–Onlinevideos,onlinecourses
- Useofonlineplatformsforassignments/Notes/Quizzes(Ex.Googleclassroom)

Module-1:StructuralMaterials(8hr)

MetalsandAlloys: Introduction,PropertiesandapplicationofIronanditsalloys,Aluminiumanditsalloys

Cement: Introduction,composition,properties,classification,manufacturingprocessofcement, process of setting and hardening of cement, additives for cement and testing ofcement.

Refractories: Introduction, classification based on chemical composition, properties andapplicationofrefractorymaterials.

Glass: Introduction, Composition, Types, Preparation of Soda-lime glass, properties andapplicationsofglass.

Self-learning: Chemistryofreinforcedconcretefromvarioussourcesofwater(seawater, groundwater,treatedwater).

Module-2:EnergyConversionandStorage,Corrosion(8hr)

Energyconversion: Introduction,construction,working,andapplicationsofPhotovoltaiccells, methanol-oxygenfuelcell.

Storagedevices: Introduction,constructionandworkingofLi-ionbattery.

1.NOTE:Wherever the contact hoursisnotsufficient,tutorialhourcanbeconvertedto theoryhours

Corrosion: Introduction, electrochemical corrosion of steel in concrete, types (differentialmetalandaeration),Stresscorrosionincivilstructures,corrosioncontrol(designan dselectionofmaterials,galvanization, anodizationandsacrificialanodemethod). **Self-learning:**Corrosioninhibitors
Module-3:WaterTechnologyandNanotechnology(8hr)
Water technology: Introduction, water parameters, hardness of water, determination oftemporary, permanent and total hardness by EDTA method, numerical problems, softeningof water by ion exchange method, desalination of water by electrodialysis, determination ofCOD,numericalproblems.Forwardosmosis: Introduction, Processandapplications. **Nanotechnology:** Introduction, size dependent properties of nanomaterial (surface areaandcatalytic),Synthesisofnanomaterialbysol-gelmethodandco-precipitationmethod. **Nanomaterials:**Introduction,propertiesandengineeringapplicationsofcarbonnanotubes, grapheneandnanomaterialsforwatertreatment(Metaloxide). **Self-learning:**Sewagetreatment(Primary,secondaryandtertiary)
Module-4:PolymerandComposites(8hr)
Polymer: Introduction,methodsofpolymerization,molecularweightofpolymers,numerical problems. Synthesis, properties and engineering applications of polyethylene(PE)and Chloropolyvinylchloride(CPVC). **Fibers**:Synthesis,propertiesandapplicationsofnylonfibers. **Polymercomposites**:Introduction,propertiesandapplicationsoffiberreinforcedpolymersco mposites(FRPC), **Geopolymerconcrete**:Introduction,synthesis,constituents,propertiesandapplications. **Adhesives**:Introduction,propertiesandapplicationsofepoxyresin. **Biodegradablepolymers**:Synthesisofpolylacticacid(PLA)andtheirapplications. **Self-learning:Biopolymer**:Introduction,structuralproperties,andapplicationsofcelluloseandlignin.
Module-5:PhaseRuleandAnalyticalTechniques(8hr)
Phase rule: Introduction, Definition of terms: phase, components, degree of freedom, phaseruleequation.Phase diagram:Twocomponent-lead-silversystem. **Analytical techniques:** Introduction, principle, instrumentation of potentiometric sensorsand its application in the estimation of iron, conductometric sensors and its application inthe estimation of acid mixture, pH-sensorsanditsapplicationinthedeterminationofsoilsample. **Self-learning:**Chromatographictechnique,applicationofchromatography(columnand thin-layeredchromatography)intheseparationofcomponents.
PRACTICALMODULE ***A–Demonstration(anytwo)offline/virtual:*** A1.Synthesisofpolyurethane A2. Quantitative estimation of Aluminium by precipitation methodA3.Synthesisofironoxidenanoparticles A4.DeterminationofchloridecontentinthegivenwatersamplebyArgentometricmethod ***B–Exercise(compulsorilyany4tobe conducted):*** B1.Conductometricestimationofacidmixture B2.PotentiometricestimationofFASusing$K_2Cr_2O_7$

B3.DeterminationofpKaofvinegarusingpHsensor(Glasselectrode)
B4.DeterminationofrateofcorrosionofmildsteelbyweightlossmethodB5.Estimation oftotalhardnessofwaterbyEDTAmethod

C–StructuredEnquiry (compulsorilyany4tobeconducted):

C1. Estimation of Copper present in electroplating effluent by optical sensor (colorimetry)C2.DeterminationofViscositycoefficientoflubricant(Ostwald'sviscometer)
C3. Estimation of iron in TMT bar by diphenyl amine/external indicator methodC4.EstimationofSodiumpresentinsoil/effluentsampleusingflamephotometr y
C5.DeterminationofChemicalOxygenDemand(COD)ofindustrialwastewatersample

D–OpenEndedExperiments(anytwo):

D1. Gravimetric estimation of gypsum in Portland cementD2.Electroplatingofdesiredmetalonsubstrate
D3.Estimationofmanganesedioxideinpyrolusite
D4.Analysisofcementforits components

Courseoutcome(CourseSkillSet)
Attheendofthecourse thestudentwillbeableto:

CO1.	Identify the terms processes involved in scientific and engineering andapplications
CO2.	Explainthephenomenaofchemistrytodescribethemethodsofengineeringprocesses
CO3.	Solvefortheproblemsinchemistrythatarepertinentinengineeringapplications
CO4.	Applythebasicconceptsofchemistrytoexplainthechemicalpropertiesandprocesses
CO5.	Analyze processes associated withchemical substances in propertiesandmu ltidisciplinarysituations

AssessmentDetails(bothCIEandSEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50).The minimum passing mark for the SEE is 35% of the maximum marks (18 marks out of 50). Astudentshallbedeemedtohavesatisfiedtheacademicrequirementsandearnedthecreditsallotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in thesemester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total oftheCIE(ContinuousInternalEvaluation)andSEE(SemesterEndExamination)takentogether.

ContinuousInternalEvaluation(CIE):

The CIE marks for the theory component of the IC shall be **30 marks** and for the laboratory component **20 Marks**.

CIE for the theory component of the IC

- Three Tests each of 20 Marks**;** after the completion of the syllabus of 35-40%, 65-70%, and 90-100% respectively.
- Two Assignments/two quizzes/ seminars/one field survey and report presentation/one-course project totalling 20 marks.

Total Marks scored (test + assignments) out of 80 shall be scaled down to **30 marks**

CIE for the practical component of the IC

- On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The **15 marks** are for conducting the experiment and preparation of the laboratory record, the other **05 marks shall be for the test** conducted at the end of the semester.

- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to 15 marks.
- The laboratory test **(duration 03 hours)** at the end of the 15th week of the semester/after completion of all the experiments (whichever is early) shall be conducted for 50 marks and scaled down to **05 marks.**

Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IC/IPCC for **20 marks**.

- The minimum marks to be secured in CIE to appear for SEE shall be 12 (40% of maximum marks) in the theory component and 08 (40% of maximum marks) in the practical component. The laboratory component of the IC/IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included**.** The maximum of 05 questions is to be set from the practical component of IC/IPCC, the total marks of all questions should not be more than 25 marks.

The theory component of the IC shall be for both CIE and SEE.

Semester End Examination(SEE):

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

- The question paper shall be set for 100 marks. The medium of the question paper shall be English/Kannada). The duration of SEE is 03 hours.
- The question paper will have 10 questions. Two questions per module. Each question is set for 20 marks. The students have to answer 5 full questions, selecting one full question from each module. The student has to answer for 100 marks and **marks scored out of 100 shall be proportionally reduced to 50 marks**.

There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

SuggestedLearningResources:

Books(TitleoftheBook/Nameoftheauthor/Nameofthepublisher/EditionandYear)

1. WileyEngineeringChemistry,WileyIndiaPvt.Ltd.NewDelhi,2013-2ndEdition.
2. EngineeringChemistry,Satyaprakash&ManishaAgrawal,KhannaBookPublishing,Delhi
3. ATextBookofEngg.Chemistry,ShashiChawla,DhanpatRai&Co.(P)Ltd.
4. EssentialsofPhysicalChemistry,Bahl&Tuli,S.ChandPublishing
5. AppliedChemistry,SunitaRattan,Kataria5.EngineeringChemistry,Baskar,Wiley
6. EngineeringChemistry–I,D.GrourKrishana,VikasPublishing
7. ATextbookofEngineeringChemistry,SSDara&Dr.SSUmare,SChand&CompanyLtd.,12thEdition,2011.
8. ATextBookofEngineeringChemistry,R.V.GadagandNityanandaShetty,I.K.International Publishinghouse.2ndEdition,2016.
9. TextBookofPolymerScience,F.W.Billmeyer,JohnWiley&Sons,4thEdition,1999.
10. NanotechnologyAChemicalApproachtoNanomaterials,G.A.Ozin&A.C.Arsenault,RSCPublishing,2005.
11. CorrosionEngineering,M.G.Fontana,N.D.Greene,McGrawHillPublications,NewYork,3rdEdition, 1996.
12. Linden'sHandbookofBatteries,KirbyW.Beard,FifthEdition,McGrawHill,2019.
13. OLEDDisplayFundamentalsandApplications,Takatoshi Tsujimura,Wiley–Blackwell,2012
14. Supercapacitors: Materials, Systems,andApplications, MaxLu, Francois Beguin,Elzbieta Frackowiak,Wiley-VCH;1st edition,2013.
15. "HandbookonElectroplatingwithManufactureofElectrochemicals",ASIAPACIFICBUSINESSPRESS Inc.,2017.Dr. H.Panda.
16. ExpandingtheVisionofSensorMaterials.NationalResearchCouncil1995,Washington,DC:TheNationalAcademies Press. doi:10.17226/4782.
17. EngineeringChemistry,EditedbyDr.MaheshBandDr.RoopashreeB,SunstarPublisher,Bengaluru,

ISBN978-93-85155-70-3, 2022.

18. HighPerformanceMetallicMaterialsforCostSensitiveApplications,F.H.Froes,etal.JohnWiley&Sons, 2010.
19. InstrumentalMethodsofAnalysis,Dr. K.R.Mahadik andDr.L.Sathiyanarayanan,NiraliPrakashan,2020.
20. PrinciplesofInstrumentalAnalysis,DouglasA.Skoog,F.JamesHoller,StanleyR.CrouchSeventhEdition,CengageLearning, 2020.
21. PolymerScience,VRGowariker,NVViswanathan,Jayadev,Sreedhar,NewageInt.Publishers,4thEdition, 2021
22. EngineeringChemistry,PCJain&MonicaJain,DhanpatRaiPublication,2015-16thEdition.
23. Nanostructuredmaterialsandnanotechnology,Hari Singh, Nalwa,academicpress, 1stEdition,2002.
24. NanotechnologyPrinciplesandPractices,SulabhaKKulkarni,CapitalPublishingCompany,3rdEdition2014
25. Principlesofnanotechnology,Phanikumar,Scitechpublications,2ndEdition,2010.
26. Chemistryfor EngineeringStudents,B.S.JaiPrakash,R.Venugopal, Sivakumaraiah&PushpaIyengar.,SubashPublications,5thEdition, 2014
27. “EngineeringChemistry”,O.G.Palanna,TataMcGrawHillEducationPvt.Ltd.NewDelhi,FourthReprint,2015.
28. ChemistryofEngineeringmaterials,MaliniS,KSAnanthaRaju,CBSpublishersPvtLtd.,
29. LaboratoryManualEngg.Chemistry,AnupmaRajput,DhanpatRai&Co.

WeblinksandVideoLectures(e-Resources):

- http://libgen.rs/
- https://nptel.ac.in/downloads/122101001/
- https://nptel.ac.in/courses/104/103/104103019/
- https://ndl.iitkgp.ac.in/
- https://www.youtube.com/watch?v=faESCxAWR9k
- https://www.youtube.com/watch?v=TBqXMWaxZYM&list=PLyhmwFtznRhuz8L1bb3X-9IbHrDMjHWWh
- https://www.youtube.com/watch?v=j5Hml6KN4TI
- https://www.youtube.com/watch?v=X9GHBdyYcyo
- https://www.youtube.com/watch?v=1xWBPZnEJk8
- https://www.youtube.com/watch?v=wRAo-M8xBHM

ActivityBasedLearning(SuggestedActivitiesinClass)/PracticalBasedlearning

- https://www.vlab.co.in/broad-area-chemical-sciences
- https://demonstrations.wolfram.com/topics.php
- https://interestingengineering.com/science

COsandPOsMapping(Individualteacherhastofillup)

	PO											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	1	1				1					
CO2	3	1	1				1					
CO3	3	1	1				1					
CO4	3	1	1				1					
CO5	3	1	1				1					

16-2-2023

Course Title:	**Applied Physics for CV Stream**		
Course Code:	**BPHYC102/202**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Integrated	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P: S)	2:2:2:0	Exam Hours	03
Total Hours of Pedagogy	40 hours Theory + 10-12 Lab slots	Credits	04

Course objectives

- To understand the types of oscillation, shock waves & its generation, and applications.
- To Study the elastic properties of materials and failures of engineering materials
- To Study the acoustics buildings and the essentials of radiometry and photometry.
- To understand the principles photonic devices and their application relevant to civil engineering.
- To understand the various natural disaster and safety

Teaching-Learning Process

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes and make Teaching –Learning more effective

1. Flipped Class
2. Chalk and Talk
3. Blended Mode of Teaching and Learning
4. Simulations, Interactive Simulations and Animations
5. NPTEL and Other Videos for theory topics
6. Smart Class Room
7. Lab Experiment Videos

Module-1 (8 Hours)

Module -I: Oscillations and Shock waves:

Oscillations: Simple Harmonic motion (SHM), Differential equation for SHM (No derivation), Sprigs: Stiffness Factor and its Physical Significance, Series and Parallel combination of springs (Derivation), Types of Springs and their applications. Theory of Damped oscillations (Qualitative), Types of Damping (Graphical Approach). Engineering applications of Damped oscillations, Theory of Forced oscillations (Qualitative), Resonance, Sharpness of resonance. Numerical Problems.

