



Dr. AMBEDKAR INSTITUTE OF TECHNOLOGY

(An Autonomous Institute affiliated to VTU, Accredited by NAAC with 'A' grade)

BDA Outer Ring Road, Mallathalli, Bengaluru-56

School of Electricals, Electronics Sciences and Engineering

Board of Studies 2026-27



Approved UG Scheme and Syllabus FOR Academic Year 2026-27

**Submitted by
Department of Electronics and Communication
Engineering**

**To
DEAN (Academic)**

Dr. Ambedkar Institute of Technology, Bengaluru-560056													
Outcome Based Education(OBE) and Choice Based Credit System (CBCS													
B.E. Electronics and Communication Engineering													
Scheme of Teaching and Examination effective from the Academic Year 2025 - 26													
I Semester			BRANCH: ECE, EEE, ETE, EIE, ME, AE, IEM						(Chemistry Group)				
Sl. No	Course and Course Code		Course Title	TD/PSB	Teaching Hours/Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	SAAE	Duration in hours	CIE Marks	SEE Marks	Total Marks	
1	ASC(IC)	1BMAU101x	Applied Mathematics-I (Stream Specific)	Maths Dept	2	2	2		03	50	50	100	04
2	ASC(IC)	1BCHU102x	Applied Chemistry (Stream Specific)	CHE Dept	2	2	2		03	50	50	100	04
3	ETC	1BAIT103	Introduction to AI and Applications	Any Dept	3	0	0		03	50	50	100	03
4	ESC	1BEST104x	Engineering Science Course I	Respective Engg Dept	3	0	0		03	50	50	100	03
5	PLC(IC)	1BPLU105x	Programming Language Course	CSE & allied Dept	3	0	2		03	50	50	100	04
6	AEC	1BENGL106	Communication Skills	Humanities Dept	1	0	1		02	50	50	100	01
7	AEC (NCMC)	1BICT107	Indian Constitution & Engineering Ethics	Humanities Dept	1	0	0		--	100	--	100	PP/NP
8	AEC/SDC	1BIDL108	Innovation and Design Thinking Lab (Project-based learning)	Any Dept	0	0	2		02	50	50	100	01
9	MC	1BCDN109	Career Development Skill –I	Placement Cell	2	0	0		---	50	---	---	PP/NP
	TOTAL				17	02	07		20	500	350	800	20
9	AICTE Activity Points (students have to earn 100 activity points between 01 to 08 semesters)				Compulsory requirement for the award of a degree								
ASC-Applied Science Course, ESC- Engineering Science Courses, IC – Integrated Course (Practical Course Integrated with Theory Course), PLC(IC)- Programming Language Course (Integrated Course), AEC- Ability Enhancement Course, NCMC: Non Credit Mandatory Course, AEC/SDC- Ability Enhancement Course/Skill Development course, TD/PSB- Teaching Department / Paper Setting Board, S- (SAAE)-Students’ Academic Activity Engagement Hours, CIE –Continuous Internal Evaluation, SEE- Semester End Examination, PP : (Pass/Pass) is assigned to a noncredit course. “PP” represents pass in a course provided students have successfully completed the CIE requirements. Otherwise, “NP-not pass shall be awarded. “PP” is essential for the award of the degree													
Credit Definition:				04-Credit courses are designed for 50 hours of Teaching-Learning sessions									
1-hour Lecture (L) per week=1Credit				04-Credit (IC) courses are designed for 40 hours’ theory and 10-12 hours of practical sessions									
2-hoursTutorial(T) per week=1Credit				03-Credit courses are designed for 40 hours of Teaching-Learning Session									
2-hours Practical / Drawing (P) per week=1Credit				02- Credit courses are designed for 25 hours of Teaching-Learning Session									
				01-Credit courses are designed for 12 hours of Teaching-Learning sessions									

Applied Mathematics-I					Applied Chemistry				
Code	Title	L	T	P	Code	Title	L	T	P
1BMAU101A	Differential Calculus and Linear Algebra: CV Stream	2	2	2	1BCHU102A	Applied Chemistry for Metal Protection and Sustainable Energy (ME stream)	2	2	2
1BMAU101B	Calculus And Linear Algebra: CSE stream	2	2	2	1BCHU102B	Applied Chemistry for Futuristic Devices (EEE stream)	2	2	2
1BMAU101C	Differential Calculus and Linear Algebra: ME Stream	2	2	2	1BCHU102C	Applied Chemistry for Sustainable Built Environment (CV)	2	2	2
1BMAU101D	Differential Calculus and Linear Algebra; EEE stream	2	2	2	1BCHU102D	Applied Chemistry for Smart Systems (CSE stream)	2	2	2
Engineering Science Courses-I (ESC-I)					Programming Language Courses (PLC)				
Code	Title	L	T	P	Code	Title	L	T	P
1BEST104A	Introduction to Building Sciences	3	0	0	1BPLU105A	Introduction to C (For none IT programmes)	3	0	2
1BEST104B	Introduction to Electrical Engineering	3	0	0	1BPLU105B	Python Programming (for CSE and allied programmes)	3	0	2
1BEST104C	Introduction to Electronics and Communication Engineering	3	0	0					
1BEST104D	Introduction to Mechanical Engineering	3	0	0					
1BEST104E	Essentials of Information Technology	3	0	0					
Integrated courses (IC), combining theory with practical components. (i) Theory sessions shall be conducted for 3 hours per week, while the practical sessions shall be conducted for 2 hours per week. (ii) Theory components shall be evaluated through both Continuous Internal Evaluation (CIE) and Semester End Examination (SEE). (iii) The practical component shall be assessed only through CIE.									
The Mathematics/Chemistry courses shall be taught by a single faculty member per session, with no sharing of the course (subject) modules. The Practical sessions for the mathematics course shall be conducted in the laboratory environment using Maxima/Mathematica/ Python/Scilab/MATLAB software to enhance computational understanding and application skills.									
All students admitted to the engineering program have to complete Applied Mathematics-I and Applied Mathematics-II in I and II semesters by selecting the subjects prescribed for their stream, viz. CV, ME, EEE or CSE, under the heading Mathematics-I and Mathematics-II. Those who have completed the chemistry course under the heading Applied Chemistry in I semester have to select the prescribed stream wise physics course under the heading Applied physics during II semester.									
Engineering Sciences Courses-I (ESC-I): These courses are designed to broaden the technical knowledge of students beyond their core area of study. These courses enable students to gain a foundational understanding of engineering principles from other stream courses. Students are required to select and complete two courses that are not belong to their admitted program stream. For example, a student admitted to the any programme of the Civil Engineering stream should not select Introduction to Building Sciences but any other two. One course shall selected under ESC-I and another course under ESC-II. The two courses must be different from the other.									

The **Student Induction Programme (SIP)**, initiated by the All India Council for Technical Education (AICTE), is designed to help newly admitted students in technical institutions transition smoothly into the higher education environment. It aims to familiarize students with the institutional culture, foster connections with peers and faculty, and provide a foundation for holistic learning. Activities under SIP may include Physical Activities, Creative Arts, Universal Human Values, Literary Events, and Proficiency Modules. Lectures shall be by Eminent Personalities, Local Area Visits, Department/Branch Familiarization, and Innovation-related sessions.

The first year of the Engineering programmes is composed of I semester, II semester and Summer Semester. SIP activities shall be scheduled in the afternoon sessions during the first week of class commencement of I and II semesters only.

The specific programmes to be conducted will be notified separately by the University via the academic calendar or through a separate notification.

AICTE Activity Points Requirement for BE/B.Tech. Programmes

As per AICTE guidelines (refer Chapter 6 – *AICTE Activity Point Program, Model Internship Guidelines*), in addition to academic requirements, students must earn a specified number of **Activity Points** to be eligible for the award of the degree. The points to be earned is:

1. **Regular students** admitted to a 4-year degree program must earn **100 Activity Points**.
2. **Lateral entry students** (joining from the second year) must earn **75 Activity Points**.
3. **Students transferred** from other universities directly into the fifth semester must earn **50 Activity Points** from the date of entry into VTU.

These Activity Points are **non-credit** and will not be considered for **the SGPA/CGPA** or be used for **vertical progression**. However, earning Activity Points is mandatory for the **award of the degree**, and the points earned will be reflected on the **eighth semester Grade Card**.

If a student completes all the semesters (eight or six) at the end of the programme but fails to earn the required Activity Points, the eighth-semester Grade Card will be withheld until the requirement is fulfilled. Also, the degree will be awarded only after the Grade Card has been released.

The hours spent earning the activity points will not be counted for regular attendance requirements. Students can accumulate these points at any time during their program period, including weekends, holidays, and vacations, starting from the year of admission, provided they meet the minimum hours of engagement prescribed for each activity by AICTE.

Sl. No	Stream	UG Programmes under the stream with code
1	Civil Engineering Stream (CV)	(1) Civil engineering (CV), (2) Mining Engineering (MI)
2	Mechanical Engineering Stream ME	(1)Aeronautical Engineering (AE), (2)Aerospace Engineering (AS),(3) Agreecultural Engineering (AG),(4)Automation and Robotics (AR), (5)Automobile Engineering (AU), (6)Chemical Engineering (CH), (7) Industrial & Production Engineering (IP), (8)Industrial Eng ineering & Management (IM), (9) Manufacturing Science and Engineering (MS), (10) Marine Engineering (MR), (11) Mechanical & Smart Manufacturing (MM), (12) Mechanical Engineering (ME), (13)Mechatronics (MT), (14) Petrochem Engineering (PC), (15)Robotics & Automation (RA),(16) Robotics and Artificial Intelligence (RI),(17)Silk Technology (ST), (18) Textile Technology (TX),(19)Energy Engineering (ER),(20) Smart Agritech (SA).
3	Electrical and Electronics Engineering Stream (EEE)	(1)Electronics & Communication Engineering (EC), (2)Biomedical Engineering (BM), (3)Electrical & Electronics Engineering (EE), (4) Electronics & Instrumentation Engineering (EI),(5) Electronics & Telecommunication Engineering (ET),(6) Industrial IoT (IO), (7) Medical Electronics Engineering (ML),(8) Electronics Engineering (VLSI Design and Technology) (VL),(9) Electronics & Communication(Advanced Communication Technology) (EA),(10) Electronics & Computer Engineering (UE).
4	Computer Science and Engineering Stream (CSE)	(1) Computer Science and Engineering (CS), (2)Computer Engineering (CE), (3) Artificial Intelligence and Data Science (AD), (4)Artificial Intelligence and Machine Learning (AI),(5)Biotechnology (BT),(6)Computer & Communication Engineering (CM), (7) Computer Science and Business System (CB),(8)Computer Science and Design (CG),(9)Computer Science and Engineering (IoT) (CO), (10)CSE(Artificial Intelligence and Machine Learning) (CI),(11) CSE(Artificial Intelligence) (CA),(12) CSE(Cyber Security) (CY), (13)CSE(Data Science) (CD),(14) CSE(IoT and Cyber Security including Block Chain Technology) (IC), (15) Data Science (DS), (16) Information Science & Engineering (IS),(17) Computer Science (CR).