Shock waves: Mach number and Mach Angle, Mach Regimes, Definition and Characteristics of Shock waves, Construction and working of Reddy Shock tube, Applications of Shock Waves, Numerical problems.

Pre-requisites: Basics of Oscillations

Self-learning: Simple Harmonic motion, Differential equation for SHM

Module-2 (8 Hours)

Elasticity

Stress-Strain Curve, Stress hardening and softening. Elastic Moduli, Poisson's ratio, Relation between Y, n and σ (with derivation), mention relation between K, Y and σ, limiting values of Poisson's ratio. Beams, Bending moment and derivation of expression, Cantilever and I section girder and their Engineering Applications, Elastic materials (qualitative). Failures of engineering materials - Ductile fracture, Brittle fracture, Stress concentration, Fatigue and factors affecting fatigue (only qualitative explanation), Numerical problems.

Pre requisites: Elasticity,Stress & Strain

Self-learning: Stress-Strain Curve

Module-3 (8 Hours)

Acoustics,RadiometryandPhotometry:

Acoustics: Introduction to Acoustics, Types of Acoustics, Reverberation and reverberation time, Absorption power andAbsorption coefficient, Requisites for acoustics in auditorium, Sabine's formula (derivation), Measurement of absorptioncoefficient, Factors affecting the acoustics and remedial measures, Sound Insulation and itsmeasurements. Noise and its Measurements, Impact of Noise in Multi-storied buildings.

Radiometry and Photometry: Radiation Quantities, Spectral Quantities, Relation between luminance and Radiantquantities, Reflectanceand Transmittance, Photometry (cosinelaw and inverse square law).

Prerequisites:BasicsofSound,Waves&lightproperties.
Self-learning:Introductiontoacoustics.

Module-4 (8 Hours)

Photonics:
LASER
Properties of a LASER Beam, Interaction of Radiation with Matter, LASER action, Population Inversion, MetastableState,Requisites of a LASER System, Semiconductor LASER, LASER Range Finder, LIDAR, Road Profiling, BridgeDeflection, SpeedChecker, NumericalProblems.
OpticalFiber
Principle and Construction of Optical Fibers, Acceptance angle and Numerical Aperture (NA), Expression for NA, Modes of Propagation,Attenuation and Fiber Losses, Fiber Optic Displacement Sensor, Fiber Optic Temperature Sensor, Numerical Problems

Pre requisite: Propertiesof light.
Self-learning: Total Internal Reflection.

Module-5 (8 Hours)

NaturalhazardsandSafety
Introduction, Earthquake, (general characteristics, Physics of earthquake, Richter scale of measurement and earthquakeresistant measures), Tsunami (causes for tsunami, characteristics, adverse effects, risk reduction measures, engineeringstructures to withstand tsunami), Landslide (causes such as excess rain fall, geological structure, human excavation etc.,types of land slide, adverse effects, engineering solution for landslides). Forest Fires and detection using remote sensing.Firehazardsandfireprotection,fire-proofingmaterials,firesafetyregulationsandfirefightingequipment-Preventionandsafety measures.NumericalProblems.

Pre requisite: Oscillations.
Self-learning:Richterscale.

Course outcome (Course Skill Set)
At the end of the course the student will be able to:

CO1	**Elucidate** the concepts in oscillations, waves, elasticity and material failures
CO2	**Summarize** concepts of acoustics in buildings and explain the concepts in radiation and photometry
CO3	**Discuss** the principles photonic devices and their application relevant to civil engineering.
CO4	**Describe** the various natural hazards and safety precautions.
CO5	**Practice** working in groups to conduct experiments in physics and **perform** precise and honest measurements.

Assessment Details (both CIE and SEE)
The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). The minimum passing mark for the SEE is 35% of the maximum marks (18 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.
Continuous Internal Evaluation(CIE):
The CIE marks for the theory component of the IC shall be **30 marks** and for the laboratory component **20 Marks**.

CIE for the theory component of the IC

- Three Tests each of 20 Marks**;** after the completion of the syllabus of 35-40%, 65-70%, and 90-100% respectively.
- Two Assignments/two quizzes/ seminars/one field survey and report presentation/one-course project totalling 20 marks.

Total Marks scored (test + assignments) out of 80 shall be scaled down to **30 marks**
CIE for the practical component of the IC

- On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The **15 marks** are for conducting the experiment and preparation of the laboratory record, the other **05 marks shall be for the test** conducted at the end of the semester.

- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to 15 marks.
- The laboratory test **(duration 03 hours)** at the end of the 15th week of the semester /after completion of all the experiments (whichever is early) shall be conducted for 50 marks and scaled down to **05 marks.**

Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IC/IPCC for **20 marks**.

- The minimum marks to be secured in CIE to appear for SEE shall be 12 (40% of maximum marks) in the theory component and 08 (40% of maximum marks) in the practical component. The laboratory component of the IC/IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included**.** The maximum of 05 questions is to be set from the practical component of IC/IPCC, the total marks of all questions should not be more than 25 marks.

The theory component of the IC shall be for both CIE and SEE.

Semester End Examination(SEE):

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

- The question paper shall be set for 100 marks. The medium of the question paper shall be English/Kannada). The duration of SEE is 03 hours.
- The question paper will have 10 questions. Two questions per module. Each question is set for 20 marks. The students have to answer 5 full questions, selecting one full question from each module. The student has to answer for 100 marks and **marks scored out of 100 shall be proportionally reduced to 50 marks**.

There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

Suggested Learning Resources:

Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)

1. Materials Science and Engineering by R Balasubramaniam, second edition, Wiley India Pvt. Ltd. Ansari Road, Daryaganj, New Delhi-110002.
2. A Textbook of Engineering Physics by M .N. Avadhanulu, P G. Kshirsagar and T V S Arun Murthy, Eleventh edition, S Chand and Company Ltd. New Delhi-110055.
3. Engineering Physics by R. K. Gaur and S. L. Gupta, 2010 edition, Dhanpat Rai Publications Ltd., New Delhi-110002,
4. Building Science: Lighting and Accoustics, B. P. Singh and Devaraj Singh, Dhanpat Rai Publications (P) Ltc.,
5. Building Acoustics : Tor Eric Vigran, Taylor and Francis, 2008 Edition.
6. Photometry Radiometry and Measurements of Optical Losses, Micheal Bukshtab, Springer, 2nd edition.
7. Materials Science for Engineers by James F. Shackelford and Madanapalli K Muralidhara, sixth edition, Pearson Education Asia Pvt. Ltd., New Delhi.
8. Lasers and Non Linear Optics, B B Loud, New Age Internationals, 2011 edition
9. Shock waves made simple by Chintoo S Kumar, K Takayama and K P J Reddy: Willey India Pvt. Ltd, Delhi 2014.
10. An Introduction to Disaster Management, Natural Disastr & Man Made Hazards, S. Vaidyanathan, IKON Books P
11. Natural Hazards, Edward Bryant, Cambridge University, Press, 2nd Edition
12. Natural Hazards by Ramesh .P. Singh, CRC Press, Taylor and Francis group.
13. Disaster Education and Management, Rajendra Kumar Bhandari, Springer, India 2014
14. Principles of Fire Safety Engineering Understanding Fire & Fire Protection, Akhil Kumar Das, PHI Learning , II Edition.

Web links and Video Lectures (e-Resources):

Web links:

Simple Harmonic motion:https://www.youtube.com/watch?v=k2FvSzWeVxQ

Shock waves:https://physics.info/shock/

Shock waves and its applications:https://www.youtube.com/watch?v=tz_3M3v3kxk

Stress-strain curves:https://web.mit.edu/course/3/3.11/www/modules/ss.pdf

Stress curves:https://www.youtube.com/watch?v=f08Y39UiC-o

Oscillations and waves :https://openstax.org › books › college-physics-2e

Earthquakes:www.asc-india.org

Earthquakes and Hazards:http://quake.usgs.gov/tsunami

Landslide hazards:http://landslides.usgs.gov

Acoustics:https://www.youtube.com/watch?v=fHBPvMDFyO8

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

http://nptel.ac.in

https://swayam.gov.in

https://virtuallabs.merlot.org/vl_physics.html

https://phet.colorado.edu

https://www.myphysicslab.com

Laboratory Component:

Any Ten Experiments have to be completed from the list of experiments

Note: The experiments have to be classified into

a) Exercise

b) Demonstration

c) Structured Inquiry

d) Open Ended

Based on the convenience classify the following experiments into above categories. Select at least one simulation/spreadsheet activity.

List of Experiments

1. Determination of Young’s modulus of the material of the given bar Uniform Bending.
2. Determination of Rigidity modulus of the Material of the wire using Torsional Pendulum.
3. Study of Forced Mechanical Oscillations and Resonance.
4. Study of the frequency response of Series & Parallel LCR circuits.
5. Determination of Fermi Energy of the given Conductor.
6. Determination of Resistivity by Four Probe Method.
7. Determination of effective spring constant of the given springs in series and parallel combinations.
8. Determination of Young’s modlus of the material of the given bar Single Cantilever.
9. Determination of the the Moment of Inertia of the given irregular body using torsional pendulum.
10. Determination of Wavelength of Laser using Diffraction Grating.
11. Determination of Acceptance angle and Numerical Aperture of the given Optical Fiber.
12. Determination of the Radius of Curvature of the given Plano Convex Lens by setting Newton’s Rings.
13. Step Interactive Physical Simulations.
14. Study of motion using spread Sheets
15. Application of Statistics using Spread Sheets.
16. PHET Interactive Simulations :
(https://phet.colorado.edu/en/simulations/filter?subjects=physics&type=html,prototype)

COs and POs Mapping (Individual teacher has to fill up)

COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	3	2	-	-	1	-	-	-	-	-	-	2
CO2	3	2	-	-	-	-	-	-	-	-	-	2
CO3	3	2	-	-	-	-	-	-	-	-	-	2
CO4	3	3	-	-	-	1	-	-	-	-	-	2
CO5	3	2	1	-	2	-	-	3	3	-	-	2

Level 3- Highly Mapped, Level 2-Moderately Mapped, Level 1-Low Mapped

Note : The CO-PO mapping values are indicative. The course coordinator can alter the mapping using **Competency and Performance Indicators** mentioned in the **AICTE Exam reforms**

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B.E. in Civil Engineering

Scheme of Teaching and Examinations2022

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2023-24)

III SEMESTER

Sl. No	Course	Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week: Theory Lecture (L)	Tutorial (T)	Practical/ Drawing (P)	SDA (S)	Examination: Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
1	PCC	BCV301	Strength of Materials	TD: CVPSB: CV	3	0	0		03	50	50	100	3
2	IPCC	BCV302	Engineering Survey	TD: CVPSB: CV	3	0	2		03	50	50	100	4
3	IPCC	BCV303	Engineering Geology	TD- Geology/CV PSB-Geology/CV	3	0	2		03	50	50	100	4
4	PCC	BCV304	Water Supply and Waste water Engineering	TD: CV PSB: CV	3	0	0		03	50	50	100	3
5	PCCL	BCV305	Computer Aided Building Planning and Drawing	TD: CV PSB: CV	0	0	2		03	50	50	100	1
6	ESC	BCV306x	ESC/ETC/PLC	PSB: CV	3	0	0		03	50	50	100	3
7	UHV	BSCK307	**Social Connect and Responsibility**	Any Department	0	0	2		01	100	---	100	1
8	AEC/ SEC	BCV358x	Ability Enhancement Course/Skill Enhancement Course - III		If the course is a Theory					50	50	100	1
					1	0	0		01				
					If a course is a laboratory								
					0	0	2		02				
9	MC	BNSK359	National Service Scheme (NSS)	NSS coordinator	0	0	2			100	---	100	0
		BPEK359	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		BYOK359	Yoga	Yoga Teacher									
									Total	**550**	**350**	**900**	**20**

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **UHV**: Universal Human Value Course, **MC**: Mandatory Course (Non-credit), **AEC**: Ability Enhancement Course, **SEC**: Skill Enhancement Course, **L:** Lecture, **T**: Tutorial, **P**: Practical **S= SDA**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation. K: This letter in the course code indicates common to all the stream of Engineering. ESC: Engineering Science Course, ETC: Emerging Technology Course, PLC: Programming Language Course

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Engineering Science Course (ESC/ETC/PLC)			
BCV306A	Rural, Urban Planning and Architecture	BCV306C	Sustainable Design Concept for Building Services
BCV306B	Geospatial Techniques in Practice	BCV306D	Fire Safety in Buildings
Ability Enhancement Course – III			
BCVL358A	Data analytics with Excel (0:0:1)	BCVL358C	Problem Solving with PYTHON
BCV358B	Smart Urban Infrastructure	BCV358D	Personality Development for Civil Engineers

Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practicals of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (B.E./B.Tech.) 2022-23 may please be referred.

National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), and Yoga(YOG) with the concerned coordinator of the course during the first Week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the Degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of Degree.

VARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

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IV SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	PCC	BCV401	Analysis of Structures	TD: CV PSB: CV	3	0	0		03	50	50	100	3
2	IPCC	BCV402	Fluid Mechanics and Hydraulics	TD: CV PSB: CV	3	0	2		03	50	50	100	4
3	IPCC	BCV403	Transportation Engineering	TD: CV PSB: CV	3	0	2		03	50	50	100	4
4	PCCL	BCVL404	Building Materials Testing Lab	TD: CV PSB: CV	0	0	2		03	50	50	100	1
5	ESC	BCV405x	ESC/ETC/PLC		3	0	0		03	50	50	100	3
6	AEC/ SEC	BCV456x	Ability Enhancement Course/Skill Enhancement Course- IV	TD and PSB: Concerned department	If the course is Theory				01	50	50	100	1
					1	0	0						
					If the course is a lab				02				
					0	0	2						
7	BSC	BBOK407	Biology For Engineers	TD / PSB: BT, CHE,	3	0	0		03	50	50	100	3
8	UHV	BUHK408	Universal human values course	Any Department	1	0	0		01	50	50	100	1
9	MC	BNSK459	National Service Scheme (NSS)	NSS coordinator	0	0	2			100	---	100	0
		BPEK459	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		BYOK459	Yoga	Yoga Teacher									
									Total	**500**	**400**	**900**	**20**

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **UHV**: Universal Human Value Course, **MC**: Mandatory Course (Non-credit), **AEC**: Ability Enhancement Course, **SEC**: Skill Enhancement Course, **L:** Lecture, **T**: Tutorial, **P**: Practical **S= SDA**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation. K :This letter in the course code indicates common to all the stream of engineering.

Ability Enhancement Course / Skill Enhancement Course - IV			
BCVL456A	Building Information Modelling in Civil Engineering – Basics (0:0:2)	BCV456C	Electronic Waste Management - Issues and Challenges
BCV456B	GIS with Quantum GIS	BCV456D	Technical Writing Skills
Engineering Science Course (ESC/ETC/PLC)			
BCV405A	Finance for Professionals	*BCV405C*	Concreting Techniques & Practices
BCV405B	Construction Equipment, Plants and Machinery	*BCV405D*	Watershed Management

Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practical of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (B.E./B.Tech.) 2022-23

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III SEMESTER

Sl. No	Course	Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	SDA	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	PCC	BBT301	Cell Biology and Genetics	TD: BT PSB: BT	3	0	0		03	50	50	100	3
2	IPCC	BBT302	Unit Operations + Lab	TD: BT PSB: BT	3	0	2		03	50	50	100	4
3	IPCC	BBT303	Biochemistry +Lab	TD: BT PSB: BT	3	0	2		03	50	50	100	4
4	PCC	BBT304	Microbiology	TD: BT PSB: BT	3	0	0		03	50	50	100	3
5	PCCL	BBTL305	Microbiology Lab	TD: BT PSB: BT	0	0	2		03	50	50	100	1
6	ESC	BBT306x	Engineering Science Course	TD: BT PSB: BT	3	0	0		03	50	50	100	3
7	UHV	BSCK307	Social Connect and Responsibility	Any Department	0	0	2		01	100	---	100	1
8	AEC/ SEC	BBT358x	Ability Enhancement Course/Skill Enhancement Course - III	TD: BT PSB: BT	If the course is a Theory				01	50	50	100	1
					1	0	0						
					If a course is a laboratory				02				
					0	0	2						
9	MC	BNSK359	National Service Scheme (NSS)	NSS coordinator	0	0	2			100	---	100	0
		BPEK359	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		BYOK359	Yoga	Yoga Teacher									
									Total	**550**	**350**	**900**	**20**

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **UHV**: Universal Human Value Course, **MC**: Mandatory Course (Non-credit), **AEC**: Ability Enhancement Course, **SEC**: Skill Enhancement Course, **L:** Lecture, **T**: Tutorial, **P**: Practical **S= SDA**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation.**K**:This letter in the course code indicates common to all the stream of engineering. ESC: Engineering Science Course, ETC: Emerging Technology

Course, PLC: Programming Language Course.

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Engineering Science Course			
BBT306A	Python Programming	BBT306C	R programming for Biologists
BBT306B	Human Anatomy and Physiology	BBT306D	Plant Physiology and Phyto-hormones
Ability Enhancement Course – III			
BBT358A	Bio-Lab Management and Risk Assessment	BBTL358C	Analysis Of Dairy Products Lab
BBT358B	Data presentation, Error Analysis and Inferences	BBT358D	Biodiversity and Conservation Law

Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practicals of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (B.E./B.Tech.) 2022-23 may please be referred.

National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), and Yoga(YOG) with the concerned coordinator of the course during the first week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree.

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Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	PCC	BBT401	Molecular Biology & Genetic Engineering	TD: BT PSB: BT	3	0	0		03	50	50	100	3
2	IPCC	BBT402	Biostatistics and Tools + Lab	TD: Maths/BT PSB: Maths/BT	3	0	2		03	50	50	100	4
3	IPCC	BBT403	Immunotechnology + Lab	TD: BT PSB: BT	3	0	2		03	50	50	100	4
4	PCCL	BBTL404	Molecular Biology & Genetic Engineering Lab	TD: BT PSB: BT	0	0	2		03	50	50	100	1
5	ESC	BBT405x	Engineering Science Course	TD: BT PSB: BT	3	0	0		03	50	50	100	3
6	AEC/ SEC	BBT456x	Ability Enhancement Course/Skill Enhancement Course- IV	TD and PSB: Concerned department	If the course is Theory				01	50	50	100	1
					1	0	0						
					If the course is a lab				02				
					0	0	2						
4	BSC	BBOK407	Biology For Engineers (Dr VM, SCE)	TD / PSB: BT, CHE,	3	0	0		03	50	50	100	3
7	UHV	BUHK408	Universal human values course	Any Department	1	0	0		01	50	50	100	1
9	MC	BNSK459	National Service Scheme (NSS)	NSS coordinator	0	0	2			100	---	100	0
		BPEK459	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		BYOK459	Yoga	Yoga Teacher									
									Total	**500**	**400**	**900**	**20**

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **UHV**: Universal Human Value Course, **MC**: Mandatory Course (Non-credit), **AEC**: Ability

Enhancement Course, **SEC**: Skill Enhancement Course, **L:** Lecture, **T**: Tutorial, **P**: Practical **S= SDA**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation. K : This letter in the course code indicates common to all the stream of engineering.

Ability Enhancement Course / Skill Enhancement Course – IV

BBT456A	Hydroponics, Aquaponics and Aeroponics	BBTL456C	Extraction methods and herbal products lab
BBTL456B	Water Analysis Lab	BBT456D	Biopesticides and Biofertilizers

Engineering Science Course

BBT405A	Biochemical Thermodynamics	BBT405C	Bioprocess Principles and Stoichiometry
BBT405B	Marine Bioresources and applications	BBT405D	Structural Biology and Biophysical Techniques

Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practical of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (B.E./B.Tech.) 2022-23

National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), and Yoga(YOG) with the concerned coordinator of the course during the first week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses is mandatory for the award of degree.

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V SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	HSMS	BBT501	Bioeconomy and Entrepreneurship	TD: BT PSB: BT	3	0	0		03	50	50	100	3
2	IPCC	BBT502	Enzyme Technology + Lab	TD: BT PSB: BT	3	0	2		03	50	50	100	4
3	PCC	BBT503	Genomics, Proteomics and Bioinformatics	TD: BT PSB: BT	4	0	0		04	50	50	100	4
4	PCCL	BBTL504	Bioinformatics Lab	TD: BT PSB: BT	0	0	2		03	50	50	100	1
5	PEC	BBT515x	Professional Elective Course	TD: BT PSB: BT	3	0	0		03	50	50	100	3
6	PROJ	BBT586	Mini Project	TD: BT PSB: BT	0	0	4		03	100		100	2
7	AEC	BRMK557	Research Methodology and IPR	TD: Any Dept PSB: As identified by University	2	2	0		02	50	50	100	3
8	MC	BESK508	Environmental Studies	TD: CV/ENV/CHE.E/BT PSB: CV	2	0	0		02	50	50	100	2
9	MC	BNSK559	National Service Scheme (NSS)	NSS coordinator	0	0	2			100		100	0
		BPEK559	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		BYOK559	Yoga	Yoga Teacher									
									Total	**500**	**300**	**800**	**22**

Professional Elective Course

BBT515A	Food Processing and Nutraceuticals (include nutrigenomics)	BBT515C	Medicinal Chemistry and Chemoinformatics
BBT515B	Forensic Biology	BBT515D	Bioprocess Equipment Design and CAED

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Semester End Evaluation. **K :** The letter in the course code indicates common to al the stream of engineering. **PROJ**: Project /Mini Project. **PEC**: Professional Elective Course
Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practicals of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (B.E./B.Tech.) 2022-23 **National Service Scheme /Physical Education/Yoga:** All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), and Yoga(YOG) with the concerned coordinator of the course during the first week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree.
Mini-project work: Mini Project is a laboratory-oriented/hands on course that will provide a platform to students to enhance their practical knowledge and skills by the development of small systems/applications etc. Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary Mini- project can be assigned to an individual student or to a group having not more than 4 students. **CIE procedure for Mini-project:** **(i) Single discipline:** The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two faculty members of the Department, one of them being the Guide. The CIE marks awarded for the Mini-project work shall be based on the evaluation of the project report, project presentation skill, and question and answer session in the ratio of 50:25:25. The marks awarded for the project report shall be the same for all the batches mates. **(ii) Interdisciplinary:** Continuous Internal Evaluation shall be group-wise at the college level with the participation of all the guides of the project. The CIE marks awarded for the Mini-project, shall be based on the evaluation of the project report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates. **No SEE component for Mini-Project.**
Professional Elective Courses (PEC): A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an option to select one course. The minimum number of students' strengths for offering a professional elective is 10. However, this conditional shall not be applicable to cases where the admission to the program is less than 10.

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E) and Choice Based Credit System (CBCS)

(Effective from the academic year 2023-24)

VI SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	IPCC	BBT601	Bioprocess Control & Automation + Lab	TD: BT PSB: BT	3	0	2		03	50	50	100	4
2	PCC	BBT602	Biokinetics	TD: BT PSB: BT	4	0	0		04	50	50	100	4
3	PEC	BBT613x	Professional Elective Course	TD: BT PSB: BT	3	0	0		03	50	50	100	3
4	OEC	BBT654x	Open Elective Course	TD: BT PSB: BT	3	0	0		03	50	50	100	3
5	PROJ	BBT685	Project Phase I	TD: BT PSB: BT	0	0	4		03	100	--	100	2
6	PCCL	BBTL606	Biokinetics Lab	TD: BT PSB: BT	0	0	2		03	50	50	100	1
7	AEC/SDC	BBT657x	Ability Enhancement Course/Skill Development Course V	TD: BT PSB: BT	If the course is offered as a Theory 1	 0	 0		01	50	50	100	1
					If course is offered as a practical 0	 0	 2		02				
8	MC	BNSK658	National Service Scheme (NSS)	NSS coordinator	0	0	2			100	---	100	0
		BPEK658	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		BYOK658	Yoga	Yoga Teacher									
9	MC	BIKS609	Indian Knowledge System		1	0	0			100		100	0
									Total	**500**	**300**	**800**	**18**

Professional Elective Course (MVIT)			
BBT613A	Biopharmaceuticals	BBT613C	Synthetic Biology and Tissue Engineering
BBT613B	Biomedical Imaging and Health Informatics	BBT613D	Systems Biology and Rational Drug design
Open Elective Course			
BBT654A	Robotics in Healthcare and Agri-Tech	BBT654C	Nanobiotechnology
BBT654B	Food, Nutrition and Health	BBT654D	Ecology and Ecosystem
Ability Enhancement Course / Skill Enhancement Course-V			
BBT657A	Bio-Innovation and Start-ups	BBTL657C	Modelling and Simulations in Biology Lab
BBTL657B	Bioinstrumentation and Servicing Lab	BBT657D	Good Manufacturing and Laboratory Practices

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **UHV**: Universal Human Value Course, **MC**: Mandatory Course (Non-credit), **AEC**: Ability Enhancement Course, **SEC**: Skill Enhancement Course, **L:** Lecture, **T**: Tutorial, **P**: Practical **S= SDA**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation. **K :** The letter in the course code indicates common to all the stream of engineering. **PROJ**: Project /Mini Project. **PEC**: Professional Elective Course. **PROJ**: Project Phase -I, **OEC**: Open Elective Course

Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practicals of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (B.E./B.Tech.) 2022-23

National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), and Yoga(YOG) with the concerned coordinator of the course during the first week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree.

Professional Elective Courses (PEC): A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an option to select one course. The minimum number of students' strengths for offering professional electives is 10. However, this conditional shall not be applicable to cases where the admission to the program is less than 10.

Open Elective Courses:

Students belonging to a particular stream of Engineering and Technology are not entitled to the open electives offered by their parent Department. However, they can opt for an elective offered by other Departments, provided they satisfy the prerequisite condition if any. Registration to open electives shall be documented under the guidance of the Program Coordinator/ Advisor/Mentor. The minimum numbers of students' strength for offering Open Elective Course is 10. However, this condition shall not be applicable to class where the admission to the program is less than 10.