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II Semester		BRANCH: ECE, EEE, ETE, EIE, ME, AE, IEM				(For the students who have studied the Chemistry group in I semester)							
Sl. No	Course and Course Code		Course Title	TD/PSB	Teaching Hours/Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	SAAE	Duration in hours	CIE Marks	SEE Marks	Total Marks	
1	ASC(IC)	1BMAU201x	Applied Mathematics -II (Stream Specific)	Maths Dept	2	2	2		03	50	50	100	04
2	ASC(IC)	1BCHU202x	Applied Physics (Stream Specific)	PHY Dept	2	2	2		03	50	50	100	04
3	ESC	1BCED203x	Computer-Aided Engineering Drawing (Stream Specific)	ME dept	2	0	2		03	50	50	100	03
4	ESC	1BEST204x	Engineering Science Course-II	Respective Engg Dept	3	0	0		03	50	50	100	03
5	PSC	1BXXT205x	Programme Specific Courses	Respective Engg Dept	3	0	0		03	50	50	100	03
6	AEC (NCMC)	1BSST206	Soft Skills	Humanities Dept	1	0	0		--	100	---	100	PP/NP
7	PSC/ESC	1BXXL207	Program-Specific Course Lab	Respective dept	0	0	2		02	50	50	100	01
8	AEC/SDC	1BPRJ208	Interdisciplinary Project-Based Learning	Combination of Departments	0	0	0	02	02	50	50	100	01
9	HSMC	1BKST209/1BKBT209	Sanskrutika Kannada/ Balake Kannada	Humanities Dept	1	0	0		01	50	50	100	01
10	MC	1BCDN210	Career Development Skill -II	Placement Cell	2	0	0		---	50	---	---	PP/NP
	TOTAL				16	02	06		21	550	400	900	20

ASC-Applied Science Course, **IC** – Integrated Course (Practical Course Integrated with Theory Course), **ESC**- Engineering Science Courses, **PSC**-Programme Specific Course, **ESC**- Engineering Science Courses, **ETC**- Emerging Technology Course, **AEC**- Ability Enhancement Course, **NCMC**: Non Credit Mandatory Course, **PP** : (Pass/Pass) is assigned to a non credit course. “PP” represents pass in course provided students have successfully completed the CIE requirements. Otherwise, “NP-not pass shall be awarded. “PP” is essential for the award of the degree **HSMC**-Humanity, Social Science and management Course, **AEC/SDC**- Ability Enhancement Course/Skill Development course, **TD/PSB**-Teaching Department / Paper Setting Board, **CIE** –Continuous Internal Evaluation, **SEE**- Semester End Examination, **S- (SAAE)**-Students’ Academic Activity Engagement Hours,

Applied Mathematics-II					Applied Physics				
Code	Title	L	T	P	Code	Title	L	T	P
1BMAU201A	Differential Calculus and Numerical Methods: CV stream	2	2	2	1BPHU202A	Physics for Sustainable Structural Systems (CV stream)	2	2	2
1BMAU201B	Numerical Methods: CSE Stream	2	2	2	1BPHU202B	Quantum Physics and Applications (CSE stream)	2	2	2
1BMAU201C	Multivariable Calculus and Numerical Methods: ME stream	2	2	2	1BPHU202C	Physics of Materials (Mech stream)	2	2	2
1BMAU201D	Calculus, Laplace Transform, and Numerical Techniques: EEE stream	2	2	2	1BPHU202D	Quantum Physics and Electronic Sensors (ECE , EIE, ETE)	2	2	2
					1BPHU202E	Electrical Engineering Materials (EEE)	2	2	2
Programme Specific Courses (PSC)					Programme Specific Courses Lab (PSCL)				
1BCVT105	Engineering Mechanics	3	0	0	1BCVL207	Mechanics and Materials Lab	0	0	2
1BEET105	Elements of Mechanical Engineering	3	0	0	1BEEL207	Elements of Mechanical Engineering Lab	0	0	2
1BECT105	Basics of Electrical Engineering	3	0	0	1BECL207	Basic Electrical Engineering Lab	0	0	2
1BMET105	Fundamentals of Electronics & Communication Engineering	3	0	0	1BMEL207	Fundamentals of Electronics & Communication Engineering Lab	0	0	2
1BITT105	Programming in C	3	0	0	1BITL207	C Programming Lab	0	0	2
Engineering Science Courses-II (ESC-II)					Computer-Aided Engineering Drawing				
Code	Title	L	T	P	Code	Title	L	T	P
1BEST204A	Introduction to Building Sciences	3	0	0	1BCED203A	Computer-Aided Engineering Drawing for CV Stream	2	0	2
1BEST204B	Introduction to Electrical Engineering	3	0	0	1BCED203B	Computer-Aided Engineering Drawing for CSE stream	2	0	2
1BEST204C	Introduction to Electronics & Communication Engineering	3	0	0	1BCED203C	Computer-Aided Engineering Drawing for ME stream	2	0	2
1BEST204D	Introduction to Mechanical Engineering	3	0	0	1BCED203D	Computer-Aided Engineering Drawing for ECE stream	2	0	2
1BEST204E	Essentials of Information Technology	3	0	0	1BCED203E	Computer-Aided Engineering Drawing for EEE stream (only for EEE students)	2	0	2
Integrated courses (IC), combining theory with practical components. (i) Theory sessions will be conducted for 3 hours per week, while the practical sessions will be conducted for 2 hours per week. (ii) Theory component shall be evaluated through both Continuous Internal Evaluation (CIE) and Semester End Examination (SEE). (iii) The practical component will be assessed only through CIE.									
The Mathematics/Physics courses shall be taught by a single faculty member per session, with no sharing of the course (subject) modules. The Practical sessions for the mathematics course shall be conducted in a laboratory environment using Maxima/Mathematica/ Python/Scilab/MATLAB software to enhance computational understanding and application skills.									
Students admitted to a specific engineering stream are required to select and successfully complete Applied Mathematics-I and Applied Physics courses that are aligned to their program stream.									

Programme Specific Courses (PSC): Programme Specific Courses (PSC) are a set of core courses tailored to a specific branch or discipline of engineering in which a student is enrolled (e.g., Mechanical Engineering, Computer Science, Civil Engineering, etc.). These courses are intended to provide students with in-depth knowledge and specialized skills essential for professional competence in the chosen field. Students must select and complete the course from this group that corresponds to their admitted program stream. Similarly, students are also required to choose and pass laboratory courses that are specific to their stream from the Programme Specific Courses Laboratory (PSCL) group.
Computer-Aided Engineering Drawing: The courses under this category are stream-specific. Students must select and complete the course that corresponds to their admitted engineering stream.
Engineering Sciences Courses-II (ESC-II): These courses are designed to broaden the technical knowledge of students beyond their core area of study. These courses enable students to gain a foundational understanding of engineering principles from other disciplines. Students are required to select and complete a course that does not belong to their admitted program stream. Students should select a course other than that was selected under ESC-I and other than course not belonging to their stream.
For the course <i>Interdisciplinary Project (BPRJ208)</i>, it is mandatory to form a team comprising students from multiple engineering disciplines. For example, a project team may include students from Mechanical Engineering, Electronics and Communication Engineering (ECE), and Computer Science and Engineering (CSE), working collaboratively to design and implement the project.



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III SEMESTER															
Sl. No	Course	Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)		Teaching & Learning Scheme				Examination				Credits	
						CI		LI	TW & SL	# TH/S	Duration in hours	CIE Marks	SEE Marks		Total Marks
						L	T	P	SL						
1	ASC/PCC	1BMAT301	Transform Techniques and Optimization Theory	TD /PSB: Mathematics		42	28	0	50	120	3	50	50	100	4
2	IPCC	1BSESU302	Digital System Design Using Verilog	TD: EESE, PSB: ECE		42	0	28	50	120	3	50	50	100	4
3	PCC	1BSEST303	Network Analysis	TD: EESE, PSB: EE		42	0	0	78	120	3	50	50	100	4
4	PCC	1BSEST304	Analog Electronics and Linear Integrated circuits	TD: EESE, PSB: ET		42	28	0	20	90	3	50	50	100	3
5	PCC	1BECT305	Python Programming	TD: EESE, PSB: EESE		42	0	0	48	90	3	50	50	100	3
6	PCCL	1BSESL306	Analog Electronics and Linear Integrated circuits Lab	TD: EESE		0	0	28	2	30	2	50	50	100	1
7	AEC	1BECL307x	Ability Enhancement Course Laboratory**	TD: EESE, PSB: ECE		0	0	28	2	30	2	50	50	100	1
8	SDC	1BECP308	Community Project (Project-Based Learning) / Societal Project	TD: EC/EE/EI/ET/VLSI PSB: EC/EE/EI/ET/VLSI		0	0	0	30	30	2	50	50	100	1
9	MC	1BCDN309	Career Development Skill	Placement Cell		2	0	0			---	50	---	---	PP/NP
10	NCMC	1BNSS310	National Service Scheme (NSS)	Campus	NSS coordinator	0	0	0	28	28	--	100	---	100	PP
		1BPE310	Physical Education (PE) (Sports and Athletics)		Physical Education Director										
		1BYOG310	Yoga		Yoga Teacher										
		1BMUK310	Music		Music Teacher										
Total												500	400	900	21
11	NCMC	1BMATDIP311	Mathematics course for Lateral Entry Students	TD/PSB -Maths Dept		14	0	0	14	28	3	100	---	100	PP
Total										686		600	400	1000	21

TH/S- Total Hours per Semester, TW & SL- Term Work & Self Learning

Ability Enhancement Course (Laboratory) 1BECL307x			
1BECL307A	Analog Electronic Circuit Simulations Lab	1BECL307C	Introduction to Data Structures and OOPs using Python Lab
1BECL307B	Digital Application Lab	1BECL307D	Programming Using JAVA

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IV SEMESTER																
Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)		Teaching & Learning Scheme				Examination				Credits		
						CI		LI	# TW & SL	TH/S	Duration in hours	CIE Marks	SEE Marks		Total Marks	
						L	T	P								
1	ASC/PCC	1BEC401	Mathematics for Machine Learning	TD /PSB: Mathematics		42	0	0	48	90	3	50	50	100	3	
2	IPCC	1BSESU402	Microcontrollers	TD: EESE, PSB: EI		42	0	28	50	120	3	50	50	100	4	
3	PCC	1BSEST403	Control Systems	TD: EESE, PSB: EE		42	28	0	50	120	3	50	50	100	4	
4	PCC	1BECT404	Signals and Systems	TD: EESE, PSB: EESE		42	0	0	48	90	3	50	50	100	3	
5	PCCL	1BECL405	Signals and Analog Communication Lab	TD: EESE, PSB: EESE		0	0	28	02	30	2	50	50	100	1	
6	AEC	1BECL406	Ability Enhancement Course Laboratory**	TD: EESE, PSB: EESE		0	0	28	02	30	2	50	50	100	1	
7	BSC	1BSEST407	Biology for Electrical & Electronics Engineer	TD: EESE, PSB: EC		28	0	0	32	60	3	50	50	100	2	
8	SDC	1BEC408	Environmental Science Project	TD/ PSB: civil		0	0	0	30	30	3	50	50	100	1	
9	PCC/PEC	1BECT409	Introduction to Analog Communication Systems	TD: EESE, PSB: EESE		42	0	0	48	90	3	50	50	100	3	
10	MC	1BCDN409	Career Development Skill	Placement Cell		2	0	0			---	50	---	---	PP/NP	
11	NCMC	1BNSK410	National Service Scheme (NSS)	Campus	NSS coordinator		0	0	0	28	28	--	100	---	100	PP
		Physical Education (PE) (Sports and Athletics)			Physical Education Director											
		Yoga			Yoga Teacher											
		Music			Music Teacher											
Total										688		550	450	1000	22	
12	NCMC	1BMATDIP411	Mathematics course for Lateral Entry Students	TD/PSB -Maths Dept		14	0	0	14	28	--	100	--	100	PP	
Total										716		650	450	1100	22	
	Ability Enhancement Course (Laboratory) 1BECL406x															
1BECL406A		Debugging and Fault Analysis of Analog and Digital Circuits			1BECL406C		Basics of Machine Learning Lab									
1BECL406B		IOT lab			1BECL406D		Control Systems Lab									

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V SEMESTER														
Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board	Teaching & Learning Scheme				Examination				Credits	
					CI		LI	# TW & SL	# TH/S	Duration in hours	CIE Marks	SEE Marks		Total Marks
					L	T	P							
1	HSMC	1BEC501	This course must be pertaining to economics and management of the concerned degree program. The course syllabus should have both economics and management topics and the course title should bear the word Management.	TD/PSB:	42	0	0	48	90	3	50	50	100	3
2	IPCC	1BEC502	Digital Signal Processing	TD/PSB	42	0	28	50	120	3	50	50	100	4
3	PCC	1BEC503	Engineering Electromagnetics	TD/PSB	42	28	0	20	90	3	50	50	100	3
4	PCC	1BEC504	Introduction to VLSI Design	TD/PSB	42	0	0	48	90	3	50	50	100	3
5	PEC	1BEC505x	Professional Elective Course-I	TD/PSB	42	0	0	48	90	3	50	50	100	3
6	BSC	1BRM506	Research Methodology and IPR	TD/PSB-	28	0	0	32	60	02	50	50	100	2
7	PCCL	1BECL507	VLSI Lab	TD/PSB	0	0	28	2	30	02	50	50	100	1
8	SDC	1BEC508	Hackathon-Based Project	CIE: By Departments SEE: Evaluation by industry experts	0	0	0	60	60	--	50	50	100	2
	Total								630		400	400	800	21
	Professional Elective Course-I													
1BEC505A		Machine Learning for Communication system			1BEC505C		Sensors and Measurements							
1BEC505B		Real Time Systems			1BEC505D		Semiconductor Process and Manufacturing Techniques							