Project Phase-I: Students have to discuss with the mentor /guide and with their helphe/she has to complete the literature survey and prepare the report and finally define the problem statement for the project work.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

B.E. in Biotechnology

Scheme of Teaching and Examinations2022

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2023-24)

VII SEMESTER (Swappable VII and VIII SEMESTER)

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	IPCC	BBT701	Upstream Process Technology + Lab	TD: BTPSB: BT	3	0	2		03	50	50	100	4
2	IPCC	BBT702	Downstream Process Technology + Lab	TD: BT PSB: BT	3	0	2		03	50	50	100	4
3	PCC	BBT703	Bioethics, Biosafety and Regulatory affairs	TD: BT PSB: BT	4	0	0		04	50	50	100	4
4	PEC	BBT714x	**Professional Elective Course**	TD: BTPSB: BT	3	0	0		03	50	50	100	3
5	OEC	BBT755x	**Open Elective Course**	TD: BTPSB: BT	3	0	0		01	50	50	100	3
6	PROJ	BBT786	**Major Project Phase-II**	TD: BTPSB: BT	0	0	12		03	100	100	200	6
										400	**300**	**700**	**24**

Professional Elective Course

BBT714A	Clinical Research	BBT714C	Biological Data Management
BBT714B	Environmental Biotechnology	BBT714D	Agricultural Biotechnology

Open Elective Course

BBT755A	Biomaterials and Medical Implants	BBT755C	Traditional Medicine And Health Management
BBT755B	Public Health and Community Medicine	BBT755D	Bioremediation Techniques

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **PEC**: Professional Elective Course, **OEC**: Open Elective Course PR: Project Work, **L:** Lecture, **T**: Tutorial, **P**: Practical **S= SDA**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation. **TD-** Teaching Department, **PSB**: Paper Setting department, **OEC**: Open Elective Course, **PEC**: Professional Elective Course. **PROJ**: Project work

Note: VII and VIII semesters of IV years of the program

(1) Institutions can swap the VII and VIII Semester Schemes of Teaching and Examinations to accommodate research internships/ industry internships after the VI semester**.**

(2) Credits earned for the courses of VII and VIII Semester Scheme of Teaching and Examinations shall be counted against the corresponding semesters whether the VII or VIII semesters is completed during the beginning of the IV year or the later part of IV years of the program.

Professional Elective Courses (PEC): A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and

Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an option to select one course. The minimum number of students' strengths for offering professional electives is 10. However, this conditional shall not be applicable to cases where the admission to the program is less than 10.

Open Elective Courses:

Students belonging to a particular stream of Engineering and Technology are not entitled to the open electives offered by their parent Department. However, they can opt for an elective offered by other Departments, provided they satisfy the prerequisite condition if any. Registration to open electives shall be documented under the guidance of the Program Coordinator/ Advisor/Mentor. The minimum numbers of students' strength for offering Open Elective Course is 10. However, this condition shall not be applicable to class where the admission to the program is less than 10.

PROJECT WORK (21BTP75): The objective of the Project work is

- **(i)** To encourage independent learning and the innovative attitude of the students.
- **(ii)** To develop interactive attitude, communication skills, organization, time management, and presentation skills.
- **(iii)** To impart flexibility and adaptability.
- **(iv)** To inspire team working.
- **(v)** To expand intellectual capacity, credibility, judgment and intuition.
- **(vi)** To adhere to punctuality, setting and meeting deadlines.
- **(vii)** To install responsibilities to oneself and others.
- **(viii)** To train students to present the topic of project work in a seminar without any fear, face the audience confidently, enhance communication skills, involve in group discussion to present and exchange ideas.

CIE procedure for Project Work:

(1) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide.

The CIE marks awarded for the project work shall be based on the evaluation of the project work Report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

(2) Interdisciplinary: Continuous Internal Evaluation shall be group-wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable. The CIE marks awarded for the project work, shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

SEE procedure for Project Work: SEE for project work will be conducted by the two examiners appointed by the University. The SEE marks awarded for the project work shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

B.E. in Biotechnology

Scheme of Teaching and Examinations2022

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2023-24)

VIII SEMESTER (Swappable VII and VIII SEMESTER)

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	PEC	BBT801x	**Professional Elective (Online Courses)**	TD: BTPSB: BT	3	0	0		03	50	50	100	3
2	OEC	BBT802x	**Open Elective (Online Courses)**	TD: BTPSB: BT	0	2	0		01	50	50	100	3
3	INT	BBT803	**Internship (Industry/Research) (14 - 20 weeks)**	TD: BTPSB: BT	0	0	12		03	100	100	200	10
										200	**200**	**400**	**16**

Professional Elective Course (BOS recommended Online courses)

BBT801A		BBT801C	
BBT801B		BBT801D	

Open Elective Courses (BOS recommended Online Courses)

BBT802A		BBT802C	
BBT802B		BBT802D	

L: Lecture, **T**: Tutorial, **P**: Practical **S= SDA**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation. **TD-** Teaching Department, **PSB**: Paper Setting department, **OEC**: Open Elective Course, **PEC**: Professional Elective Course. **PROJ**: Project work, **INT**: Industry Internship / Research Internship / Rural Internship

Note: VII and VIII semesters of IV years of the program

Swapping Facility

- Institutions can swap VII and VIII Semester Scheme of Teaching and Examinations to accommodate **research internships/ industry internships/Rural Internship** after the VI semester**.**
- Credits earned for the courses of VII and VIII Semester Scheme of Teaching and Examinations shall be counted against the corresponding semesters whether VII or VIII semester is completed during the beginning of IV year or later part of IV year of the program.

Elucidation:

At the beginning of IV years of the program i.e., after VI semester, VII semester classwork and VIII semester **Research Internship /Industrial Internship / Rural Internship** shall be permitted to be operated simultaneously by the University so that students have ample opportunity for an internship. In other words, a good percentage of the class shall attend VII semester classwork and a similar percentage of others shall attend to Research Internship or Industrial Internship or Rural Internship.

Research/Industrial /Rural Internship shall be carried out at an Industry, NGO, MSME, Innovation center, Incubation center, Start-up, center of Excellence (CoE), Study Centre established in the parent institute and /or at reputed research organizations/institutes.

The mandatory Research internship /Industry internship / Rural Internship is for 14 to 20 weeks. The internship shall be considered as a head of passing and shall be considered for the award of a degree. Those, who do not take up/complete the internship shall be declared to fail and shall have to complete it during the subsequent University examination after satisfying the internship requirements.

Research internship: A research internship is intended to offer the flavor of current research going on in the research field. It helps students get familiarized with the field and imparts the skill required for carrying out research.

Industry internship: Is an extended period of work experience undertaken by students to supplement their degree for professional development. It also helps them learn to overcome unexpected obstacles and successfully navigate organizations, perspectives, and cultures. Dealing with contingencies helps students recognize, appreciate, and adapt to organizational realities by tempering their knowledge with practical constraints.

Rural Internship: Rural development internship is an initiative of Unnat Bharat Abhiyan Cell, RGIT in association with AICTE to involve students of all departments studying in different academic years for exploring various opportunities in techno-social fields, to connect and work with Rural India for their upliftment.

The faculty coordinator or mentor has to monitor the student's internship progress and interact with them to guide for the successful completion of the internship.

The students are permitted to carry out the internship anywhere in India or abroad. University shall not bear any expenses incurred in respect of the internship.

With the consent of the internal guide and Principal of the Institution, students shall be allowed to carry out the internship at their hometown (**within or outside the state or abroad**), provided favorable facilities are available for the internship and the student remains regularly in contact with the internal guide. **University shall not bear any cost involved in carrying out the internship by students.** However, students can receive any financial assistance extended by the organization.

Professional Elective /Open Elective Course: These are ONLINE courses suggested by the respective Board of Studies. Details of these courses shall be made available for students on the VTU web portal.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

B.E. in the title of the program

Scheme of Teaching and Examinations2022

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2023-24)

VI SEMESTER(A) for the candidate those who seek an internship with project work (A)

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	SDA	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	IPCC	BXX601	Bioprocess Control & Automation + Lab		3	0	2		03	50	50	100	4
2	PCC	BXX602	Biokinetics		4	0	0		03	50	50	100	4
3	PEC	BXX613x	Professional Elective Course		3	0	0		03	50	50	100	3
4	OEC	BXX654x	Open Elective Course		3	0	0		03	50	50	100	3
5	PCCL	BXXL606	Biokinetics Lab		0	0	2		03	50	50	100	1
6	AEC/SDC	BXX657x	Ability Enhancement Course/Skill Development Course V		If the course is offered as a Theory				01	50	50	100	1
					1	0	0						
					If course is offered as a practical								
					0	0	2						
7	MC	BNSK658	National Service Scheme (NSS)	NSS coordinator	0	0	2			100	---	100	0
		BPEK658	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		BYOK658	Yoga	Yoga Teacher									
8	IKS	BIKS609	Indian Knowledge System		1	0	0		01	100	0	100	0
									Total	**500**	**300**	**800**	**16**

Professional Elective Course (MVIT)

BBT613A	Biopharmaceuticals	BBT613C	Synthetic Biology and Tissue Engineering
BBT613B	Biomedical Imaging and Health Informatics	BBT613D	Systems Biology and Rational Drug design

Open Elective Course

BBT654A	Robotics in Healthcare and Agri-Tech	BBT654C	Nanobiotechnology
BBT654B	Food, Nutrition and Health	BBT654D	Ecology and Ecosystem

Ability Enhancement Course / Skill Enhancement Course-V			
BBT657A	Bio-Innovation and Start-ups	BBTL657C	Modelling and Simulations in Biology Lab
BBTL657B	Bioinstrumentation and Servicing Lab	BBT657D	Good Manufacturing and Laboratory Practices

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

B.E. in the title of the program

Scheme of Teaching and Examinations2022

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2023-24)

VII and VIII semesters for the candidate those who seek an internship with project work (A)

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	SDA	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	IPCC	BXX701	To be completed in 5^{th}/6^{th} semester		3	0	2		03	50	50	100	4
2	IPCC	BXX702	To be completed in 5^{th} /6^{th} semester		3	0	2		03	50	50	100	4
3	PCC	BXX703	To be completed in the 6^{th} semester		4	0	0		03	50	50	100	3
4	PEC	BXX714x	Professional Elective Course (MOOC Courses)		3	0	0		03	50	50	100	3
5	OEC	BXX755x	Open Elective Courses(MOOC courses)		3	0	0		01	50	50	100	3
1	PEC	Bxx801x	Professional Elective (MOOC Courses)		3	0	0		03	50	50	100	3
2	OEC	Bxx802x	Open Elective (MOOC Courses)		3	0	0		01	50	50	100	3
3	PROJ	BXX883	Project - outcome of training		0	0	12		03	100	100	200	9
4	INT	Bxx804	Internship (Industry/Research) (02 semesters)		0	0	12		03	100	100	200	10
										200	**200**	**400**	**42**

Please note: If any clarifications / suggestions please email to **sbhvtuso@yahoo.com**

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

B.E. in Electronics and Communication Engineering

Scheme of Teaching and Examinations2022

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2023-24)

III SEMESTER

Sl. No	Course	Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	SDA	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	PCC	BMATEC301	AV Mathematics-III for EC Engineering	TD- Maths PSB - Maths	3	0	0		03	50	50	100	3
2	IPCC	BEC302	Digital System Design using Verilog	TD: ECE PSB: ECE	3	0	2		03	50	50	100	4
3	IPCC	BEC303	Electronic Principles and Circuits	TD: ECE PSB: ECE	3	0	2		03	50	50	100	4
4	PCC	BEC304	Network Analysis	TD: ECE PSB: ECE	3	0	0		03	50	50	100	3
5	PCCL	BECL305	Analog and Digital Systems Design Lab	TD: ECE PSB: ECE	0	0	2		03	50	50	100	1
6	ESC	BXX306x	ESC/ETC/PLC	TD: PSB:	3	0	0		03	50	50	100	3
7	UHV	BSCK307	Social Connect and Responsibility	Any Department	0	0	2		01	100	---	100	1
8	AEC/ SEC	BXX358x	Ability Enhancement Course/Skill Enhancement Course– III		If the course is a Theory				01	50	50	100	1
					1	0	0						
					If a course is a laboratory				02				
					0	0	2						
9	MC	BNSK359	National Service Scheme (NSS)	NSS coordinator	0	0	2			100	---	100	0
		BPEK359	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		BYOK359	Yoga	Yoga Teacher									
									Total	**550**	**350**	**900**	**20**

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **UHV**: Universal Human Value Course, **MC**: Mandatory Course (Non-credit), **AEC**: Ability Enhancement Course, **SEC**: Skill Enhancement Course, **L:** Lecture, **T**: Tutorial, **P**: Practical **S= SDA**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation.K :This letter in the course code indicates common to all the stream of engineering. ESC: Engineering Science Course, ETC: Emerging

Technology Course, PLC: Programming Language Course			
.			
Engineering Science Course (ESC/ETC/PLC)			
BEC306A	Electronic Devices	BEC306C	Computer Organization and Architecture
BEC306B	Sensors and Instrumentation	BEC306D	Applied Numerical Methods for EC Engineers
Ability Enhancement Course – III			
BEC358A	LABVIEW programming	BEC358C	C++ Basics
BEC358B	MATLAB Programming	BEC358D	IOT for Smart Infrastructure

Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practical's of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (B.E./B.Tech.) 2022-23 may please be referred.

National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), and Yoga(YOG) with the concerned coordinator of the course during the first week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

B.E. in Electronics and Communication Engineering

Scheme of Teaching and Examinations2022

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2023-24)

IV SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	PCC	BEC401	Electromagnetics Theory	TD: ECE /ETE PSB: ECE/ETE	3	0	0		03	50	50	100	3
2	IPCC	BEC402	Principles of Communication Systems	TD: ECE /ETE PSB: ECE/ETE	3	0	2		03	50	50	100	4
3	IPCC	BEC403	Control Systems	TD: ECE /ETE PSB: ECE/ETE	3	0	2		03	50	50	100	4
4	PCCL	BECL404	Communication Lab	TD: ECE /ETE PSB: ECE/ETE	0	0	2		03	50	50	100	1
5	ESC	BEC405x	ESC/ETC/PLC	TD: ECE /ETE PSB: ECE/ETE	3	0	0		03	50	50	100	3
6	AEC/ SEC	BXX456x	Ability Enhancement Course/Skill Enhancement Course- IV	TD and PSB: Concerned department	If the course is Theory				01	50	50	100	1
					1	0	0						
					If the course is a lab				02				
					0	0	2						
4	BSC	BBOK407	Biology For Engineers	TD / PSB: BT, CHE,	3	0	0		03	50	50	100	3
7	UHV	BUHK408	Universal human values course	Any Department	1	0	0		01	50	50	100	1
9	MC	BNSK459	National Service Scheme (NSS)	NSS coordinator	0	0	2			100	---	100	0
		BPEK459	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		BYOK459	Yoga	Yoga Teacher									
									Total	**500**	**400**	**900**	**20**

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **UHV**: Universal Human Value Course, **MC**: Mandatory Course (Non-credit), **AEC**: Ability Enhancement Course, **SEC**: Skill Enhancement Course, **L:** Lecture, **T**: Tutorial, **P**: Practical **S= SDA**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation. K :This letter in the course code indicates common to all the stream of engineering.