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VI SEMESTER														
Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching & Learning Scheme				Examination				Credits	
					CI		LI	# TW & SL	# TH/S	Duration in hours	CIE Marks	SEE Marks		Total Marks
1	IPCC	1BEC601	Computer Networking and Communication	TD/PSB-	42	0	28	50	120	3	50	50	100	4
2	PCC	1BEC602	Antenna and Wireless Communication	TD/PSB-	42	28	0	20	90	3	50	50	100	3
3	PCC	1BEC603	Digital Communication Systems	TD/PSB-	42	0	0	48	90	3	50	50	100	3
4	PCC	1BEC604	FPGA Based System Design	TD/PSB-	42	0	0	48	90	3	50	50	100	3
5	PEC	1BEC605x	Professional Elective Courses-II	TD/PSB-	42	0	0	48	90	3	50	50	100	3
6	PCCL	1BECL606	Communication Lab	TD/PSB-	0	0	28	2	30	2	50	50	100	1
7	AEC	1BECL607x	Ability Enhancement Course Laboratory	TD/PSB-	0	0	28	2	30	2	50	50	100	1
8	SDC	1BEC608	Capstone Project - Phase I	TD/PSB-	0	0	0	50	90	3	100	--	100	3
9	NCMC	1BEC609	Universal Human Value	CIE: TD/PSB	14	0	0	14	28	--	100	---	100	PP
	Total								658		550	350	900	21
	Professional Elective Course-II													
1BEC605A		5G & 6G Communication Standards			1BEC605C		Artificial Neural Networks & Deep Learning							
1BEC605B		Embedded Secure Element			1BEC605D		Analog and Mixed Mode VLSI Design							
	Ability Enhancement Course Laboratory**													
1BECL607A		PCB Design and Simulation using EDA tools			1BECL607C		FPGA Computing Lab							
1BECL607B		Design of Sensor Boards for Applications			1BECL607D		Tools for Machine Learning and Deep Learning							

Dr. Ambedkar Institute of Technology, Bengaluru-560056
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
B.E. Electronics and Communication Engineering
Scheme of Teaching and Examination effective from the Academic Year 2025 – 26

VII SEMESTER (Swappable VII and VIII 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	
					CI		LI	# TW & SL	# TH/s	Duration in hours	CIE Marks	SEE Marks		Total Marks
1	IPCC	1BEC701	Edge computing with Tiny ML	TD/PSB-	42	0	28	50	120	3	50	50	100	4
2	PEC	1BEC702x	Professional Elective Course-III	TD/PSB-	42	0	0	48	90	3	50	50	100	3
3	PEC	1BEC703x	Professional Elective Course -IV	TD/PSB-	42	0	0	48	90	3	50	50	100	3
4	OEC	1BEC704x	Open Elective Course-I	TD/PSB-	42	0	0	48	90	3	50	50	100	3
5	SDC	1BEC705	Capstone Project - Phase-II	TD/PSB-	0	0	0	210	210	3	100	100	200	7
6	NCMC	1BIKS706	Indian Knowledge System	TD/PSB	14	0	0	14	28	---	100	--	100	PP
	Total								628	15	400	300	700	20
	Professional Elective Course-III													
1BEC702A	RF Electronics			1BEC702C	Image Processing and Pattern Recognition									
1BEC702B	IoT Device Security			1BEC702D	Low Power VLSI									
	Professional Elective Course-IV													
1BEC703A	Digital Logic Verification with System Verilog			1BEC703C	Introduction to agentic AI									
1BEC703B	Cloud computing			1BEC703D	Cryptography & Network Security									
	Open Elective Course-I													
1BEC704A	Sensors and actuators			1BEC704C	Consumer Electronics									
1BEC704B	Automotive Electronics			1BEC704D	Foreign Language (NPTEL/SWAYAM/online VTU)									

Dr. Ambedkar Institute of Technology, Bengaluru-560056
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
B.E. Electronics and Communication Engineering

Scheme of Teaching and Examination effective from the Academic Year 2025 - 26

VIII SEMESTER (Swappable VII and VIII SEMESTER) (SCHEME-A)

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week					Examination				
					CI		LI	# TW & SL	# TH/S	Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
1	PEC	1BEC801x	Professional Elective-V (NPTEL/VTU Online Course)	Online Evaluation	42	0	0	48	90	3	50	50	100	3
2	OEC	1BEC802x	Open Elective-II (NPTEL/VTU Online Course)	Online Evaluation	42	0	0	48	90	3	50	50	100	3
3	SDC	1BEC803x	Internship (15 weeks or 90 working days)	--	--	--	--	--	360	3	100	100	200	09
Total									540	9	200	200	400	15

Professional Elective Course (Online courses)-V

1BEC801A	NPTEL/VTU Online Course	1BEC801C	NPTEL/VTU Online Course
1BEC801B	NPTEL/VTU Online Course	1BEC801D	NPTEL/VTU Online Course

Open Elective Courses -II (Online Courses)

1BEC802A	NPTEL/VTU Online Course	1BEC802C	NPTEL/VTU Online Course
1BEC802B	NPTEL/VTU Online Course	1BEC802D	Foreign Language (NPTEL / SWAYAM/online VTU)

Types of Internships (Course Code: 1BEC803x)

Students shall undertake one of the following internship types during the eighth semester, as per academic guidelines:

- 1BEC803A – Industry Internship:** Shall involve practical exposure and training within an industrial or corporate setting.
- 1BEC803B – Research Internship:** Shall focus on academic or applied research under the guidance of faculty or research institutions.
- 1BEC803C – Post-Placement Internship:** Shall be undertaken by students who have secured placement, aligning with their future employment domain.
- 1BEC803D – Societal Internship:** Shall engage students in community-based or social impact projects with NGOs, government bodies, or civic organizations.
- 1BEC803E – Online Internship:** Shall be conducted through recognized digital platforms offering structured internship modules.
- 1BEC803F – Skill Enhancement Internship:** Shall be opted by students unable to secure internships, offering credit equivalence through curated online courses available at [http:// www.online.vtu.ac.in](http://www.online.vtu.ac.in)

	To ensure uniformity, quality, and transparency in the internship process, VTU has launched a centralized web portal that serves as a single platform for all internship opportunities. Reputed industries, Centres of Excellence, Research Laboratories, and other recognized bodies will be registered on this portal. Students must choose internships exclusively through this portal. No other mode of internship selection will be permitted
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Dr. Ambedkar Institute of Technology, Bengaluru-560056
Scheme of Teaching and Examination for I/II Semester B.E. CBCS 2022, Academic Year-2023-24
2024 Scheme for ECE/EI/ET

Chemistry Cycle										SEMESTER: I				
Sl. No.	Course Category	Course Code	Course Title	Teaching Department	Teaching Hours/Week					Examination				Credits
					L	T	P	SDA	Total	Duration(Hrs)	CIE Marks	SEE Marks	Total Marks	
1	ASC(IC)	MAU101D	Mathematics- I	Maths	2	2	2	0	4+2	03	50	50	100	04
2	ASC(IC)	CHU102B	Applied Chemistry	Chemistry	3	0	2	0	3+2	03	50	50	100	04
3	ESC	MED103	Computer Aided Engineering Drawing	Civil/Mech.	2	2	0	0	3	03	50	50	100	03
4	ESC-1	ESX104x	Engineering Science Course-I	Respective Engg. dept	3	0	0	0	3	03	50	50	100	03
5	ETC-1	ETT105x	Programming Language Course - I	Any Engg. Dept	3	0	0	0	3	03	50	50	100	03
6	AEC	ENT106	Communicative English	Humanities	1	0	0	0	1	02	50	50	100	01
7	HSS	CIT107	Constitution of India	Humanities	1	0	0	0	1	02	50	50	100	01
8	HSS	SFH108	Scientific Foundation of Health	Any dept.	1	0	0	0	1	02	50	50	100	01
9	MC	CDN109	Career Development skill-I	Placement cell	2	0	0	0	2	-	50	---	---	NP/PP
Total									25		450	400	800	20

D/PSB- Teaching Department / Paper Setting Board, SS- Self Study, ASC- Applied Science Course, ESC- Engineering Science Courses, ETC- Emerging Technology Course, AEC- Ability Enhancement Course, HSS- Humanity and Social Science 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	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 ANNEXUREI of Induction Programs notification of the University published at the beginning of the 1 st semester.	
AICTE Activity Points to be earned by students admitted to B.E. 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 hour's 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.	
22MAU101D Shall have the 03 hours of theory examination(SEE), however, practical sessions question shall be included in the theory question papers #- 22CHU102B SEE shall have the 03 hours of theory examination), however, practical sessions question shall be included in the theory question papers. 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 then the syllabus shall be designed as an Integrated course (L:T:P:S= 2:0:2:0). All PLC courses are Integrated courses. All 01 Credit- courses shall have the SEE of 02 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 22ESX104x	Title	L	T	P	Code 22ETT105x	Title	L	T	P
EST104A	Introduction to Civil Engineering	3	0	0	ETT1051	Introduction to Cyber Security	3	0	0
EST104B	Introduction to Electrical Engineering	3	0	0	ETT1052	Introduction to Internet of Things (IOT)	3	0	0
EST104C	Introduction to Electronics Engineering	3	0	0	ETT1053	Renewable Energy Sources	3	0	0
EST104D	Introduction to Mechanical Engineering	3	0	0	ETT1054	Waste Management	3	0	0
ESU104E	Introduction to C Programming	2	0	2	ETT1055	Green Buildings	3	0	0
					ETT1056	Smart Materials and Systems	3	0	0
					ETT1057	Introduction to Nano Technology	3	0	0
					ETT1058	Introduction to Sustainable Engineering	3	0	0
					ETT1059	Introduction to Embedded System	3	0	0
(PLC-I) Programming Language Courses-I					Applied Science Course(ASC)				
Code 22PLU105x	Title	L	T	P	Code	Title			
PLU105A	Introduction to Web Programming	2	0	2	MAU101D	Mathematics – I for EE stream			
PLU105B	Introduction to Python Programming	2	0	2	CHU102B	Applied Chemistry for EE stream			
PLU105C	Basics of JAVA programming	2	0	2					
PLU105D	Introduction to C++ Programming	2	0	2					
The course ESU104E: 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.
- ME/AE/IEM stream Engineering Students shall opt for any one of the courses from the ESC-I group except, **22ESU104C - Introduction to Electronics Engineering**
- The students must opt for the courses from ESC group without repeating the course 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.

Dr. Ambedkar Institute of Technology, Bengaluru-560056
Scheme of Teaching and Examination for I/II Semester B.E. CBCS 2022, Academic Year-2023-24
2024 Scheme: ECE/EI/ET

Physics Cycle										SEMESTER : II					
Sl. No.	Course Category	Course Code	Course Title	Teaching Department	Teaching Hours/Week					Examination				Credits	
					L	T	P	SD A	Total	Duration (Hrs)	CIE Marks	SEE Marks	Total Marks		
1	ASC(IC)	MAU201D	Mathematics	Maths	2	2	2	0	4+2	3	50	50	100	4	
2	ASC(IC)	HU202D	Applied Physics	Physics	3	0	2	0	3+2	3	50	50	100	4	
3	ESC	ECT203	Basic Electronics	EEE	3	0	0	0	3	3	50	50	100	3	
4	ESC-II	ESX204x	Engineering Science Course-II	Respective Enggdept	3	0	0	0	3	3	50	50	100	3	
5	ETC-II	ETT205X	Emerging Technology Course – II	Any Engg. Dept	2	0	2	0	4	3	50	50	100	3	
6	AEC	ENT206	Professional writing skill	Humanities	1	0	0	0	1	2	50	50	100	1	
7	HSS	SKT207/ BKT207	Samskrutika/ Balake Kannada	Humanities	1	0	0	0	1	2	50	50	100	1	
8	HSS	IDT208	Innovation and Design Thinking	Humanities	1	0	0	0	1	2	50	50	100	1	
9	MC	CDN209	Career Development skill-II	Humanities	2	0	0	0	2	-	50	---	---	NP/ PP	
Total									26		450	400	800	20	

TD/PSB- Teaching Department / Paper Setting Board, SS- Self Study, ASC- Applied Science Course, ESC- Engineering Science Courses, ETC- Emerging Technology Course, AEC- Ability Enhancement Course, HSS- Humanity and Social Science 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	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 02- 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 ANNEXUREI of Induction Programs notification of the University published at the beginning of the 1 st semester.	
AICTE Activity Points to be earned by students admitted to B.E. 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 hour's 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.	
22MAU101D Shall have the 03 hours of theory examination(SEE), however, practical sessions question shall be included in the theory question papers #- 22PHU202D SEE shall have the 03 hours of theory examination), however, practical sessions question shall be included in the theory question papers. 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 then the syllabus shall be designed as an Integrated course (L:T:P:S= 2:0:2:0). All PLC courses are Integrated courses. All 01 Credit- courses shall have the SEE of 02 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 ESX104x	Title	L	T	P	Code ETT105x	Title	L	T	P
EST204A	Introduction to Civil Engineering	3	0	0	ETT2051	Introduction to Cyber Security	3	0	0
EST204B	Introduction to Electrical Engineering	3	0	0	ETT2052	Introduction to Internet of Things (IOT)	3	0	0
EST204C	Introduction to Electronics Engineering	3	0	0	ETT2053	Renewable Energy Sources	3	0	0
EST204D	Introduction to Mechanical Engineering	3	0	0	ETT2054	Waste Management	3	0	0
ESU204E	Introduction to C Programming	2	0	2	ETT2055	Green Buildings	3	0	0
					ETT2056	Smart Materials and Systems	3	0	0
					ETT2057	Introduction to Nano Technology	3	0	0
					ETT2058	Introduction to Sustainable Engineering	3	0	0
					ETT2059	Introduction to Embedded System	3	0	0
(PLC-I) Programming Language Courses-I					Applied Science Course(ASC)				
Code PLU105x	Title	L	T	P	Code	Title			
PLU205A	Introduction to Web Programming	2	0	2	MAU201D	Mathematics – I for EE/EC/EI/ET			
PLU205B	Introduction to Python Programming	2	0	2	PHU202D	Applied Physics for EE/EC/EI/ET			
PLU205C	Basics of JAVA programming	2	0	2					
PLU205D	Introduction to C++ Programming	2	0	2					
The course ESU104E: 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.
- ME/AE/IEM stream Engineering Students shall opt for any one of the courses from the ESC-II group except, **22ESU204C - Introduction to Electronics Engineering**
- The students have to opt for the courses from ESC group without repeating the course 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.

Dr. Ambedkar Institute of Technology, Bengaluru-560056
Outcome Based Education (OBE) and Choice Based Credit System
B.E. Name of the programme: Electronics and Communication Engineering
Tentative Scheme of Teaching and Examination effective from the Academic Year 2023-24
(Applicable to 2024 batch)

III SEMESTER

Sl. No	Course	Course Code	Course Title	Teaching Department (TD) and Question Paper Setting	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	MAT301xx	Maths for AV Communication	Maths	3	2	0		03	50	50	100	4
2	IPCC	ECU302	Digital System Design using Verilog	ECE	3	0	2		03	50	50	100	4
3	IPCC	ECU303	Analog Electronic Circuits	ECE	3	0	2		03	50	50	100	4
4	PCC	ECT304	Network Analysis	ECE	2	2	0		03	50	50	100	3
5	PCCL	ECL305	Analog and Digital Electronics Laboratory	ECE	0	0	2		03	50	50	100	1
6	ESC	ECT306x	ESC/ETC/PLC	ECE	3	0	0		03	50	50	100	3
7	UHV	HST307	Social Connect and Responsibility	Any Department	0	0	2		01	100	---	100	1
8	AEC/ SEC	ECT308x or ECL308x	Ability Enhancement Course/Skill Enhancement Course – III	ECE	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	HS	CDN309	Aptitude and Verbal Ability Skill-I	Placement Cell	2	0	0		--	50	--	50	PP/NP
10	MC	NSN310	National Service Scheme (NSS)	NSS coordinator	0	0	2		--	100	---	100	PP/NP
		PEN310	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		YON310	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=** Self-Study, **CIE:** Continuous Internal Evaluation, **SEE:** Semester End Evaluation. **K:** This letter in the course code indicates common to all the streams of Engineering. **ESC:** Engineering Science Course, **ETC:** Emerging Technology Course, **PLC:** Programming Language Course

Engineering Science Course (ESC/ETC/PLC) ECT306x			
ECT306A	Signals and system	ECT306C	Computer Organization and Architecture
ECT306B	Sensors and Instrumentation	ECT306D	Applied Numerical methods
Ability Enhancement Course – III ECT308x OR 2ECL308x			
ECL308A	LICs Lab using PSPICE	ECT308C	Digital Engineering Course (NASSCOM)
ECL308B	Simulink Programming Basics	ECT308D	IOT for Smart Infrastructure
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. 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.			

Dr. Ambedkar Institute of Technology, Bengaluru-560056
Outcome Based Education(OBE) and Choice Based Credit System
B.E. Name of the programme: Electronics and Communication Engineering
Tentative Scheme of Teaching and Examination effective from the Academic Year 2023-24
(Applicable to 2024 batch)

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	Tutorial	Practical/ Drawing	Self - Study	Duration in hours	CIE Marks	SEE Marks	Total Marks		
													L	
1	PCC	ECT401	Engineering Electromagnetics	ECE	3	0	0		03	50	50	100	3	
2	IPCC	ECU402	Principles of Communication Systems	ECE	3	0	2		03	50	50	100	4	
3	IPCC	ECU403	Modern Control systems	ECE	3	0	2		03	50	50	100	4	
4	PCCL	ECL404	Communication laboratory	ECE	0	0	2		03	50	50	100	1	
5	ESC	ECT405x	ESC/ETC/PLC	ECE	3	0	0		03	50	50	100	3	
6	AEC/ SEC	ECT406x or ECL406x	Ability Enhancement Course/Skill Enhancement Course- IV	ECE	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	BIT407	Biology For Engineers	TD / PSB: BT, CHE,	2	0	0		03	50	50	100	2	
8	UHV	HST408	Universal human values course	Any Department	1	0	0		01	50	50	100	1	
9	HS	CDN409	Aptitude and Verbal Ability Skill-II	Placement Cell	2	0	0		--	50	--	50	PP/ NP	
10	MC	NSN410	National Service Scheme (NSS)	NSS coordinator	0	0	2			100	---	100	PP/ NP	
		PEN410	Physical Education (PE) (Sports and Athletics)	Physical Education Director										
		YON410	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= Self-Study, 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) ECT405x OR ECL405x			
ECT405A	8051 Microcontroller	ECT405C	Operating Systems
ECT405B	Power Electronics	ECT405D	Engineering Statistics and Linear Algebra
Ability Enhancement Course / Skill Enhancement Course – IV ECT405x OR ECL406x			
ECL406A	C++ Basics	ECL406C	LabVIEW Programming
ECL406B	Electronic Devices	ECL406D	Risk Management in IOT Implementation
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. 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.			

Dr.Ambedkar Institute of Technology, Bengaluru-560056
Outcome Based Education(OBE) and Choice Based Credit System
B.E. Name of the programme: Electronics and Communication Engineering
Tentative Scheme of Teaching and Examination effective from the Academic Year 2023-24
(Applicable to 2024 batch)

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	ECT501	Technological Innovation Management and Entrepreneurship	ECE	3	0	0		03	50	50	100	3
2	IPCC	ECU502	ARM Microcontroller	ECE	3		2		03	50	50	100	4
3	PCC	ECT503	Digital Signal Processing and Machine Learning	ECE	3	0	2		03	50	50	100	4
4	PCCL	ECL504	Digital Signal Processing Laboratory	ECE	0	0	2		03	50	50	100	1
5	PEC	ECT505x	Professional Elective Course	ECE	3	0	0		03	50	50	100	3
6	PROJ	ECM506	Mini Project	ECE	0	0	4		03	100		100	2
7	AEC	RMT507	Research Methodology and IPR	EEE department	2	2	0		02	50	50	100	3
8	MC	CVT508	Environmental Studies	TD: CV PSB: CV	2	0	0		02	50	50	100	2
9	HS	CDN509	Aptitude and Verbal Ability Skills	Placement Cell	2	0	0		--	50	--	50	PP/ NP
10	MC	NSN510	National Service Scheme (NSS)	NSS coordinator	0	0	2			100		100	PP/ NP
		PEN510	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		YON510	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= Self-Study 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 Elective Course ECT505x			
ECT505A	System Verilog for verification	ECT505D	Multicore Architecture
ECT505B	Artificial Intelligence	ECT505E	Advanced Control Systems
ECT505C	Fundamentals of Virtual Reality	ECT505F	Programming with Python

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 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.

Dr.Ambedkar Institute of Technology, Bengaluru-560056
Outcome Based Education(OBE) and Choice Based Credit System
B.E. Name of the programme: Electronics and Communication Engineering
Tentative Scheme of Teaching and Examination effective from the Academic Year 2023-24
(Applicable to 2024 batch)

VI SEMESTER

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
1	IPCC	ECU601	Microwave and Antenna	ECE	3	0	2		03	50	50	100	4	
2	PCC	ECT602	VLSI Design and Testing	ECE	3	2	0		03	50	50	100	4	
3	PEC	ECT603x	Professional Elective Course	ECE	3	0	0		03	50	50	100	3	
4	OEC	ECT604x	Open Elective Course	ECE	3	0	0		03	50	50	100	3	
5	PROJ	ECP605	Major Project Phase I	ECE	0	0	4		03	100	--	100	2	
6	PCCL	ECL606	VLSI Laboratory	ECE	0	0	2		03	50	50	100	1	
7	AEC/SDC	ECT607x OR ECL607x	Ability Enhancement Course/Skill Development Course V	ECE	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	HS	CDN608	Analytical and Reasoning Skills	Placement Cell	2	0	0		--	50	--	50	PP/ NP	
9	MC	NSN609	National Service Scheme (NSS)	NSS coordinator	0	0	2			100	---	100	PP/ NP	
		PEN609	Physical Education (PE) (Sports and Athletics)	Physical Education Director										
		YON609	Yoga	Yoga Teacher										
Total									500	300	800	18		

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=** Self-Study, **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 Elective Course ECT603x			
ECT603A	Satellite Communication	ECT603D	Digital Image Processing
ECT603B	Cryptography	ECT603E	Robotics and Machine Vision System
ECT603C	Machine Learning	ECT603F	Adaptive Signal Processing
Open Elective Course ECT604x			
ECT604A	Mechatronics	ECT604C	RTOS
ECT604B	MEMS	ECT604D	Robotics Mechanics and Control

Ability Enhancement Course / Skill Enhancement Course-V ECT607x OR ECL607x			
ECT607A	Automotive Electronics	ECT607C	Real Time Embedded Systems
ECT607B	Introduction to E-Vehicles	ECT607D	Introduction to Unmanned Aerial Vehicle (UAV)
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 help he/she has to complete the literature survey and prepare the report and finally define the problem statement for the project work.

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Outcome Based Education(OBE) and Choice Based Credit System
B.E. Name of the programme: Electronics and Communication Engineering
Tentative Scheme of Teaching and Examination effective from the Academic Year 2023-24
(Applicable to 2024 batch)

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 hours	CIE Marks	SEE Marks	Total Marks	
1	IPCC	ECU701	Digital communication and coding		3	0	2		03	50	50	100	4
2	IPCC	ECU702	Computer Networks and Protocols		3	0	2		03	50	50	100	4
3	PCC	ECT703	Wireless Communication Systems		3	2	0		03	50	50	100	4
4	PEC	ECT704x	Professional Elective Course		3	0	0		03	50	50	100	3
5	OEC	ECT705x	Open Elective Course		3	0	0		01	50	50	100	3
6	PROJ	ECP706	Major Project Phase-II		0	0	12		03	100	100	200	6
										400	300	700	24

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=** Self-Study, **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

Professional Elective Course ECT704x

ECT704A	ASIC	ECT704D	FPGA System Design using Verilog
ECT704B	Intelligent Systems and Machine Learning Algorithms	ECT704E	Cyber Security
ECT704C	Operation Research		

Open Elective Course ECT705x

ECT705A	E-waste Management	ECT705D	Embedded Systems Applications
ECT705B	Automotive Electronics	ECT705E	Sensors and Actuators
ECT705C	Basic VLSI Design		

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. To install responsibilities to oneself and others.
- (vii) 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.

Dr. Ambedkar Institute of Technology, Bengaluru-560056
Outcome Based Education(OBE) and Choice Based Credit System
B.E. Name of the programme: Electronics and Communication Engineering
Tentative Scheme of Teaching and Examination effective from the Academic Year 2023-24
(Applicable to 2024 batch)

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	ECT801x	Professional Elective (Online Courses)		3	0	0		-	-	-	-	3
2	OEC	ECT802x	Open Elective (Online Courses)		3	0	0		-	-	-	-	3
3	INT	ECI803	Internship (Industry/Research) (14 - 20 Weeks)		0	0	12		03	100	100	200	10
										200	200	400	16

L: Lecture, **T:** Tutorial, **P:** Practical **S=** Self-Study, **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.