Engineering Science Course (ESC/ETC/PLC)			
BEC405A	Microcontrollers	BEC405C	Operating Systems
BEC405B	Industrial Electronics	BEC405D	Data Structures using C
Ability Enhancement Course / Skill Enhancement Course - IV			
BEC456A	Microcontroller Lab	BEC456C	Octave Programming
BEC456B	Programmable Logic Controllers	BEC456D	Data Structures Lab using C

Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practical of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (B.E./B.Tech.) 2022-23

National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), and Yoga(YOG) with the concerned coordinator of the course during the first week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses is mandatory for the award of degree.

Visvesvaraya Technological University, Belagavi

SchemeofTeaching andExaminations-2022

Outcome-Based Education(OBE)andChoiceBasedCreditSystem(CBCS)

(Effectivefromtheacademicyear 2022-23)

ISemester(Electrical & Electronics EngineeringStream) **(For Physics Group)**

Sl. No	Course	andCourseCode	CourseTitle	TD/PSB	TeachingHours/Week Theory Lecture L	Tutorial T	Practical/ Drawing P	SDA S	Examination Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
1	*ASC(IC)	BMATE101	**Mathematics-I** for EEE Streams	Maths	2	2	2	0	03	50	50	100	04
2	#ASC(IC)	BPHYE102	**Applied Physics** for EEE Stream	PHY	2	2	2	0	03	50	50	100	04
3	ESC	BEEE103	# **Elements**of Electrical Engineering	EEE/ECE/TCE	2	2	0	0	03	50	50	100	03
		OR			OR								
		BBEE103	## **Basic Electronics**for EEE stream		3	0	0	0					
4	ESC-I	BESCK104x	Engineering Science Course-I	Respective Engg Dept	3	0	0	0	03	50	50	100	03
5	ETC-I	BETCK105x	Emerging Technology Course-I	Any Dept	3	0	0	0	03	50	50	100	03
	OR												
	PLC-I	BPLCK105x	Programming Language Course-I		2	0	2	0	03				
6	AEC	BENGK106	Communicative English	Humanities	1	0	0	0	01	50	50	100	01
			OR										
		BPWSK106	Professional Writing Skills in English										
7	HSMC	BKSKK107/ BKBKK107	Samskrutika Kannada/ Balake Kannada	Humanities	1	0	0	0	01	50	50	100	01
		OR											
		BICOK107	Indian Constitution		1	0	0	0					
8	AEC/SDC	BIDTK158	Innovation and Design Thinking	Any Dept	1	0	0	0	01	50	50	100	01
		OR											
		BSFHK158	Scientific Foundations of Health		1	0	0	0	01				

TOTAL						**400**	**400**	**800**	**20**

 # Electrical & Electronics Engineering Students have to study BEEE103**- Element of Electrical Engineering compulsorily**
Where as Electronics and allied stream students have to study BBEE103 **Basic Electronics compulsorily**

SDA-Skill Development Activities, **TD/PSB-** Teaching Department / Paper Setting Board, **ASC-**Applied Science Course, **ESC-** Engineering Science Courses, **ETC-** Emerging Technology Course, **AEC-** Ability Enhancement Course, **HSMS-**Humanity and Social Science and Management Course, **SDC-** Skill Development Course, **CIE**–Continuous Internal Evaluation, **SEE-** Semester End Examination, **IC** – Integrated Course (Theory Course Integrated with Practical Course)

Credit Definition: 1-hour Lecture **(L)** per week=**1Credit** 2-hoursTutorial**(T)** per week=**1Credit** 2-hours Practical / Drawing (**P**) per week=**1Credit** **2-**hous Skill Development Actives **(SDA)** per week = **1 Credit**	04-Credits courses are to be designed for 50 hours of Teaching-Learning Session 04-Credits (IC) are to be designed for 40 hours' theory and 12-14 hours of practical sessions 03-Credits courses are to be designed for 40 hours of Teaching-Learning Session 02- Credits courses are to be designed for 25 hours of Teaching-Learning Session 01-Credit courses are to be designed for 12-15 hours of Teaching-Learning sessions

Student's Induction Program: Motivating (Inspiring) Activities under the Induction program – The main aim of the induction program is to provide newly admitted students a broad understanding of society, relationships, and values. Along with the knowledge and skill of his/her study, students' character needs to be nurtured as an essential quality by which he/she would understand and fulfill the responsibility as an engineer. The following activities are to be covered in 21 days. Physical Activity, Creative Arts, Universal Human Values, Literary, Proficiency Modules, Lectures by Eminent People, Visits to Local areas, Familiarization with Department/Branch and Innovation, etc. For details, refer the ANNEXURE-I of Induction Programs notification of the University published at the beginning of the 1st semester.

AICTE Activity Points to be earned by students admitted to BE/ B.Tech., / B. Plan day college program (For more details refer to Chapter 6, AICTE Activity Point Program, Model Internship Guidelines): Over and above the academic grades, every regular student admitted to the 4 years Degree program and every student entering 4 years Degree programs through lateral entry, shall earn 100 and 75 Activity Points respectively for the award of degree through AICTE Activity Point Program. Students transferred from other Universities to the fifth semester are required to earn 50 Activity Points from the year of entry to VTU. The Activity Points earned shall be reflected on the student's eighth semester Grade Card. The activities can be spread over the years, any time during the semester weekends, and holidays, as per the liking and convenience of the student from the year of entry to the program. However, the minimum hours requirement should be fulfilled. Activity Points (non-credit) do not affect SGPA/CGPA and shall not be considered for vertical progression. In case students fail to earn the prescribed activity Points, an Eighth Semester Grade Card shall be issued only after earning the required activity points. Students shall be admitted for the award of the degree only after the release of the Eighth semester Grade Card.

-** BMATE101Shall have the 03 hours of theory examination(SEE), however, practical sessions question shall be included in the theory question papers. * The mathematics subject should be taught by a single faculty member per division, with no sharing of the course(subject)module-wise by different faculty members.**

#- BPHYE102SEE shall have the 03 hours of theory examination and 02-03 hours of practical examination.

ESC or ETC of 03 credits Courses shall have only a theory component (L:T :P:S=3:0:0:0) or if the nature the of course required experimental learning syllabus shall be designed as an Integrated course (L:T:P:S= 2:0:2:0),. **All 01 Credit-** courses shall have the SEE of 01 hours duration and the pattern of the question paper shall be MCQ

(ESC-I) Engineering Science Courses-I					(ETC-I) Emerging Technology Courses-I				
Code	**Title**	**L**	**T**	**P**	**Code**	**Title**	**L**	**T**	**P**
BESCK104A	Introduction to Civil Engineering	3	0	0	BETCK105A	Smart Materials and Systems	3	0	0
BESCK104B	Introduction to Electrical Engineering	3	0	0	BETCK105B	Green Buildings	3	0	0
BESCK104C	Introduction to Electronics **Communication**	3	0	0	BETCK105C	Introduction to Nano Technology	3	0	0
BESCK104D	Introduction to Mechanical Engineering	3	0	0	BETCK105D	Introduction to Sustainable Engineering	3	0	0
BESCK104E	Introduction to C Programming	2	0	2	BETCK105E	Renewable Energy Sources	3	0	0
					BETCK105F	Waste Management	3	0	0
					BETCK105G	Emerging Applications of Biosensors	3	0	0
					BETCK105H	Introduction to Internet of Things (IOT)	3	0	0
					BETCK105I	Introduction to Cyber Security	3	0	0
					BETCK105J	Introduction to Embedded System	3	0	0
(PLC-I) Programming Language Courses-I									
Code	**Title**	**L**	**T**	**P**					
BPLCK105A	Introduction to Web Programming	2	0	2					
BPLCK105B	Introduction to Python Programming	2	0	2					
BPLCK105C	Basics of JAVA programming	2	0	2					
BPLCK105D	Introduction to C++ Programming	2	0	2					
The course BESCK104E**, Introduction to C Programming, and all courses under PLC and ETC groupscan be taught by faculty of ANY DEPARTMENT**									

- The student has to select one course from the ESC-I group.
- **EEE** Students shall opt for any one of the courses from the ESC-I group **except,** BESCK104B**-Introduction to Electrical Engineering** and **ECE/ETC/BM/ML** students shall opt any one of the courses from ESC-I **except** BESCK104C **Introduction to Electronics** Engineering
- The students have to opt for the courses from ESC group without repeating the course in either 1st or 2nd semester
- The students must select one course from either ETC-I or PLC-I group.
- If students study the subject from ETC-I in 1st semester he/she has to select the course from PLC-II in the 2nd semester and vice-versa

Visvesvaraya Technological University, Belagavi

SchemeofTeaching and Examinations-2022

Outcome-Based Education(OBE)andChoiceBasedCreditSystem(CBCS)

(Effectivefromtheacademicyear 2022-23)

IISemester (Electrical & Electronics EngineeringStream) **(For the students who attended 1st semester under Physics Group)**

Sl. No	Course and Course Code		Course Title	TD/PSB	Teaching Hours/Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	SDA	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	*ASC(IC)	BMATE201	**Mathematics-II** for EESI	Maths	2	2	2	0	03	50	50	100	04
2	#ASC(IC)	BCHEE202	**Chemistry** for EES	Chemistry	2	2	2	0	03	50	50	100	04
3	ESC	BCEDK203	Computer-Aided Engineering Drawing	Civil/Mech Engg dept	2	0	2	0	03	50	50	100	03
4	ESC-II	BESCK204x	Engineering Science Course-II	Respective Engg Dept	3	0	0	0	03	50	50	100	03
5	PLC-II	BPLCK205x	Programming Language Course-II	Any Dept	2	0	2	0	03	50	50	100	03
	OR												
	ETC-II	**BETCK205x**	Emerging Technology Course-II		03	0	0	0	03				
6	AEC	BPWKS206	Professional Writing Skills in English	Humanities	1	0	0	0	01	50	50	100	01
			OR										
		BENGK206	Communicative English										
7	HSMS	BICOK207	Indian Constitution	Humanities	1	0	0	0	01	50	50	100	01
			OR										
		BKSKK207/ BKBKK207	Samskrutika Kannada/ Balake Kannada										
8	HSMS	BSFHK258	Scientific Foundations of Health	Any Dept.	1	0	0	0	01	50	50	100	01
			OR										
		BIDTK258	Innovation and Design Thinking		1	0	0	0	01				
				TOTAL						**400**	**400**	**800**	**20**

SDA-Skill Development Activities, **TD/PSB**- Teaching Department / Paper Setting Board, **ASC**-Applied Science Course, **ESC**- Engineering Science Courses, **ETC**- Emerging Technology Course, **AEC**- Ability Enhancement Course, **HSMS**-Humanity and Social Science and Management Course, **SDC**- Skill Development Course, **CIE** -Continuous Internal Evaluation, **SEE**- Semester End Examination, **IC** – Integrated Course (Theory Course Integrated with Practical Course)

-** BMATE201Shall have the 03 hours of theory examination(SEE), however, practical sessions question shall be included in the theory question papers. * The mathematics subject should be taught by a single faculty member per division, with no sharing of the course(subject)module-wise by different faculty members.**

#- BCHEE202- SEE shall have the 03 hours of theory examination and 02-03 hours of practical examination

ESC or ETC of 03 credits Courses shall have only a theory component (L:T :P:S=3:0:0:0) or if the nature the of course required practical learning, syllabus shall be designed as an Integrated course (L:T:P:S= 2:0:2:0)

All 01 Credit- courses shall have the SEE of 01 hours duration and the pattern of the question paper shall be MCQ

(ESC-II) Engineering Science Courses-II					**(ETC-II) Emerging Technology Courses-II**				
Code	**Title**	**L**	**T**	**P**	**Code**	**Title**	**L**	**T**	**P**
BESCK201A	Introduction to Civil Engineering	3	0	0	BETCK205A	Smart materials and Systems	3	0	0
BESCK202B	Introduction to Electrical Engineering	3	0	0	BETCK205B	Green Buildings	3	0	0
BESCK203C	Introduction to Electronics **Communication**	3	0	0	BETCK205C	Introduction to Nano Technology	3	0	0
BESCK204D	Introduction to Mechanical Engineering	3	0	0	BETCK205D	Introduction to Sustainable Engineering	3	0	0
BESCK205E	Introduction to C Programming	2	0	2	BETCK205E	Renewable Energy Sources	3	0	0
					BETCK205F	Waste Management	3	0	0
					BETCK205G	Emerging Applications of Biosensors	3	0	0
					BETCK205H	Introduction to Internet of Things(IoT)	3	0	0
					BETCK205I	Introduction to Cyber Security	3	0	0
					BETCK205J	Introduction to Embedded System	3	0	0
(PLC-II) Programming Language Courses-II									
Code	**Title**	**L**	**T**	**P**					
BPLCK205A	Introduction to Web Programming	2	0	2					
BPLCK205B	Introduction to Python Programming	2	0	2					
BPLCK205C	Basics of JAVA programming	2	0	2					
BPLCK205D	Introduction to C++ Programming	2	0	2					
The course BESCK205E**, Introduction to C Programming, and all courses under PLC and ETC groups can be taught by faculty of ANY DEPARTMENT**									