Professional Elective Course (Online courses) ECT801x

ECT801A		ECT801C	
ECT801B		ECT801D	
Open Elective Courses (Online Courses) ECT802x			
ECT802A		ECT802C	
ECT802B		ECT802D	

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 home town (**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/Institute shall not bear any cost involved in carrying out the internship by students. However, students can receive any financial assistance extended by the organization

Dr. Ambedkar Institute of Technology, Bengaluru-560056
Scheme of Teaching and Examination for I/II Semester B.E. CBCS 2022, Academic Year-2023-24
2022 Scheme for ECE/EI/ET

Chemistry Cycle										SEMESTER: I				
Sl. No.	Course Category	Course Code	Course Title	Teaching Department	Teaching Hours/Week					Examination				Credits
					L	T	P	SDA	Total	Duration(Hrs)	CIE Marks	SEE Marks	Total Marks	
1	ASC(IC)	22MAU101D	Mathematics- I	Maths	2	2	2	0	4+2	03	50	50	100	04
2	ASC(IC)	22CHU102B	Applied Chemistry	Chemistry	3	0	2	0	3+2	03	50	50	100	04
3	ESC	22MED103	Computer Aided Engineering Drawing	Civil/Mech.	2	2	0	0	3	03	50	50	100	03
4	ESC-1	22ESX104x	Engineering Science Course-I	Respective Engg. dept	3	0	0	0	3	03	50	50	100	03
5	ETC-1	22ETT105x	Programming Language Course - I	Any Engg. Dept	3	0	0	0	3	03	50	50	100	03
6	AEC	22ENT106	Communicative English	Humanities	1	0	0	0	1	02	50	50	100	01
7	HSS	22CIT107	Constitution of India	Humanities	1	0	0	0	1	02	50	50	100	01
8	HSS	22SFH108	Scientific Foundation of Health	Any dept.	1	0	0	0	1	02	50	50	100	01
9	MC	22CDN109	Career Development skill-I	Placement cell	2	0	0	0	2	-	50	---	---	NP/PP
Total									25		450	400	800	20

D/PSB- Teaching Department / Paper Setting Board, SS- Self Study, ASC- Applied Science Course, ESC- Engineering Science Courses, ETC- Emerging Technology Course, AEC- Ability Enhancement Course, HSS- Humanity and Social Science 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	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 ANNEXUREI of Induction Programs notification of the University published at the beginning of the 1 st semester.	
AICTE Activity Points to be earned by students admitted to B.E. 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 hour's 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.	
22MAU101D Shall have the 03 hours of theory examination(SEE), however, practical sessions question shall be included in the theory question papers #- 22CHU102B SEE shall have the 03 hours of theory examination), however, practical sessions question shall be included in the theory question papers. 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 then the syllabus shall be designed as an Integrated course (L:T:P:S= 2:0:2:0). All PLC courses are Integrated courses. All 01 Credit- courses shall have the SEE of 02 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 22ESX104x	Title	L	T	P	Code 22ETT105x	Title	L	T	P
22EST104A	Introduction to Civil Engineering	3	0	0	22ETT1051	Introduction to Cyber Security	3	0	0
22EST104B	Introduction to Electrical Engineering	3	0	0	22ETT1052	Introduction to Internet of Things (IOT)	3	0	0
22EST104C	Introduction to Electronics Engineering	3	0	0	22ETT1053	Renewable Energy Sources	3	0	0
22EST104D	Introduction to Mechanical Engineering	3	0	0	22ETT1054	Waste Management	3	0	0
22ESU104E	Introduction to C Programming	2	0	2	22ETT1055	Green Buildings	3	0	0
					22ETT1056	Smart Materials and Systems	3	0	0
					22ETT1057	Introduction to Nano Technology	3	0	0
					22ETT1058	Introduction to Sustainable Engineering	3	0	0
					22ETT1059	Introduction to Embedded System	3	0	0
(PLC-I) Programming Language Courses-I					Applied Science Course(ASC)				
Code 22PLU105x	Title	L	T	P	Code	Title			
22PLU105A	Introduction to Web Programming	2	0	2	22MAU101D	Mathematics – I for EE stream			
22PLU105B	Introduction to Python Programming	2	0	2	22CHU102B	Applied Chemistry for EE stream			
22PLU105C	Basics of JAVA programming	2	0	2					
22PLU105D	Introduction to C++ Programming	2	0	2					
The course 22ESU104E: 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.
- ME/AE/IEM stream Engineering Students shall opt for any one of the courses from the ESC-I group except, **22ESU104C - Introduction to Electronics Engineering**
- The students must opt for the courses from ESC group without repeating the course 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.

Dr. Ambedkar Institute of Technology, Bengaluru-560056
Scheme of Teaching and Examination for I/II Semester B.E. CBCS 2022, Academic Year-2023-24
2022 Scheme: ECE/EI/ET

Physics Cycle										SEMESTER : II				
Sl. No.	Course Category	Course Code	Course Title	Teaching Department	Teaching Hours/Week					Examination				Credits
					L	T	P	SD A	Total	Duration (Hrs)	CIE Marks	SEE Marks	Total Marks	
1	ASC(IC)	22MAU201D	Mathematics	Maths	2	2	2	0	4+2	3	50	50	100	4
2	ASC(IC)	22PHU202D	Applied Physics	Physics	3	0	2	0	3+2	3	50	50	100	4
3	ESC	22ECT203	Basic Electronics	EEE	3	0	0	0	3	3	50	50	100	3
4	ESC-II	22ESX204x	Engineering Science Course-II	Respective Enggdept	3	0	0	0	3	3	50	50	100	3
5	ETC-II	22ETT205X	Emerging Technology Course - II	Any Engg. Dept	2	0	2	0	4	3	50	50	100	3
6	AEC	22ENT206	Professional writing skill	Humanities	1	0	0	0	1	2	50	50	100	1
7	HSS	22SKT207/ 22BKT207	Samskrutika/ Balake Kannada	Humanities	1	0	0	0	1	2	50	50	100	1
8	HSS	22IDT208	Innovation and Design Thinking	Humanities	1	0	0	0	1	2	50	50	100	1
9	MC	22CDN209	Career Development skill-II	Humanities	2	0	0	0	2	-	50	---	---	NP/ PP
Total									26		450	400	800	20

TD/PSB- Teaching Department / Paper Setting Board, SS- Self Study, ASC- Applied Science Course, ESC- Engineering Science Courses, ETC- Emerging Technology Course, AEC- Ability Enhancement Course, HSS- Humanity and Social Science 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	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 02- 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 ANNEXUREI of Induction Programs notification of the University published at the beginning of the 1 st semester.	
AICTE Activity Points to be earned by students admitted to B.E. 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 hour's 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.	
22MAU101D Shall have the 03 hours of theory examination(SEE), however, practical sessions question shall be included in the theory question papers #- 22PHU202D SEE shall have the 03 hours of theory examination), however, practical sessions question shall be included in the theory question papers. 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 then the syllabus shall be designed as an Integrated course (L:T:P:S= 2:0:2:0). All PLC courses are Integrated courses. All 01 Credit- courses shall have the SEE of 02 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 22ESX104x	Title	L	T	P	Code 22ETT105x	Title	L	T	P
22EST204A	Introduction to Civil Engineering	3	0	0	22ETT2051	Introduction to Cyber Security	3	0	0
22EST204B	Introduction to Electrical Engineering	3	0	0	22ETT2052	Introduction to Internet of Things (IOT)	3	0	0
22EST204C	Introduction to Electronics Engineering	3	0	0	22ETT2053	Renewable Energy Sources	3	0	0
22EST204D	Introduction to Mechanical Engineering	3	0	0	22ETT2054	Waste Management	3	0	0
22ESU204E	Introduction to C Programming	2	0	2	22ETT2055	Green Buildings	3	0	0
					22ETT2056	Smart Materials and Systems	3	0	0
					22ETT2057	Introduction to Nano Technology	3	0	0
					22ETT2058	Introduction to Sustainable Engineering	3	0	0
					22ETT2059	Introduction to Embedded System	3	0	0
(PLC-I) Programming Language Courses-I					Applied Science Course(ASC)				
Code 22PLU105x	Title	L	T	P	Code	Title			
22PLU205A	Introduction to Web Programming	2	0	2	22MAU201D	Mathematics – I for EE/EC/EI/ET			
22PLU205B	Introduction to Python Programming	2	0	2	22PHU202D	Applied Physics for EE/EC/EI/ET			
22PLU205C	Basics of JAVA programming	2	0	2					
22PLU205D	Introduction to C++ Programming	2	0	2					
The course 22ESU104E: 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.
- ME/AE/IEM stream Engineering Students shall opt for any one of the courses from the ESC-II group except, **22ESU204C - Introduction to Electronics Engineering**
- The students have to opt for the courses from ESC group without repeating the course 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.

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III SEMESTER

Sl. No	Course	Course Code	Course Title	Teaching Department (TD) and Question Paper Setting	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	22MAT301xx	Maths for AV Communication	Maths	3	2	0		03	50	50	100	4
2	IPCC	22ECU302	Digital System Design using Verilog	ECE	3	0	2		03	50	50	100	4
3	IPCC	22 ECU303	Analog Electronic Circuits	ECE	3	0	2		03	50	50	100	4
4	PCC	22ECT304	Network Analysis	ECE	2	2	0		03	50	50	100	3
5	PCCL	22ECL305	Analog and Digital Electronics Laboratory	ECE	0	0	2		03	50	50	100	1
6	ESC	22ECT306x	ESC/ETC/PLC	ECE	3	0	0		03	50	50	100	3
7	UHV	22HST307	Social Connect and Responsibility	Any Department	0	0	2		01	100	---	100	1
8	AEC/ SEC	22ECT308x or 22ECL308x	Ability Enhancement Course/Skill Enhancement Course – III	ECE	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	HS	22CDN309	Aptitude and Verbal Ability Skill-I	Placement Cell	2	0	0		--	50	--	50	PP/NP
10	MC	22NSN310	National Service Scheme (NSS)	NSS coordinator	0	0	2		--	100	---	100	PP/NP
		22PEN310	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		22YON310	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=** Self-Study, **CIE:** Continuous Internal Evaluation, **SEE:** Semester End Evaluation. **K:** This letter in the course code indicates common to all the streams of Engineering. **ESC:** Engineering Science Course, **ETC:** Emerging Technology Course, **PLC:** Programming Language Course

Engineering Science Course (ESC/ETC/PLC) 22ECT306x			
22ECT306A	Signals and system	22ECT306C	Computer Organization and Architecture
22ECT306B	Sensors and Instrumentation	22ECT306D	Applied Numerical methods
Ability Enhancement Course – III 22ECT308x OR 2ECL308x			
22ECL308A	LICs Lab using PSPICE	22ECT308C	Digital Engineering Course (NASSCOM)
22ECL308B	Simulink Programming Basics	22ECT308D	IOT for Smart Infrastructure
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. 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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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	Tutorial	Practical/ Drawing	Self - Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
1	PCC	22ECT401	Engineering Electromagnetics	ECE	3	0	0		03	50	50	100	3
2	IPCC	22ECU402	Principles of Communication Systems	ECE	3	0	2		03	50	50	100	4
3	IPCC	22ECU403	Modern Control systems	ECE	3	0	2		03	50	50	100	4
4	PCCL	22ECL404	Communication laboratory	ECE	0	0	2		03	50	50	100	1
5	ESC	22ECT405x	ESC/ETC/PLC	ECE	3	0	0		03	50	50	100	3
6	AEC/ SEC	22ECT406x or 22ECL406x	Ability Enhancement Course/Skill Enhancement Course- IV	ECE	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	22BIT407	Biology For Engineers	TD / PSB: BT, CHE,	2	0	0		03	50	50	100	2
8	UHV	22HST408	Universal human values course	Any Department	1	0	0		01	50	50	100	1
9	HS	22CDN409	Aptitude and Verbal Ability Skill-II	Placement Cell	2	0	0		--	50	--	50	PP/ NP
10	MC	22NSN410	National Service Scheme (NSS)	NSS coordinator	0	0	2			100	---	100	PP/ NP
		22PEN410	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		22YON410	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= Self-Study, 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) 22ECT405x OR 22ECL405x			
22ECT405A	8051 Microcontroller	22ECT405C	Operating Systems
22ECT405B	Power Electronics	22ECT405D	Engineering Statistics and Linear Algebra
Ability Enhancement Course / Skill Enhancement Course – IV 22XXT405x OR 22XXL406x			
22ECL406A	C++ Basics	22ECL406C	LabVIEW Programming
22ECL406B	Electronic Devices	22ECL406D	Risk Management in IOT Implementation
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. 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	22ECT501	Technological Innovation Management and Entrepreneurship	ECE	3	0	0		03	50	50	100	3
2	IPCC	22ECU502	ARM Microcontroller	ECE	3		2		03	50	50	100	4
3	PCC	22ECT503	Digital Signal Processing and Machine Learning	ECE	3	0	2		03	50	50	100	4
4	PCCL	22ECL504	Digital Signal Processing Laboratory	ECE	0	0	2		03	50	50	100	1
5	PEC	22ECT505x	Professional Elective Course	ECE	3	0	0		03	50	50	100	3
6	PROJ	22ECM506	Mini Project	ECE	0	0	4		03	100		100	2
7	AEC	22RMT507	Research Methodology and IPR	EEE department	2	2	0		02	50	50	100	3
8	MC	22CVT508	Environmental Studies	TD: CV PSB: CV	2	0	0		02	50	50	100	2
9	HS	22CDN509	Aptitude and Verbal Ability Skills	Placement Cell	2	0	0		--	50	--	50	PP/ NP
10	MC	22NSN510	National Service Scheme (NSS)	NSS coordinator	0	0	2			100		100	PP/ NP
		22PEN510	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		22YON510	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= Self-Study 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 Elective Course 22ECT505x			
22ECT505A	System Verilog for verification	22ECT505D	Multicore Architecture
22ECT505B	Artificial Intelligence	22ECT505E	Advanced Control Systems
22ECT505C	Fundamentals of Virtual Reality	22ECT505F	Programming with Python

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 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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VI SEMESTER

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	22ECU601	Microwave and Antenna	ECE	3	0	2		03	50	50	100	4	
2	PCC	22ECT602	VLSI Design and Testing	ECE	3	2	0		03	50	50	100	4	
3	PEC	22ECT603x	Professional Elective Course	ECE	3	0	0		03	50	50	100	3	
4	OEC	22ECT604x	Open Elective Course	ECE	3	0	0		03	50	50	100	3	
5	PROJ	22ECP605	Major Project Phase I	ECE	0	0	4		03	100	--	100	2	
6	PCCL	22ECL606	VLSI Laboratory	ECE	0	0	2		03	50	50	100	1	
7	AEC/SDC	22XXT607x OR 22XXL607x	Ability Enhancement Course/Skill Development Course V	ECE	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	HS	22CDN608	Analytical and Reasoning Skills	Placement Cell	2	0	0		--	50	--	50	PP/ NP	
9	MC	22NSN609	National Service Scheme (NSS)	NSS coordinator	0	0	2			100	---	100	PP/ NP	
		22PEN609	Physical Education (PE) (Sports and Athletics)	Physical Education Director										
		22YON609	Yoga	Yoga Teacher										
Total										500	300	800	18	

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=** Self-Study, **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 Elective Course 22ECT603x			
22ECT603A	Satellite Communication	22ECT603D	Digital Image Processing
22ECT603B	Cryptography	22ECT603E	Robotics and Machine Vision System
22ECT603C	Machine Learning	22ECT603F	Adaptive Signal Processing
Open Elective Course 22ECT604x			
22ECT604A	Mechatronics	22ECT604C	RTOS
22ECT604B	MEMS	22ECT604D	Robotics Mechanics and Control

Ability Enhancement Course / Skill Enhancement Course-V 22ECT607x OR 22ECL607x			
22ECT607A	Automotive Electronics	22ECT607C	Real Time Embedded Systems
22ECT607B	Introduction to E-Vehicles	22ECT607D	Introduction to Unmanned Aerial Vehicle (UAV)
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 help he/she has to complete the literature survey and prepare the report and finally define the problem statement for the project work.

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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 hours	CIE Marks	SEE Marks	Total Marks	
1	IPCC	22ECU701	Digital communication and coding		3	0	2		03	50	50	100	4
2	IPCC	22ECU702	Computer Networks and Protocols		3	0	2		03	50	50	100	4
3	PCC	22ECT703	Wireless Communication Systems		3	2	0		03	50	50	100	4
4	PEC	22ECT704x	Professional Elective Course		3	0	0		03	50	50	100	3
5	OEC	22ECT705x	Open Elective Course		3	0	0		01	50	50	100	3
6	PROJ	22ECP706	Major Project Phase-II		0	0	12		03	100	100	200	6
										400	300	700	24

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=** Self-Study, **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

Professional Elective Course 22ECT704x

22ECT704A	ASIC	22ECT704D	FPGA System Design using Verilog
22ECT704B	Intelligent Systems and Machine Learning Algorithms	22ECT704E	Cyber Security
22ECT704C	Operation Research		

Open Elective Course 22ECT705x

22ECT705A	E-waste Management	22ECT705D	Embedded Systems Applications
22ECT705B	Automotive Electronics	22ECT705E	Sensors and Actuators
22ECT705C	Basic VLSI Design		

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. To install responsibilities to oneself and others.
- (vii) 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.

Dr. Ambedkar Institute of Technology, Bengaluru-560056
Outcome Based Education(OBE) and Choice Based Credit System
B.E. Name of the programme: Electronics and Communication Engineering
Tentative Scheme of Teaching and Examination effective from the Academic Year 2023-24
(Applicable to 2023 batch)

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	22ECT801x	Professional Elective (Online Courses)		3	0	0		-	-	-	-	3
2	OEC	22ECT802x	Open Elective (Online Courses)		3	0	0		-	-	-	-	3
3	INT	22ECI803	Internship (Industry/Research) (14 - 20 Weeks)		0	0	12		03	100	100	200	10
										200	200	400	16

L: Lecture, **T:** Tutorial, **P:** Practical **S=** Self-Study, **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.

Professional Elective Course (Online courses) 22ECT801x

22ECT801A		22ECT801C	
22ECT801B		22ECT801D	

Open Elective Courses (Online Courses) 22ECT802x

22ECT802A		22ECT802C	
22ECT802B		22ECT802D	

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 home town (**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/Institute shall not bear any cost involved in carrying out the internship by students. However, students can receive any financial assistance extended by the organization

Dr. Ambedkar Institute of Technology, Bengaluru-560056													
Outcome Based Education(OBE) and Choice Based Credit System (CBCS													
B.E. Electronics and Communication Engineering													
Scheme of Teaching and Examination effective from the Academic Year 2025 - 26													
I Semester													
BRANCH: ECE, EEE, ETE, EIE, ME, AE, IEM													
Sl. No	Course and Course Code		Course Title	TD/PSB	Teaching Hours/Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	SAAE	Duration in hours	CIE Marks	SEE Marks	Total Marks	
1	ASC(IC)	1BMAU101x	Applied Mathematics-I (Stream Specific)	Maths Dept	2	2	2		03	50	50	100	04
2	ASC(IC)	1BCHU102x	Applied Chemistry (Stream Specific)	CHE Dept	2	2	2		03	50	50	100	04
3	ETC	1BAIT103	Introduction to AI and Applications	Any Dept	3	0	0		03	50	50	100	03
4	ESC	1BEST104x	Engineering Science Course I	Respective Engg Dept	3	0	0		03	50	50	100	03
5	PLC(IC)	1BPLU105x	Programming Language Course	CSE & allied Dept	3	0	2		03	50	50	100	04
6	AEC	1BENGL106	Communication Skills	Humanities Dept	1	0	1		02	50	50	100	01
7	AEC (NCMC)	1BICT107	Indian Constitution & Engineering Ethics	Humanities Dept	1	0	0		--	100	--	100	PP/NP
8	AEC/SDC	1BIDL108	Innovation and Design Thinking Lab (Project-based learning)	Any Dept	0	0	2		02	50	50	100	01
9	MC	1BCDN109	Career Development Skill –I	Placement Cell	2	0	0		---	50	---	---	PP/NP
	TOTAL				17	02	07		20	500	350	800	20
9	AICTE Activity Points (students have to earn 100 activity points between 01 to 08 semesters)				Compulsory requirement for the award of a degree								
ASC-Applied Science Course, ESC- Engineering Science Courses, IC – Integrated Course (Practical Course Integrated with Theory Course), PLC(IC)- Programming Language Course (Integrated Course), AEC- Ability Enhancement Course, NCMC: Non Credit Mandatory Course, AEC/SDC- Ability Enhancement Course/Skill Development course, TD/PSB- Teaching Department / Paper Setting Board, S- (SAAE)-Students’ Academic Activity Engagement Hours, CIE –Continuous Internal Evaluation, SEE- Semester End Examination, PP : (Pass/Pass) is assigned to a noncredit course. “PP” represents pass in a course provided students have successfully completed the CIE requirements. Otherwise, “NP-not pass shall be awarded. “PP” is essential for the award of the degree													
Credit Definition:													
1-hour Lecture (L) per week=1Credit				04-Credit courses are designed for 50 hours of Teaching-Learning sessions									
2-hoursTutorial(T) per week=1Credit				04-Credit (IC) courses are designed for 40 hours’ theory and 10-12 hours of practical sessions									
2-hours Practical / Drawing (P) per week=1Credit				03-Credit courses are designed for 40 hours of Teaching-Learning Session									
				02- Credit courses are designed for 25 hours of Teaching-Learning Session									
				01-Credit courses are designed for 12 hours of Teaching-Learning sessions									

Applied Mathematics-I					Applied Chemistry				
Code	Title	L	T	P	Code	Title	L	T	P
1BMAU101A	Differential Calculus and Linear Algebra: CV Stream	2	2	2	1BCHU102A	Applied Chemistry for Metal Protection and Sustainable Energy (ME stream)	2	2	2
1BMAU101B	Calculus And Linear Algebra: CSE stream	2	2	2	1BCHU102B	Applied Chemistry for Futuristic Devices (EEE stream)	2	2	2
1BMAU101C	Differential Calculus and Linear Algebra: ME Stream	2	2	2	1BCHU102C	Applied Chemistry for Sustainable Built Environment (CV)	2	2	2
1BMAU101D	Differential Calculus and Linear Algebra; EEE stream	2	2	2	1BCHU102D	Applied Chemistry for Smart Systems (CSE stream)	2	2	2
Engineering Science Courses-I (ESC-I)					Programming Language Courses (PLC)				
Code	Title	L	T	P	Code	Title	L	T	P
1BEST104A	Introduction to Building Sciences	3	0	0	1BPLU105A	Introduction to C (For none IT programmes)	3	0	2
1BEST104B	Introduction to Electrical Engineering	3	0	0	1BPLU105B	Python Programming (for CSE and allied programmes)	3	0	2
1BEST104C	Introduction to Electronics and Communication Engineering	3	0	0					
1BEST104D	Introduction to Mechanical Engineering	3	0	0					
1BEST104E	Essentials of Information Technology	3	0	0					
Integrated courses (IC), combining theory with practical components. (i) Theory sessions shall be conducted for 3 hours per week, while the practical sessions shall be conducted for 2 hours per week. (ii) Theory components shall be evaluated through both Continuous Internal Evaluation (CIE) and Semester End Examination (SEE). (iii) The practical component shall be assessed only through CIE.									
The Mathematics/Chemistry courses shall be taught by a single faculty member per session, with no sharing of the course (subject) modules. The Practical sessions for the mathematics course shall be conducted in the laboratory environment using Maxima/Mathematica/ Python/Scilab/MATLAB software to enhance computational understanding and application skills.									
All students admitted to the engineering program have to complete Applied Mathematics-I and Applied Mathematics-II in I and II semesters by selecting the subjects prescribed for their stream, viz. CV, ME, EEE or CSE, under the heading Mathematics-I and Mathematics-II. Those who have completed the chemistry course under the heading Applied Chemistry in I semester have to select the prescribed stream wise physics course under the heading Applied physics during II semester.									
Engineering Sciences Courses-I (ESC-I): These courses are designed to broaden the technical knowledge of students beyond their core area of study. These courses enable students to gain a foundational understanding of engineering principles from other stream courses. Students are required to select and complete two courses that are not belong to their admitted program stream. For example, a student admitted to the any programme of the Civil Engineering stream should not select Introduction to Building Sciences but any other two. One course shall selected under ESC-I and another course under ESC-II. The two courses must be different from the other.									

The **Student Induction Programme (SIP)**, initiated by the All India Council for Technical Education (AICTE), is designed to help newly admitted students in technical institutions transition smoothly into the higher education environment. It aims to familiarize students with the institutional culture, foster connections with peers and faculty, and provide a foundation for holistic learning. Activities under SIP may include Physical Activities, Creative Arts, Universal Human Values, Literary Events, and Proficiency Modules. Lectures shall be by Eminent Personalities, Local Area Visits, Department/Branch Familiarization, and Innovation-related sessions.

The first year of the Engineering programmes is composed of I semester, II semester and Summer Semester. SIP activities shall be scheduled in the afternoon sessions during the first week of class commencement of I and II semesters only.

The specific programmes to be conducted will be notified separately by the University via the academic calendar or through a separate notification.

AICTE Activity Points Requirement for BE/B.Tech. Programmes

As per AICTE guidelines (refer Chapter 6 – *AICTE Activity Point Program, Model Internship Guidelines*), in addition to academic requirements, students must earn a specified number of **Activity Points** to be eligible for the award of the degree. The points to be earned is:

1. **Regular students** admitted to a 4-year degree program must earn **100 Activity Points**.
2. **Lateral entry students** (joining from the second year) must earn **75 Activity Points**.
3. **Students transferred** from other universities directly into the fifth semester must earn **50 Activity Points** from the date of entry into VTU.

These Activity Points are **non-credit** and will not be considered for **the SGPA/CGPA** or be used for **vertical progression**. However, earning Activity Points is mandatory for the **award of the degree**, and the points earned will be reflected on the **eighth semester Grade Card**.

If a student completes all the semesters (eight or six) at the end of the programme but fails to earn the required Activity Points, the eighth-semester Grade Card will be withheld until the requirement is fulfilled. Also, the degree will be awarded only after the Grade Card has been released.

The hours spent earning the activity points will not be counted for regular attendance requirements. Students can accumulate these points at any time during their program period, including weekends, holidays, and vacations, starting from the year of admission, provided they meet the minimum hours of engagement prescribed for each activity by AICTE.