- The student has to select one course from the ESC-II group.
- **EEE** Students shall opt for any one of the courses from the ESC-I group **except,** BESCK202**-Introduction to Electrical Engineering and ECE/ETC/BM/ML** students shall opt any one of the courses from ESC-I **except** BESCK203**Introduction to Electronics** Engineering
- The students have to opt for the courses from ESC group without repeating the course in either 1st or 2nd semester
- The students must select one course from either ETC-II or PLC-II group.
- If students study the subject from ETC-I in 1st semester he/she has to select the course from PLC-II in the 2nd semester and vice-versa

<table>
<tr><td colspan="16">Visvesvaraya Technological University, Belagavi
SchemeofTeaching and Examinations-2022
Outcome-Based Education(OBE)andChoiceBasedCreditSystem(CBCS)
(Effectivefromtheacademicyear 2022-23)</td></tr>
<tr><td colspan="11">**ISemester (Electrical & Electronics Engineering Stream)**</td><td colspan="5">**(For Chemistry Group)**</td></tr>
<tr><td rowspan="3">**Sl. No**</td><td rowspan="3" colspan="2">**Course and Course Code**</td><td rowspan="3">**Course Title**</td><td rowspan="3">**TD/PSB**</td><td colspan="4">**TeachingHours/Week**</td><td colspan="4">**Examination**</td><td rowspan="3">**Credits**</td></tr>
<tr><td>**Theory Lecture**</td><td>**Tutorial**</td><td>**Practical/ Drawing**</td><td>**SDA**</td><td rowspan="2">**Duration in hours**</td><td rowspan="2">**CIE Marks**</td><td rowspan="2">**SEE Marks**</td><td rowspan="2">**Total Marks**</td></tr>
<tr><td>**L**</td><td>**T**</td><td>**P**</td><td>**S**</td></tr>
<tr><td>1</td><td>*ASC(IC)</td><td>BMATE101</td><td>**Mathematics-I** for EES</td><td>Maths</td><td>2</td><td>2</td><td>2</td><td>0</td><td>03</td><td>50</td><td>50</td><td>100</td><td>04</td></tr>
<tr><td>2</td><td>#ASC(IC)</td><td>BCHEE102</td><td>**Chemistry** for EES</td><td>Chemistry</td><td>2</td><td>2</td><td>2</td><td>0</td><td>03</td><td>50</td><td>50</td><td>100</td><td>04</td></tr>
<tr><td>3</td><td>ESC</td><td>BCEDK103</td><td>Computer-Aided Engineering Drawing</td><td>Mechanical</td><td>2</td><td>0</td><td>2</td><td>0</td><td>03</td><td>50</td><td>50</td><td>100</td><td>03</td></tr>
<tr><td>4</td><td>ESC-I</td><td>BESCK104x</td><td>Engineering Science Course-I</td><td>Respective Engg Dept</td><td>3</td><td>0</td><td>0</td><td>0</td><td>03</td><td>50</td><td>50</td><td>100</td><td>03</td></tr>
<tr><td rowspan="3">5</td><td>ETC-I</td><td>BETCK105x</td><td>Emerging Technology Course-I</td><td rowspan="3">Any Dept</td><td>3</td><td>0</td><td>0</td><td>0</td><td>03</td><td rowspan="3">50</td><td rowspan="3">50</td><td rowspan="3">100</td><td rowspan="3">03</td></tr>
<tr><td colspan="3">OR</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>PLC-I</td><td>BPLCK105x</td><td>Programming Language Course-I</td><td>2</td><td>0</td><td>2</td><td>0</td><td>03</td></tr>
<tr><td rowspan="3">6</td><td rowspan="3">AEC</td><td>BPWSK106</td><td>Professional Writing Skills in English</td><td rowspan="3">Humanities</td><td rowspan="3">1</td><td rowspan="3">0</td><td rowspan="3">0</td><td rowspan="3">0</td><td rowspan="3">01</td><td rowspan="3">50</td><td rowspan="3">50</td><td rowspan="3">100</td><td rowspan="3">01</td></tr>
<tr><td></td><td>OR</td></tr>
<tr><td>**BENGK106**</td><td>Communicative English</td></tr>
<tr><td rowspan="3">7</td><td rowspan="3">HSMS</td><td>BICOK107</td><td>Indian Constitution</td><td rowspan="3">Humanities</td><td rowspan="3">1</td><td rowspan="3">0</td><td rowspan="3">0</td><td rowspan="3">0</td><td rowspan="3">01</td><td rowspan="3">50</td><td rowspan="3">50</td><td rowspan="3">100</td><td rowspan="3">01</td></tr>
<tr><td></td><td>OR</td></tr>
<tr><td>BKSKK107/ BKBKK107</td><td>Samskrutika Kannada/ Balake Kannada</td></tr>
<tr><td rowspan="3">8</td><td rowspan="3">HSMS</td><td>BSFHK158</td><td>Scientific Foundations of Health</td><td rowspan="3">Any Dept.</td><td>1</td><td>0</td><td>0</td><td>0</td><td>01</td><td rowspan="3">50</td><td rowspan="3">50</td><td rowspan="3">100</td><td rowspan="3">01</td></tr>
<tr><td></td><td>OR</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>BIDTK158</td><td>Innovation and Design Thinking</td><td>1</td><td>0</td><td>0</td><td>0</td><td>01</td></tr>
<tr><td colspan="5">**TOTAL**</td><td></td><td></td><td></td><td></td><td></td><td>**400**</td><td>**400**</td><td>**800**</td><td>**20**</td></tr>
</table>

SDA-Skill Development Activities, **TD/PSB**- Teaching Department / Paper Setting Board, **ASC**-Applied Science Course, **ESC**- Engineering Science Courses, **ETC**- Emerging Technology Course, **AEC**- Ability Enhancement Course, **HSMS**-Humanity and Social Science and Management Course, **SDC**- Skill Development Course, **CIE** -Continuous Internal Evaluation, **SEE**- Semester End Examination, **IC** – Integrated Course (Theory Course Integrated with Practical Course)
-** BMATE101Shall have the 03 hours of theory examination (SEE), however, practical sessions question shall be included in the theory question papers. * The mathematics subject should be taught by a single faculty member per division, with no sharing of the course(subject)module-wise by different faculty members.** **#-** BCHEE102- SEE shall have the 03 hours of theory examination and 02-03 hours of practical examination **ESC or ETC of 03 credits Courses** shall have only a theory component (L:T :P:S=3:0:0:0) or if the nature the of course required practical learning syllabus shall be designed as an Integrated course (L:T:P:S= 2:0:2:0) **All 01 Credit-** courses shall have the SEE of 01 hours duration and the pattern of the question paper shall be MCQ

Credit Definition: 1-hour Lecture **(L)** per week=**1Credit** 2-hoursTutorial**(T)** per week=**1Credit** 2-hours Practical / Drawing (**P**) per week=**1Credit** **2-**hous Skill Development Actives **(SDA)** per week = **1 Credit**	04-Credits courses are to be designed for 50 hours of Teaching-Learning Session 04-Credits (IC) are to be designed for 40 hours' theory and 12-14 hours of practical sessions 03-Credits courses are to be designed for 40 hours of Teaching-Learning Session 02- Credits courses are to be designed for 25 hours of Teaching-Learning Session 01-Credit courses are to be designed for 12-15 hours of Teaching-Learning sessions

Student's Induction Program: Motivating (Inspiring) Activities under the Induction program – The main aim of the induction program is to provide newly admitted students a broad understanding of society, relationships, and values. Along with the knowledge and skill of his/her study, students' character needs to be nurtured as an essential quality by which he/she would understand and fulfill the responsibility as an engineer. The following activities are to be covered in 21 days. Physical Activity, Creative Arts, Universal Human Values, Literary, Proficiency Modules, Lectures by Eminent People, Visits to Local areas, Familiarization with Department/Branch and Innovation, etc. For details, refer the ANNEXURE-I of Induction Programs notification of the University published at the beginning of the 1st semester.

AICTE Activity Points to be earned by students admitted to BE/ B.Tech., / B. Plan day college program (For more details refer to Chapter 6, AICTE Activity Point Program, Model Internship Guidelines): Over and above the academic grades, every regular student admitted to the 4 years Degree program and every student entering 4 years Degree programs through lateral entry, shall earn 100 and 75 Activity Points respectively for the award of degree through AICTE Activity Point Program. Students transferred from other Universities to the fifth semester are required to earn 50 Activity Points from the year of entry to VTU. The Activity Points earned shall be reflected on the student's eighth semester Grade Card. The activities can be spread over the years, any time during the semester weekends, and holidays, as per the liking and convenience of the student from the year of entry to the program. However, the minimum hours' requirement should be fulfilled. Activity Points (non-credit) do not affect SGPA/CGPA and shall not be considered for vertical progression. In case students fail to earn the prescribed activity Points, an Eighth Semester Grade Card shall be issued only after earning the required activity points. Students shall be admitted for the award of the degree only after the release of the Eighth semester Grade Card.

(ESC-I) Engineering Science Courses-I					(ETC-I) Emerging Technology Courses-I				
Code	**Title**	**L**	**T**	**P**	**Code**	**Title**	**L**	**T**	**P**
BESCK104A	Introduction to Civil Engineering	3	0	0	BETCK105A	Smart Materials and Systems	3	0	0
BESCK104B	Introduction to Electrical Engineering	3	0	0	BETCK105B	Green Buildings	3	0	0
BESCK104C	Introduction to Electronics **Communication**	3	0	0	BETCK105C	Introduction to Nano Technology	3	0	0
BESCK104D	Introduction to Mechanical Engineering	3	0	0	BETCK105D	Introduction to Sustainable Engineering	3	0	0
BESCK104E	Introduction toC Programming	2	0	2	BETCK105E	Renewable Energy Sources	3	0	0
					BETCK105F	Waste Management	3	0	0
					BETCK105G	Emerging Applications of Biosensors	3	0	0
					BETCK105H	Introduction to Internet of Things (IOT)	3	0	0
					BETCK105I	Introduction to Cyber Security	3	0	0
					BETCK105J	Introduction to Embedded System	3	0	0
(PLC-I) Programming Language Courses-I									
Code	**Title**	**L**	**T**	**P**					
BPLCK105A	Introduction to Web Programming	2	0	2					
BPLCK105B	Introduction to Python Programming	2	0	2					
BPLCK105C	Basics of JAVA programming	2	0	2					
BPLCK105D	Introduction to C++ Programming	2	0	2					
The course BESCK104E**Introduction to C Programming, and all courses under PLC and ETC groupscan be taught by faculty of ANY DEPARTMENT**									

- The student has to select one course from the ESC-I group.
- **EEE** Students shall opt for any one of the courses from the ESC-I group **except,** BESCK104B**-Introduction to Electrical Engineering and ECE/ETC/BM/ML** students shall opt any one of the courses from ESC-I **except** BESCK104C **Introduction to Electronics** Engineering
- The students have to opt for the courses from ESC group without repeating the course in either 1st or 2nd semester
- The students must select one course from either ETC-I or PLC-I group.
- If students study the subject from ETC-I in 1st semester he/she has to select the course from PLC-II in the 2nd semester and vice-versa

Visvesvaraya Technological University, Belagavi

SchemeofTeaching and Examinations-2022

Outcome-Based Education(OBE)andChoiceBasedCreditSystem(CBCS)

(Effectivefromtheacademicyear 2022-23)

II Semester (Electrical & Electronics Engineering Stream) **(For students who attended 1st semester under Chemistry Group)**

Sl. No	Course and Course Code		Course Title	TD/PSB	TeachingHours/Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	SDA	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	*ASC(IC)	BMATE201	**Mathematics-II** for EES	Maths	2	2	2	0	03	50	50	100	04
2	#ASC(IC)	BPHYE202	**Applied Physics** for EES	PHY	2	2	2	0	03	50	50	100	04
3	ESC	BEEE203	# **Elements** of Electrical Engineering	EEE/ECE/TCE	2	2	0	0	03	50	50	100	03
		OR											
		BBEE203	## **Basic Electronics**		3	0	0	0					
4	ESC-II	BESCK204x	Engineering Science Course-II	Respective Engg Dept.	3	0	0	0	03	50	50	100	03
5	PLC-II	BPLCK205x	Programming language Course-II	Any Dept	2	0	2	0	03	50	50	100	03
	OR												
	ETC-II	BETCK205x	Emerging Technology Course-II		3	0	0	0	03				
6	AEC	BENGK206	Communicative English	Humanities	1	0	0	0	01	50	50	100	01
			OR										
		BPWSK206	Professional Writing Skills in English										
7	HSMC	BKSKK207/ BKBKK207	Samskrutika Kannada/ Balake Kannada	Humanities	1	0	0	0	01	50	50	100	01
		OR											
		BICOK207	Indian Constitution		1	0	0	0					
8	AEC/SDC	BIDTK258	Innovation and Design Thinking	Any Dept	1	0	0	0	01	50	50	100	01
		OR											
		BSFHK258	Scientific Foundations of Health		1	0	0	0	01				
				TOTAL						**400**	**400**	**800**	**20**

 # Electrical & Electronics Engineering Students have to study BEEE203 **Elements of Electrical Engineering compulsorily** **## Whereas Electronics and allied stream students have to study** BBEE203 **Basic Electronics compulsorily**
SDA-Skill Development Activities, **TD/PSB-** Teaching Department / Paper Setting Board, **ASC-**Applied Science Course, **ESC-** Engineering Science Courses, **ETC-** Emerging Technology Course, **AEC-** Ability Enhancement Course, **HSMS-**Humanity and Social Science and Management Course, **SDC-** Skill Development Course, **CIE**–Continuous Internal Evaluation, **SEE-** Semester End Examination, **IC** – Integrated Course (Theory Course Integrated with Practical Course)
-** BMATE201Shall have the 03 hours of theory examination(SEE), however, practical sessions question shall be included in the theory question papers. * The mathematics subject should be taught by a single faculty member per division, with no sharing of the course(subject)module-wise by different faculty members.** **#-** BPHYE202SEE shall have the 03 hours of theory examination and 02-03 hours of practical examination. **ESC or ETC of 03 credits Courses** shall have only a theory component (L:T :P:S=3:0:0:0) or if the nature the of course required practical learning syllabus shall be designed as an Integrated course (L:T:P:S= 2:0:2:0),. **All 01 Credit-** courses shall have the SEE of 01 hours duration and the pattern of the question paper shall be MCQ