Sl. No	Stream	UG Programmes under the stream with code
1	Civil Engineering Stream (CV)	(1) Civil engineering (CV), (2) Mining Engineering (MI)
2	Mechanical Engineering Stream ME	(1)Aeronautical Engineering (AE), (2)Aerospace Engineering (AS),(3) Agreecultural Engineering (AG),(4)Automation and Robotics (AR), (5)Automobile Engineering (AU), (6)Chemical Engineering (CH), (7) Industrial & Production Engineering (IP), (8)Industrial Eng ineering & Management (IM), (9) Manufacturing Science and Engineering (MS), (10) Marine Engineering (MR), (11) Mechanical & Smart Manufacturing (MM), (12) Mechanical Engineering (ME), (13)Mechatronics (MT), (14) Petrochem Engineering (PC), (15)Robotics & Automation (RA),(16) Robotics and Artificial Intelligence (RI),(17)Silk Technology (ST), (18) Textile Technology (TX),(19)Energy Engineering (ER),(20) Smart Agritech (SA).
3	Electrical and Electronics Engineering Stream (EEE)	(1)Electronics & Communication Engineering (EC), (2)Biomedical Engineering (BM), (3)Electrical & Electronics Engineering (EE), (4) Electronics & Instrumentation Engineering (EI),(5) Electronics & Telecommunication Engineering (ET),(6) Industrial IoT (IO), (7) Medical Electronics Engineering (ML),(8) Electronics Engineering (VLSI Design and Technology) (VL),(9) Electronics & Communication(Advanced Communication Technology) (EA),(10) Electronics & Computer Engineering (UE).
4	Computer Science and Engineering Stream (CSE)	(1) Computer Science and Engineering (CS), (2)Computer Engineering (CE), (3) Artificial Intelligence and Data Science (AD), (4)Artificial Intelligence and Machine Learning (AI),(5)Biotechnology (BT),(6)Computer & Communication Engineering (CM), (7) Computer Science and Business System (CB),(8)Computer Science and Design (CG),(9)Computer Science and Engineering (IoT) (CO), (10)CSE(Artificial Intelligence and Machine Learning) (CI),(11) CSE(Artificial Intelligence) (CA),(12) CSE(Cyber Security) (CY), (13)CSE(Data Science) (CD),(14) CSE(IoT and Cyber Security including Block Chain Technology) (IC), (15) Data Science (DS), (16) Information Science & Engineering (IS),(17) Computer Science (CR).

Dr. Ambedkar Institute of Technology, Bengaluru-560056
Outcome Based Education(OBE) and Choice Based Credit System (CBCS)

B.E. Name of the programme: -----

Scheme of Teaching and Examination effective from the Academic Year 2025 - 26

II Semester		BRANCH: ECE, EEE, ETE, EIE, ME, AE, IEM				(For the students who have studied the Chemistry group in I semester)							
Sl. No	Course and Course Code		Course Title	TD/PSB	Teaching Hours/Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	SAAE	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	ASC(IC)	1BMAU201x	Applied Mathematics -II (Stream Specific)	Maths Dept	2	2	2		03	50	50	100	04
2	ASC(IC)	1BCHU202x	Applied Physics (Stream Specific)	PHY Dept	2	2	2		03	50	50	100	04
3	ESC	1BCED203x	Computer-Aided Engineering Drawing (Stream Specific)	ME dept	2	0	2		03	50	50	100	03
4	ESC	1BEST204x	Engineering Science Course-II	Respective Engg Dept	3	0	0		03	50	50	100	03
5	PSC	1BXTT205x	Programme Specific Courses	Respective Engg Dept	3	0	0		03	50	50	100	03
6	AEC (NCMC)	1BSST206	Soft Skills	Humanities Dept	1	0	0		--	100	---	100	PP/NP
7	PSC/ESC	1BXXL207	Program-Specific Course Lab	Respective dept	0	0	2		02	50	50	100	01
8	AEC/SDC	1BPRJ208	Interdisciplinary Project-Based Learning	Combination of Departments	0	0	0	02	02	50	50	100	01
9	HSMC	1BKST209/1BKBT209	Sanskrutika Kannada/ Balake Kannada	Humanities Dept	1	0	0		01	50	50	100	01
10	MC	1BCDN210	Career Development Skill -II	Placement Cell	2	0	0		---	50	---	---	PP/NP
	TOTAL				16	02	06		21	550	400	900	20

ASC-Applied Science Course, **IC** – Integrated Course (Practical Course Integrated with Theory Course), **ESC**- Engineering Science Courses, **PSC**-Programme Specific Course, **ESC**- Engineering Science Courses, **ETC**- Emerging Technology Course, **AEC**- Ability Enhancement Course, **NCMC**: Non Credit Mandatory Course, **PP** : (Pass/Pass) is assigned to a non credit course. “PP” represents pass in course provided students have successfully completed the CIE requirements. Otherwise, “NP-not pass shall be awarded. “PP” is essential for the award of the degree **HSMC**-Humanity, Social Science and management Course, **AEC/SDC**- Ability Enhancement Course/Skill Development course, **TD/PSB**- Teaching Department / Paper Setting Board, **CIE** –Continuous Internal Evaluation, **SEE**- Semester End Examination, **S- (SAAE)**-Students’ Academic Activity Engagement Hours,

Applied Mathematics-II					Applied Physics				
Code	Title	L	T	P	Code	Title	L	T	P
1BMAU201A	Differential Calculus and Numerical Methods: CV stream	2	2	2	1BPHU202A	Physics for Sustainable Structural Systems (CV stream)	2	2	2
1BMAU201B	Numerical Methods: CSE Stream	2	2	2	1BPHU202B	Quantum Physics and Applications (CSE stream)	2	2	2
1BMAU201C	Multivariable Calculus and Numerical Methods: ME stream	2	2	2	1BPHU202C	Physics of Materials (Mech stream)	2	2	2
1BMAU201D	Calculus, Laplace Transform, and Numerical Techniques: EEE stream	2	2	2	1BPHU202D	Quantum Physics and Electronic Sensors (ECE , EIE, ETE)	2	2	2
					1BPHU202E	Electrical Engineering Materials (EEE)	2	2	2
Programme Specific Courses (PSC)					Programme Specific Courses Lab (PSCL)				
1BCVT105	Engineering Mechanics	3	0	0	1BCVL207	Mechanics and Materials Lab	0	0	2
1BEET105	Elements of Mechanical Engineering	3	0	0	1BEEL207	Elements of Mechanical Engineering Lab	0	0	2
1BECT105	Basics of Electrical Engineering	3	0	0	1BECL207	Basic Electrical Engineering Lab	0	0	2
1BMET105	Fundamentals of Electronics & Communication Engineering	3	0	0	1BMEL207	Fundamentals of Electronics & Communication Engineering Lab	0	0	2
1BITT105	Programming in C	3	0	0	1BITL207	C Programming Lab	0	0	2
Engineering Science Courses-II (ESC-II)					Computer-Aided Engineering Drawing				
Code	Title	L	T	P	Code	Title	L	T	P
1BEST204A	Introduction to Building Sciences	3	0	0	1BCED203A	Computer-Aided Engineering Drawing for CV Stream	2	0	2
1BEST204B	Introduction to Electrical Engineering	3	0	0	1BCED203B	Computer-Aided Engineering Drawing for CSE stream	2	0	2
1BEST204C	Introduction to Electronics & Communication Engineering	3	0	0	1BCED203C	Computer-Aided Engineering Drawing for ME stream	2	0	2
1BEST204D	Introduction to Mechanical Engineering	3	0	0	1BCED203D	Computer-Aided Engineering Drawing for ECE stream	2	0	2
1BEST204E	Essentials of Information Technology	3	0	0	1BCED203E	Computer-Aided Engineering Drawing for EEE stream (only for EEE students)	2	0	2
Integrated courses (IC), combining theory with practical components. (i) Theory sessions will be conducted for 3 hours per week, while the practical sessions will be conducted for 2 hours per week. (ii) Theory component shall be evaluated through both Continuous Internal Evaluation (CIE) and Semester End Examination (SEE). (iii) The practical component will be assessed only through CIE.									
The Mathematics/Physics courses shall be taught by a single faculty member per session, with no sharing of the course (subject) modules. The Practical sessions for the mathematics course shall be conducted in a laboratory environment using Maxima/Mathematica/ Python/Scilab/MATLAB software to enhance computational understanding and application skills.									
Students admitted to a specific engineering stream are required to select and successfully complete Applied Mathematics-I and Applied Physics courses that are aligned to their program stream.									

Programme Specific Courses (PSC): Programme Specific Courses (PSC) are a set of core courses tailored to a specific branch or discipline of engineering in which a student is enrolled (e.g., Mechanical Engineering, Computer Science, Civil Engineering, etc.). These courses are intended to provide students with in-depth knowledge and specialized skills essential for professional competence in the chosen field.

Students must select and complete the course from this group that **corresponds to their admitted program stream.**

Similarly, students are also required to choose and pass laboratory courses that are specific to their stream from the **Programme Specific Courses Laboratory (PSCL)** group.

Computer-Aided Engineering Drawing: The courses under this category are stream-specific. Students must select and complete the course that corresponds to their admitted engineering stream.

Engineering Sciences Courses-II (ESC-II): These courses are designed to broaden the technical knowledge of students beyond their core area of study. These courses enable students to gain a foundational understanding of engineering principles from other disciplines. Students are required to select and complete a course that does not belong to their admitted program stream. Students should select a course other than that was selected under ESC-I and other than course not belonging to their stream.

For the course ***Interdisciplinary Project (BPRJ208)***, it is mandatory to form a team comprising students from multiple engineering disciplines. For example, a project team may include students from Mechanical Engineering, Electronics and Communication Engineering (ECE), and Computer Science and Engineering (CSE), working collaboratively to design and implement the project.



Dr. Ambedkar Institute of Technology, Bengaluru-560056 Outcome Based Education(OBE) and Choice Based Credit System (CBCS B.E. Electronics and Communication Engineering Scheme of Teaching and Examination effective from the Academic Year 2025 - 26													
I Semester			BRANCH: CV, CSE, CSBS, ISE, AIML, DS (Data Science)						(Physic Group)				
Sl. No	Course and Course Code		Course Title	TD/PSB	Teaching Hours/Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	SAAE	Duration in hours	CIE Marks	SEE Marks	Total Marks	
1	ASC(IC)	1BMAU101x	Applied Mathematics -I (Stream Specific)	Maths Dept.	2	2	2		03	50	50	100	04
2	ASC(IC)	1BPHU102x	Applied Physics (Stream Specific)	PHY Dept	2	2	2		03	50	50	100	04
3	ESC	1BCED103x	Computer-Aided Engineering Drawing (Stream Specific)	ME Dept	2	0	2		03	50	50	100	03
4	ESC	1BEST104x	Engineering Science Courses-I	Respective Engg Dept	3	0	0		03	50	50	100	03
5	PSC	1BXXT105x	Programme Specific Course	Respective Engg dept	3	0	0		03	50	50	100	03
6	AEC (NCMC)	1BSST106	Soft Skills	Humanities Dept	1	0	0		-	100	---	100	PP/NP
7	PSC	1BXXL107	Program-Specific Course Lab	Respective Engg Dept	0	0	2		02	50	50	100	01
8	AEC/SDC	1BIDL108	Innovation and Design Thinking Lab (Project-based learning)	Respective Dept	0	0	2		02	50	50	100	01
9	HSMS	1BKST109/1BKBT109	Sanskrutika Kannada/ Balake Kannada	Humanities Dept	1	0	0		01	50	50	100	01
10	MC	1BCDN110	Career Development Skill -I	Placement Cell	2	0	0		---	50	---	---	PP/NP
	TOTAL				16	02	08		20	550	400	900	20
10	AICTE Activity Points (students have to earn 100 activity points between 01 to 08 semester)				Compulsory requirement for the award of a degree								
ASC-Applied Science Course, IC – Integrated Course (Practical Course Integrated with Theory Course), PSC-Programme Specific Course, ESC- Engineering Science Courses, ETC- Emerging Technology Course, AEC- Ability Enhancement Course, NCMC: Non Credit Mandatory Course, PP : (Pass/Pass) is assigned to a noncredit course. “PP” represents pass in course provided students have successfully completed the CIE requirements. Otherwise, “NP-not pass shall be awarded. “PP” is essential for the award of the degree. PLC(IC)- Programming Language Course (Integrated Course), AEC/SDC- Ability Enhancement Course/Skill Development course, TD/PSB- Teaching Department / Paper Setting Board, HSMS-Humanity, Social Science and management Course, S- (SAAE) Students’ Academic Activity Engagement Hours, CIE –Continuous Internal Evaluation, SEE- Semester End Examination,													

Credit Definition:1-hour Lecture (L) per week=**1Credit**2-hours Tutorial (T) per week=**1Credit**2-hours Practical / Drawing (P) per week=**1Credit**

04-Credit courses are designed for 50 hours of Teaching-Learning Session

04-Credit (IC) is designed for 40 hours' theory and 10-12 hours of practical sessions