(ESC-II) Engineering Science Courses-II					(ETC-II) Emerging Technology Courses-II				
Code	**Title**	**L**	**T**	**P**	**Code**	**Title**	**L**	**T**	**P**
BESCK204A	Introduction to Civil Engineering	3	0	0	BETCK205A	Smart materials and Systems	3	0	0
BESCK204B	Introduction to Electrical Engineering	3	0	0	BETCK205B	Green Buildings	3	0	0
BESCK204C	Introduction to Electronics **Communication**	3	0	0	BETCK205C	Introduction to Nano Technology	3	0	0
BESCK204D	Introduction to Mechanical Engineering	3	0	0	BETCK205D	Introduction to Sustainable Engineering	3	0	0
BESCK204E	Introduction to C Programming	2	0	2	BETCK205E	Renewable Energy Sources	3	0	0
					BETCK205F	Waste Management	3	0	0
					BETCK205G	Emerging Applications of Biosensors	3	0	0
					BETCK205H	Introduction to Internet of Things(IoT)	3	0	0
					BETCK205I	Introduction to Cyber Security	3	0	0
					BETCK205J	Introduction to Embedded System	3	0	0
(PLC-II) Programming Language Courses-II									
Code	**Title**	**L**	**T**	**P**					
BPLCK205A	Introduction to Web Programming	2	0	2					
BPLCK205B	Introduction to Python Programming	2	0	2					
BPLCK205C	Basics of JAVA programming	2	0	2					
BPLCK205D	Introduction to C++ Programming	2	0	2					
The course BESCK204E**, Introduction to C Programming, and all courses under PLC and ETC groupscan be taught by faculty of ANY DEPARTMENT**									

- The student has to select one course from the ESC-II group.
- **EEE** Students shall opt for any one of the courses from the ESC-I group **except,** BESCK204B**-Introduction to Electrical Engineering and ECE/ETC/BM/ML** students shall opt any one of the courses from ESC-I **except** BESCK204C**Introduction to Electronics** Engineering
- The students have to opt for the courses from ESC group without repeating the course in either 1st or 2nd semester
- The students must select one course from either ETC-II or PLC-II group.
- If students study the subject from ETC-I in 1st semester he/she has to select the course from PLC-II in the 2nd semester and vice-versa

Visvesvaraya Technological University, Belagavi

Scheme of Teaching andExaminations-2022

Outcome-Based Education (OBE)and Choice Based Credit System(CBCS)

(Effective from the academic year 2022-23)

I Semester (Mechanical Engineering Stream) (For Physics Group)

Sl. No	Course and CourseCode		CourseTitle	TD/PSB	Teaching Hours/Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	SDA	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	*ASC(IC)	BMATM101	**Mathematics I** for Mechanical Engg Stream	Maths	2	2	2	0	03	50	50	100	04
2	#ASC(IC)	BPHYM102	**Applied Physics** for ME Stream	PHY	2	2	2	0	03	50	50	100	04
3	ESC	BEMEM103	Elements of Mechanical Engineering	Mechanical	2	2	0	0	03	50	50	100	03
4	ESC-I	BESCK104x	Engineering Science Course-I	Respective Engg Dept.	3	0	0	0	03	50	50	100	03
5	ETC-I	BETCK105x	Emerging Technology Course-I	Any Dept	3	0	0	0	03	50	50	100	03
	OR												
	PLC-I	BPLCK105x	Programming language Course-I		2	0	2	0	03				
6	AEC	BENGK106	Communicative English	Humanities	1	0	0	0	01	50	50	100	01
			OR										
		BPWSK106	Professional Writing Skills in English										
7	HSMC	BKSKK107/ BKBKK107	Samskrutika Kannada/ Balake Kannada	Humanities	1	0	0	0	01	50	50	100	01
		OR											
		BICOK107	Indian Constitution										
8	AEC/SDC	BIDTK158	Innovation and Design Thinking	Any Dept	1	0	0	0	01	50	50	100	01
		OR											
		BSFHK158	Scientific Foundations of Health		1	0	0	0	01				
				TOTAL						**400**	**400**	**800**	**20**

SDA-Skill Development Activities, **TD/PSB-** Teaching Department / Paper Setting Board, **ASC-**Applied Science Course, **ESC-** Engineering Science Courses, **ETC-** Emerging Technology Course, **AEC-** Ability Enhancement Course, **HSMS-**Humanity and Social Science and management Course, **SDC-** Skill Development Course, **CIE**–Continuous Internal Evaluation, **SEE-** Semester End Examination, **IC** – Integrated Course (Theory Course Integrated with Practical Course)

Credit Definition: 1-hour Lecture **(L)** per week=**1Credit** 2-hoursTutorial**(T)** per week=**1Credit** 2-hours Practical / Drawing (**P**) per week=**1Credit** **2-**hous Skill Development Actives **(SDA)** per week = **1 Credit**	04-Credits courses are to be designed for 50 hours of Teaching-Learning Session 04-Credits (IC) are to be designed for 40 hours' theory and 12-14 hours of practical sessions 03-Credits courses are to be designed for 40 hours of Teaching-Learning Session 02- Credits courses are to be designed for 25 hours of Teaching-Learning Session 01-Credit courses are to be designed for 12-15 hours of Teaching-Learning sessions

Student's Induction Program: Motivating (Inspiring) Activities under the Induction program – The main aim of the induction program is to provide newly admitted students a broad understanding of society, relationships, and values. Along with the knowledge and skill of his/her study, students' character needs to be nurtured as an essential quality by which he/she would understand and fulfill the responsibility as an engineer. The following activities are to be covered in 21 days. Physical Activity, Creative Arts, Universal Human Values, Literary, Proficiency Modules, Lectures by Eminent People, Visits to Local areas, Familiarization with Department/Branch and Innovation, etc. For details, refer the ANNEXURE-I of Induction Programs notification of the University published at the beginning of the 1st semester.

AICTE Activity Points to be earned by students admitted to BE/ B.Tech., / B. Plan day college program (For more details refer to Chapter 6, AICTE Activity Point Program, Model Internship Guidelines): Over and above the academic grades, every regular student admitted to the 4 years Degree program and every student entering 4 years Degree programs through lateral entry, shall earn 100 and 75 Activity Points respectively for the award of degree through AICTE Activity Point Program. Students transferred from other Universities to the fifth semester are required to earn 50 Activity Points from the year of entry to VTU. The Activity Points earned shall be reflected on the student's eighth semester Grade Card. The activities can be spread over the years, any time during the semester weekends, and holidays, as per the liking and convenience of the student from the year of entry to the program. However, the minimum hours' requirement should be fulfilled. Activity Points (non-credit) do not affect SGPA/CGPA and shall not be considered for vertical progression. In case students fail to earn the prescribed activity Points, an Eighth Semester Grade Card shall be issued only after earning the required activity points. Students shall be admitted for the award of the degree only after the release of the Eighth semester Grade Card.

-** BMATM101 Shall have the 03 hours of theory examination(SEE), however, practical sessions question shall be included in the theory question papers. * The mathematics subject should be taught by a single faculty member per division, with no sharing of the course(subject)module-wise by different faculty members.**

#- BPHYM102 SEE shall have the 03 hours of theory examination and 02-03 hours of practical examination

ESC or ETC of 03 credits Courses shall have only a theory component (L:T :P:S=3:0:0:0) or if the nature the of course required practical learning syllabus shall be designed as an Integrated course (L:T:P:S= 2:0:2:0).**All 01 Credit-** courses shall have the SEE of 01 hours duration and the pattern of the question paper shall be MCQ

(ESC-I) Engineering Science Courses-I					(ETC-I) Emerging Technology Courses-I				
Code	**Title**	**L**	**T**	**P**	**Code**	**Title**	**L**	**T**	**P**
BESCK104A	Introduction to Civil Engineering	3	0	0	BETCK105A	Smart Materials and Systems	3	0	0
BESCK104B	Introduction to Electrical Engineering	3	0	0	BETCK105B	Green Buildings	3	0	0
BESCK104C	Introduction to Electronics **Communication**	3	0	0	BETCK105C	Introduction to Nano Technology	3	0	0
BESCK104D	Introduction to Mechanical Engineering	3	0	0	BETCK105D	Introduction to Sustainable Engineering	3	0	0
BSC1K104E	Introduction to C Programming	2	0	2	BETCK105E	Renewable Energy Sources	3	0	0
					BETCK105F	Waste Management	3	0	0
					BETCK105G	Emerging Applications of Biosensors	3	0	0
					BETCK105H	Introduction to Internet of Things (IOT)	3	0	0
					BETCK105I	Introduction to Cyber Security	3	0	0
(PLC-I) Programming Language Courses-I					**BETCK105J**	**Introduction to Embedded System**	**3**	**0**	**0**
Code	**Title**	**L**	**T**	**P**					
BPLCK105A	Introduction to Web Programming	2	0	2					
BPLCK105B	Introduction to Python Programming	2	0	2					
BPLCK105C	Basics to JAVA programming	2	0	2					
BPLCK105D	Introduction to C++ Programming	2	0	2					
The course BSC1K104E, **Introduction to C Programming, and all courses under PLC and ETC groups can be taught by faculty of ANY DEPARTMENT**									

- The student has to select one course from the ESC-I group.
- MES stream Students shall opt for any one of the courses from the ESC-I group **except, 22ESC144-Introduction to Mechanical Engineering**
- The students have to opt for the courses from ESC group without repeating the course in either 1st or 2nd semester
- The students must select one course from either ETC-I or PLC-I group.
- If students study the subject from ETC-I in 1st semester he/she has to select the course from PLC-II in the 2nd semester and vice-versa

Visvesvaraya Technological University, Belagavi
Scheme of Teaching and Examinations-2022
Outcome-Based Education(OBE)and Choice Based Credit System(CBCS)
(Effective from the academic year 2022-23)

II Semester(Mechanical Engineering Stream) **(For the students who attend the 1st semester under Physics Group)**

Sl. No	Course and Course Code		Course Title	TD/PSB	Teaching Hours/Week				Examination				Credits
					Theory Lecture L	Tutorial T	Practical/ Drawing P	SDA S	Duration in hours	CIE Marks	SEE Marks	Total Marks	
1	*ASC(IC)	BMATM201	**Mathematics-II** for Mechanical Engg Stream	Maths	2	2	2	0	03	50	50	100	04
2	#ASC(IC)	BCHEM202	**Applied Chemistry** for ME Stream	Chemistry	2	2	2	0	03	50	50	100	04
3	ESC	BCEDK203	Computer-Aided Engineering Drawing	Civil/Mech Engg dept	2	0	2	0	03	50	50	100	03
4	ESC-II	BESCK204x	Engineering Science Course-II	Respective Engg Dept	3	0	0	0	03	50	50	100	03
5	PLC-II	BETCK205x	Programming Language Course-II	Any Dept	3	0	0	0	03	50	50	100	03
	OR												
	ETC-II	BETCK205x	Emerging Technology Course-II		3	0	0	0	03				
6	AEC	BPWSK206	Professional Writing Skills in English	Humanities	1	0	0	0	01	50	50	100	01
			OR										
		BENGK206	Communicative English										
7	HSMS	BICOK207	Indian Constitution	Humanities	1	0	0	0	01	50	50	100	01
		OR											
		BKSKK207 BKBKK207	Samskrutika Kannada/ Balake Kannada										
8	AEC/SEC	BSFHK258	Scientific Foundations for Health	Any Dept	1	0	0	0	01	50	50	100	01
		OR											
		BIDTK258	Innovation and Design Thinking		1	0	0	0	01				
				TOTAL						**400**	**400**	**800**	**20**

SDA-Skill Development Activities, **TD/PSB-** Teaching Department / Paper Setting Board, **ASC-**Applied Science Course, **ESC-** Engineering Science Courses, **ETC-** Emerging Technology Course, **AEC-** Ability Enhancement Course, **HSMS-**Humanity and Social Science and management Course, **SDC-** Skill Development Course, **CIE -**Continuous Internal Evaluation, **SEE-** Semester End Examination, **IC** – Integrated Course (Theory Course Integrated with Practical Course)

-** BMATM201 Shall have the 03 hours of theory examination(SEE), however, practical sessions question shall be included in the theory question papers. * The mathematics subject should be taught by a single faculty member per division, with no sharing of the course(subject)module-wise by different faculty members.**

#- BCHEM202**-** SEE shall have the 03 hours of theory examination and 02-03 hours of practical examination

ESC or ETC of 03 credits Courses shall have only a theory component (L:T :P:S=3:0:0:0) or if the nature the of course required practical learning syllabus shall be designed as an Integrated course (L:T:P:S= 2:0:2:0)

All 01 Credit- courses shall have the SEE of 01 hours duration and the pattern of the question paper shall be MCQ

(ESC-II) Engineering Science Courses-II					(ETC-II) Emerging Technology Courses-II				
Code	**Title**	**L**	**T**	**P**	**Code**	**Title**	**L**	**T**	**P**
BESCK204A	Introduction to Civil Engineering	3	0	0	BETCK205A	Smart materials and Systems	3	0	0
BESCK204B	Introduction to Electrical Engineering	3	0	0	BETCK205B	Green Buildings	3	0	0
BESCK204C	Introduction to Electronics **Communication**	3	0	0	BETCK205C	Introduction to Nano Technology	3	0	0
BESCK204D	Introduction to Mechanical Engineering	3	0	0	BETCK205D	Introduction to Sustainable Engineering	3	0	0
BESCK204E	Introduction to C Programming	2	0	2	BETCK205E	Renewable Energy Sources	3	0	0
					BETCK205F	Waste Management	3	0	0
					BETCK205G	Emerging Applications of Biosensors	3	0	0
					BETCK205H	Introduction to Internet of Things(IoT)	3	0	0
					BETCK205I	Introduction to Cyber Security	3	0	0
(PLC-II) Programming Language Courses-II					**BETCK205J**	**Introduction to Embedded System**	**3**	**0**	**0**
Code	**Title**	**L**	**T**	**P**					
BPLCK205A	Introduction to Web Programming	2	0	2					
BPLCK205B	Introduction to Python Programming	2	0	2					
BPLCK205C	Basics of JAVA programming	2	0	2					
BPLCK205D	Introduction to C++ Programming	2	0	2					

The course BESCK205E**, Introduction to C Programming, and all courses under PLC and ETC groups can be taught by faculty of ANY DEPARTMENT**

- The student has to select one course from the ESC-II group.
- Mechanical Engineering stream Students shall opt for any one of the courses from the ESC-II group **except,** BESCK204D **-Introduction to Mechanical Engineering**
- The students have to opt for the courses from ESC group without repeating the course in either 1st or 2nd semester
- The students must select one course from either ETC-II or PLC-II group.
- If students study the subject from ETC-I in 1st semester he/she has to select the course from PLC-II in the 2nd semester and vice-versa

Visvesvaraya Technological University, Belagavi

Scheme of Teaching and Examinations-2022

Outcome-Based Education(OBE)and Choice Based Credit System(CBCS)

(Effective from the academic year 2022-23)

I Semester (Mechanical Engineering Stream) **(For Chemistry Group)**

Sl. No	Course and Course Code		Course Title	TD/PSB	Teaching Hours/Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	SDA	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	*ASC(IC)	BMATM101	**Mathematics-I** for ME Streams	Maths	2	2	2	0	03	50	50	100	04
2	#ASC(IC)	BCHEM102	**Applied Chemistry** for ME Streams	Chemistry	2	2	2	0	03	50	50	100	04
3	ESC	BCEDK103	Computer-Aided Engineering Drawing	Civil/Mech Engg dept	2	0	2	0	03	50	50	100	03
4	ESC-I	BESCK104x	Engineering Science Course-I	Respective Engg Dept	3	0	0	0	03	50	50	100	03
5	ETC-I	BETCK105x	Emerging Technology Course-I/	Any Dept	3	0	0	0	03	50	50	100	03
	OR												
	PLC-I	BPLCK105x	Programming Language Course-I		2	0	2	0	03				
6	AEC	BPWSK106	Professional Writing Skills in English	Humanities	1	0	0	0	01	50	50	100	01
			OR										
		BENGK106	Communicative English										
7	HSMS	BICOK107	Indian Constitution	Humanities	1	0	0	0	01	50	50	100	01
		OR											
		BKSK0107 BKBKK107	Samskrutika Kannada/ Balake Kannada										
8	AEC/SEC	BSFHK158	Scientific Foundations for Health	Any Dept	1	0	0	0	01	50	50	100	01
		OR											
		BIDTK158	Innovation and Design Thinking		1	0	0	0	01				
				TOTAL						**400**	**400**	**800**	**20**

SDA-Skill Development Activities, **TD/PSB-** Teaching Department / Paper Setting Board, **ASC-**Applied Science Course, **ESC-** Engineering Science Courses, **ETC-** Emerging Technology Course, **AEC-** Ability Enhancement Course, **HSMS-**Humanity and Social Science and management Course, **SDC-** Skill Development Course, **CIE** -Continuous

Internal Evaluation, **SEE-** Semester End Examination, **IC** – Integrated Course (Theory Course Integrated with Practical Course)

-** BMATM101 Shall have the 03 hours of theory examination(SEE), however, practical sessions question shall be included in the theory question papers. * The mathematics subject should be taught by a single faculty member per division, with no sharing of the course(subject)module-wise by different faculty members.**

#- BCHEM102**-** SEE shall have the 03 hours of theory examination and 02-03 hours of practical examination

ESC or ETC of 03 credits Courses shall have only a theory component (L:T :P:S=3:0:0:0) or if the nature the of course required practical learning syllabus shall be designed as an Integrated course (L:T:P:S= 2:0:2:0) Questions from the practical component shall be included in SEE, however, there is no SEE for practical component.

All 01 Credit- courses shall have the SEE of 01 hours duration and the pattern of the question paper shall be MCQ

Credit Definition: 1-hour Lecture **(L)** per week=**1Credit** 2-hoursTutorial**(T)** per week=**1Credit** 2-hours Practical / Drawing (**P**) per week=**1Credit** **2-**hous Skill Development Actives **(SDA)** per week = **1 Credit**	04-Credits courses are to be designed for 50 hours of Teaching-Learning Session 04-Credits (IC) are to be designed for 40 hours' theory and 12-14 hours of practical sessions 03-Credits courses are to be designed for 40 hours of Teaching-Learning Session 02- Credits courses are to be designed for 25 hours of Teaching-Learning Session 01-Credit courses are to be designed for 12-15 hours of Teaching-Learning sessions

Student's Induction Program: Motivating (Inspiring) Activities under the Induction program – The main aim of the induction program is to provide newly admitted students a broad understanding of society, relationships, and values. Along with the knowledge and skill of his/her study, students' character needs to be nurtured as an essential quality by which he/she would understand and fulfill the responsibility as an engineer. The following activities are to be covered in 21 days. Physical Activity, Creative Arts, Universal Human Values, Literary, Proficiency Modules, Lectures by Eminent People, Visits to Local areas, Familiarization with Department/Branch and Innovation, etc. For details, refer the ANNEXURE-I of Induction Programs notification of the University published at the beginning of the 1st semester.

AICTE Activity Points to be earned by students admitted to BE/ B.Tech., / B. Plan day college program (For more details refer to Chapter 6, AICTE Activity Point Program, Model Internship Guidelines): Over and above the academic grades, every regular student admitted to the 4 years Degree program and every student entering 4 years Degree programs through lateral entry, shall earn 100 and 75 Activity Points respectively for the award of degree through AICTE Activity Point Program. Students transferred from other Universities to the fifth semester are required to earn 50 Activity Points from the year of entry to VTU. The Activity Points earned shall be reflected on the student's eighth semester Grade Card. The activities can be spread over the years, any time during the semester weekends, and holidays, as per the liking and convenience of the student from the year of entry to the program. However, the minimum hours' requirement should be fulfilled. Activity Points (non-credit) do not affect SGPA/CGPA and shall not be considered for vertical progression. In case students fail to earn the prescribed activity Points, an Eighth Semester Grade Card shall be issued only after earning the required activity points. Students shall be admitted for the award of the degree only after the release of the Eighth semester Grade Card.

(ESC-I) Engineering Science Courses-I					(ETC-I) Emerging Technology Courses-I				
Code	**Title**	**L**	**T**	**P**	**Code**	**Title**	**L**	**T**	**P**
BESCK104A	Introduction to Civil Engineering	3	0	0	BETCK105A	Smart Materials and Systems	3	0	0
BESCK104B	Introduction to Electrical Engineering	3	0	0	BETCK105B	Green Buildings	3	0	0
BESCK104C	Introduction to Electronics **Communication**	3	0	0	BETCK105C	Introduction to Nano Technology	3	0	0
BESCK104D	Introduction to Mechanical Engineering	3	0	0	BETCK105D	Introduction to Sustainable Engineering	3	0	0
BESCK104E	Introduction to C Programming	2	0	2	BETCK105E	Renewable Energy Sources	3	0	0
					BETCK105F	Waste Management	3	0	0
					BETCK105G	Emerging Applications of Biosensors	3	0	0
					BTC1K105H	Introduction to Internet of Things (IOT)	3	0	0
					BETCK105I	Introduction to Cyber Security	3	0	0
					BETCK105J	**Introduction to Embedded System**	**3**	**0**	**0**
(PLC-I) Programming Language Courses-I									
Code	**Title**	**L**	**T**	**P**					
BPLCK105A	Introduction to Web Programming	2	0	2					
BPLCK105B	Introduction to Python Programming	2	0	2					
BPLCK105C	Basics to JAVA programming	2	0	2					
BPLCK105D	Introduction to C++ Programming	2	0	2					
The course BESCK104E, **Introduction to C Programming, and all courses under PLC and ETC groups can be taught by faculty of ANY DEPARTMENT**									

- The student has to select one course from the ESC-I group.
- MES stream Students shall opt for any one of the courses from the ESC-I group **except,** BESCK104D **-Introduction to Mechanical Engineering**
- The students have to opt for the courses from ESC group without repeating the course in either 1st or 2nd semester
- The students must select one course from either ETC-I or PLC-I group.
- If students study the subject from ETC-I in 1st semester he/she has to select the course from PLC-II in the 2nd semester and vice-versa

Visvesvaraya Technological University, Belagavi

Scheme of Teaching and Examinations-2022

Outcome-Based Education(OBE)and Choice Based Credit System(CBCS)

(Effective from the academic year 2022-23)

II Semester (Mechanical Engineering Stream) **(For the students who have attended 1semster under Chemistry Group)**

Sl. No	Course and Course Code		Course Title	TD/PSB	Teaching Hours/Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	SDA	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	*ASC(IC)	BMATM201	**Mathematics-II** for ME Streams	Maths	3	0	2	0	03	50	50	100	04
2	#ASC(IC)	BPHYM202	**Applied Physics** for ME Streams	PHY	2	2	2	0	03	50	50	100	04
3	ESC	BEME203	Elements of Mechanical Engineering	Mechanical	2	2	0	0	03	50	50	100	03
4	ESC-II	BESCK204x	Engineering Science Course-II	Respective Engg Dept	3	0	0	0	03	50	50	100	03
5	PLC-II	BPLCK205x	Programming Language Course-II	Any Dept	2	0	2	0	03	50	50	100	03
	OR												
	ETC-II	BETCK205x	Emerging Technology Course-II		3	0	0	0	03				
6	AEC	BENGK206	Communicative English	Humanities	0	2	0	0	01	50	50	100	01
			OR										
		BPWSK206	Professional Writing Skills in English										
7	HSMC	BKSKK207 BKBKK207	Samskrutika Kannada/ Balake Kannada	Humanities	0	2	0	0	01	50	50	100	01
		OR											
		BICOK207	Indian Constitution										
8	AEC/SDC	BIDTK258	Innovation and Design Thinking	Any Dept	0	0	2	0	02	50	50	100	01
		OR											
		BSFHK258	Scientific Foundations of Health		1	0	0	0	01				
				TOTAL						**400**	**400**	**800**	**20**

SDA-Skill Development Activities, **TD/PSB-** Teaching Department / Paper Setting Board, **ASC-**Applied Science Course, **ESC-** Engineering Science Courses, **ETC-** Emerging Technology Course, **AEC-** Ability Enhancement Course, **HSMS-**Humanity and Social Science and management Course, **SDC-** Skill Development Course, **CIE–**Continuous Internal Evaluation, **SEE-** Semester End Examination, **IC** – Integrated Course (Theory Course Integrated with Practical Course)
-** BMATM201 Shall have the 03 hours of theory examination(SEE), however, practical sessions question shall be included in the theory question papers. * The mathematics subject should be taught by a single faculty member per division, with no sharing of the course(subject)module-wise by different faculty members.** **#-** BPHYM202 SEE shall have the 03 hours of theory examination and 02-03 hours of practical examination **ESC or ETC of 03 credits Courses** shall have only a theory component (L:T :P:S=3:0:0:0) or if the nature the of course required practical learning syllabus shall be designed as an Integrated course (L:T:P:S= 2:0:2:0),. **All 01 Credit-** courses shall have the SEE of 01 hours duration and the pattern of the question paper shall be MCQ

(ESC-II) Engineering Science Courses-II					(ETC-II) Emerging Technology Courses-II				
Code	**Title**	**L**	**T**	**P**	**Code**	**Title**	**L**	**T**	**P**
BESCK204A	Introduction to Civil Engineering	3	0	0	BETCK205A	Smart materials and Systems	3	0	0
BESCK204B	Introduction to Electrical Engineering	3	0	0	BETCK205B	Green Buildings	3	0	0
BESCK204C	Introduction to Electronics **Communication**	3	0	0	BETCK205C	Introduction to Nano Technology	3	0	0
BESCK204D	Introduction to Mechanical Engineering	3	0	0	BETCK205D	Introduction to Sustainable Engineering	3	0	0
BESCK204E	Introduction to C Programming	2	0	2	BETCK205E	Renewable Energy Sources	3	0	0
					BETCK205F	Waste Management	3	0	0
					BETCK205G	Emerging Applications of Biosensors	3	0	0
					BETCK205H	Introduction to Internet of Things(IoT)	3	0	0
					BETCK205I	Introduction to Cyber Security	3	0	0
					BETCK205J	**Introduction to Embedded System**	**3**	**0**	**0**
(PLC-II) Programming Language Courses-II									
Code	**Title**	**L**	**T**	**P**					
BPLCK205A	Introduction to Web Programming	2	0	2					
BPLCK205B	Introduction to Python Programming	2	0	2					
BPLCK205C	Basics to JAVA programming	2	0	2					
BPLCK205D	Introduction to C++ Programming	2	0	2					
The course BESCK204E**, Introduction to C Programming, and all courses under PLC and ETC groups can be taught by faculty of ANY DEPARTMENT**									

- The student has to select one course from the ESC-II group.
- Mechanical Engineering stream Students shall opt for any one of the courses from the ESC-II group **except,** BESCK204D **-Introduction to Mechanical Engineering**
- The students have to opt for the courses from ESC group without repeating the course in either 1st or 2nd semester
- The students must select one course from either ETC-II or PLC-II group.
- If students study the subject from ETC-I in 1st semester he/she has to select the course from PLC-II in the 2nd semester and vice-versa