03-Credit courses are designed for 40 hours of Teaching-Learning Session

02- Credit courses are designed for 25 hours of Teaching-Learning Session

01-Credit courses are to be designed for 12 hours of Teaching-Learning sessions

V

Applied Mathematics-I					Applied Physics				
Code	Title	L	T	P	Code	Title	L	T	P
1BMAU101A	Differential Calculus And Linear Algebra: CV Stream	2	2	2	1BPHU102A	Physics for Sustainable Structural Systems (CV stream)	2	2	2
1BMAU101B	Calculus and Linear Algebra: CSE Stream	2	2	2	1BPHU102B	Quantum Physics and Applications (CSE stream)	2	2	2
1BMAU101C	Differential Calculus and Linear Algebra: ME Stream	2	2	2	1BPHU102C	Physics of Materials (Mech stream)	2	2	2
1BMAU101D	Differential Calculus And Linear Algebra: EEE stream	2	2	2	1BPHU102D	Quantum Physics and Electronic Sensors (ECE , EIE, ETE)	2	2	2
					1BPHU102E	Electrical Engineering Materials (EEE)	2	2	2
Computer-Aided Engineering Drawing					Engineering Science Courses-I(ESC-I)				
1BCED103A	Computer-Aided Engineering Drawing for CV Stream	2	0	2	1BEST104A	Introduction to Building Sciences	3	0	0
1BCED103B	Computer-Aided Engineering Drawing for CSE stream	2	0	2	1BEST104B	Introduction to Electrical Engineering	3	0	0
1BCED103C	Computer-Aided Engineering Drawing for ME stream	2	0	2	1BEST104C	Introduction to Electronics & Communication Engineering	3	0	0
1BCED103D	Computer-Aided Engineering Drawing for ECE stream	2	0	2	1BEST104D	Introduction to Mechanical Engineering	3	0	0
1BCED103E	Computer-Aided Engineering Drawing for EEE stream (only for EEE students)				1BEST104E	Essentials of Information Technology	3	0	0
Programme Specific Courses (PSC)					Program-Specific Course Lab (PSCL)				
1BCVT105	Engineering Mechanics	3	0	0	1BCVL107	Mechanics and Materials Lab	0	0	2
1BEET105	Basics of Electrical Engineering	3	0	0	1BEEL107	Basic Electrical Engineering Lab	0	0	2
1BECT105	Fundamentals of Electronics & Communication Engineering	3	0	0	1BECL107	Fundamentals of Electronics & Communication Engineering Lab	0	0	2
1BMET105	Elements of Mechanical Engineering	3	0	0	1BMEL107	Elements of Mechanical Engineering Lab	0	0	2
1BITT105	Programming in C	3	0	0	1BITL107	C Programming Lab	0	0	2
Integrated courses (IC), combining theory with practical components. (i) Theory sessions shall be conducted for 3 hours per week, while the practical sessions shall be conducted for 2 hours per week. (ii) Theory components shall be evaluated through both Continuous Internal Evaluation (CIE) and Semester End Examination (SEE). (iii) The practical component shall be assessed only through CIE.									

The Mathematics/Physics courses shall be taught by a single faculty member per session, with no sharing of the course (subject) modules.

The **Practical sessions** for the **mathematics course** shall be conducted in the laboratory environment using **Maxima/Mathematica/ Python/Scilab/MATLAB software** to enhance computational understanding and application skills (one hour for problem solving and one hour laboratory session).

All students admitted to the engineering program have to complete **Applied Mathematics-I and Applied Mathematics-II** in I and II semesters by selecting the courses prescribed for their stream, viz. CV, ME, EEE or CSE, under the heading Mathematics –I and Mathematics-II.

Those who have completed the physics course under the heading Applied Physics in I semester have to select the prescribed stream wise chemistry course under the heading Applied chemistry during II semester.

Programme Specific Courses (PSC): Programme Specific Courses (PSC) are a set of core courses tailored to a specific branch or discipline of engineering in which a student is enrolled (e.g., Mechanical Engineering, Computer Science, Civil Engineering, etc.). These courses are intended to provide students with in-depth knowledge and specialized skills essential for professional competence in the chosen field. Students must select and complete the course from this group that **corresponds to their admitted program stream**. Similarly, students are also required to choose and pass laboratory courses that are specific to their stream from the **Programme Specific Courses Laboratory (PSCL) group**.

Engineering Sciences Courses-I(ESC-I): These courses are designed to broaden the technical knowledge of students beyond their core area of study. These courses enable students to gain a foundational understanding of engineering principles from other stream courses. Students are required to select and complete two courses that are not belong to their admitted program stream. For example, a student admitted to the any programme of the Civil Engineering stream should not select Introduction to Building Sciences but any other two. One course shall be selected under ESC-I and another course under ESC-II. The two courses must be different from the other.

Computer-Aided Engineering Drawing: The courses under this category are stream-specific. Students must select and complete the course that corresponds to their admitted engineering stream.

The **Student Induction Programme (SIP)**, initiated by the All India Council for Technical Education (AICTE), is designed to help newly admitted students in technical institutions transition smoothly into the higher education environment. It aims to familiarize students with the institutional culture, foster connections with peers and faculty, and provide a foundation for holistic learning. Activities under SIP may include Physical Activities, Creative Arts, Universal Human Values, Literary Events, Proficiency Modules. Lectures shall be by Eminent Personalities, Local Area Visits, Department/Branch Familiarization, and Innovation-related sessions.

The first year of the Engineering programmes is composed of I semester, II semester and Summer Semester. SIP activities shall be scheduled in the afternoon sessions during the first week of class commencement of I and II semesters only.

The specific programmes to be conducted will be notified separately by the University via the academic calendar or through a separate notification.

AICTE Activity Points Requirement for BE/B.Tech. Programmes

As per AICTE guidelines (refer Chapter 6 – *AICTE Activity Point Program, Model Internship Guidelines*), in addition to academic requirements, students must earn a specified number of **Activity Points** to be eligible for the award of their degree.

- **Regular students** admitted to a 4-year degree program must earn **100 Activity Points**.
- **Lateral entry students** (joining from the second year) must earn **75 Activity Points**.
- **Students transferred** from other universities directly into the fifth semester must earn **50 Activity Points** from the date of entry into VTU.

These Activity Points are **non-credit** and will not be considered for **the SGPA/CGPA** or be used for **vertical progression**. However, they are mandatory for the **award of the degree**, and the points earned will be reflected on the **eighth semester Grade Card**.

The hours spent for earning the activity points shall not be counted for regular attendance requirements. Students can accumulate these points at any time during their program, including on weekends, holidays, and vacations starting from the year of admission, provided they meet the minimum hours of engagement prescribed for each activity.

If a student fails to earn the required Activity Points, the eighth-semester Grade Card will be withheld until the requirement is fulfilled. Consequently, the degree will be awarded only after the Grade Card has been released.

Sl No	Stream	UG Programmes under the stream with code
1	Civil Engineering Stream (CV)	(1) Civil engineering (CV), (2) Mining Engineering (MI)
2	Mechanical Engineering Stream (ME)	(1)Aeronautical Engineering (AE), (2)Aerospace Engineering (AS),(3) Agricultural Engineering (AG),(4)Automation and Robotics (AR), (5)Automobile Engineering (AU), (6)Chemical Engineering (CH), (7) Industrial & Production Engineering (IP), (8)Industrial Engineering & Management (IM), (9) Manufacturing Science and Engineering (MS), (10) Marine Engineering (MR), (11) Mechanical & Smart Manufacturing (MM), (12) Mechanical Engineering (ME), (13)Mechatronics (MT), (14) Petrochem Engineering (PC), (15)Robotics & Automation (RA),(16) Robotics and Artificial Intelligence (RI),(17)Silk Technology (ST), (18) Textile Technology (TX),(19)Energy Engineering (ER),(20) Smart Agritech (SA).
3	Electrical and Electronics Engineering Stream (EEE)	(1)Electronics & Communication Engineering (EC), (2)Biomedical Engineering (BM), (3)Electrical & Electronics Engineering (EE), (4) Electronics & Instrumentation Engineering (EI),(5) Electronics & Telecommunication Engineering (ET),(6) Industrial IoT (IO), (7) Medical Electronics Engineering (ML),(8) Electronics Engineering (VLSI Design and Technology) (VL),(9) Electronics & Communication(Advanced Communication Technology) (EA),(10) Electronics & Computer Engineering (UE).
4	Computer Science and Engineering Stream (CSE)	(1) Computer Science and Engineering (CS), (2) Computer Engineering (CE), (3)Artificial Intelligence and Data Science (AD), (4) Artificial Intelligence and Machine Learning (AI),(5) Biotechnology (BT),(6)Computer & Communication Engineering (CM), (7) Computer Science and Business System (CB),(8) Computer Science and Design (CG),(9) Computer Science and Engineering (IoT) (CO), (10)CSE(Artificial Intelligence and Machine Learning) (CI),(11) CSE(Artificial Intelligence) (CA),(12) CSE(Cyber Security) (CY), (13)CSE(Data Science) (CD),(14) CSE(IoT and Cyber Security including Block Chain Technology) (IC), (15) Data Science (DS), (16) Information Science & Engineering (IS),(17) Computer Science (CR).

Scheme of Teaching and Examinations (2025) Outcome-Based Education (OBE)and Choice-Based Credit System (CBCS) (Effective from the academic year 2025-26)													
II Semester			BRANCH: CV, CSE, CSBS, ISE, AIML, DS (Data Science) (For the students who have studied Physics group in I semester)										
Sl. No	Course and Course Code		Course Title	TD/PSB	Teaching Hours/Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	SAAE	Duration in hours	CIE Marks	SEE Marks	Total Marks	
1	ASC	1BMAU201x	Applied Mathematics -II (Stream Specific)	Maths Dept	2	2	2		03	50	50	100	04
2	ASC(IC)	1BCHU202x	Applied Chemistry (Stream Specific)	CHE Dept	2	2	2		03	50	50	100	04
3	ETC	1BAIT203	Introduction to AI and Applications	Any Dept	3	0	0		03	50	50	100	03
4	ESC	1BEST204x	Engineering Science Course-II	Respective Engg Dept	3	0	0		03	50	50	100	03
5	PLC(IC)	1BPLU205x	Programming Language Course	CSE & allied Dept	3	0	2		03	50	50	100	04
6	AEC	1BENGL206	Communication Skills	Humanities Dept	1	0	1		02	50	50	100	01
7	AEC (NCMC)	1BICT207	Indian Constitution & Engineering Ethics	Humanities Dept	1	0	0		01	100	0	100	PP/NP
8	AEC/SDC	1BPRJ208	Interdisciplinary Project-Based Learning	Respective Dept (Multiple Dept)	0	0	0	2	02	50	50	100	01
9	MC	1BCDN209	Career Development Skill -II	Placement Cell	2	0	0		---	50	---	---	PP/NP
TOTAL					17	02	05	02	20	500	350	800	20
ASC-Applied Science Course, IC – Integrated Course (Practical Course Integrated with Theory Course), ESC- Engineering Science Courses, PLC(IC)- Programming Language Course (Integrated Course), AEC- Ability Enhancement Course, NCMC: Non Credit Mandatory Course, TD/PSB- Teaching Department / Paper Setting Board, HSMC- Humanity, Social Science and management Course, S- (SAAE)- Students’ Academic Activity Engagement Hours, AEC/SDC- Ability Enhancement Course/Skill Development course, CIE –Continuous Internal Evaluation, SEE- Semester End Examination, PP : (Pass/Pass) is assigned to a noncredit course. “PP” represents pass in course provided students have successfully completed the CIE requirements. Otherwise, “NP-not pass shall be awarded. “PP” is essential for the award of the degree													

Integrated courses (IC), combining theory with practical components.

The theory sessions shall be conducted for 3 hours per week, while the practical sessions shall be conducted for 2 hours per week.

- The theory component will be evaluated through both Continuous Internal Evaluation (CIE) and Semester End Examination (SEE).
- The practical component will be assessed only through CIE.

Applied Mathematics-II					Applied Chemistry				
Code	Title	L	T	P	Code	Title	L	T	P
1BMAU201A	Differential Calculus and Numerical Methods: CV Stream	2	2	2	1BCHU202A	Applied Chemistry for Metal Protection and Sustainable Energy (ME stream)	2	2	2
1BMAU201B	Numerical Methods: CSE Stream	2	2	2	1BCHU202B	Applied Chemistry for Futuristic Devices (EEE stream)	2	2	2
1BMAU201C	Multivariable Calculus and Numerical Methods: ME Stream	2	2	2	1BCHU202C	Applied Chemistry for Sustainable Built Environment (CV)	2	2	2
1BMAU201D	Calculus, Laplace Transform And Numerical Techniques: EEE stream	2	2	2	1BCHU202D	Applied Chemistry for Smart Systems (CSE stream)	2	2	2
Engineering Sciences Courses II(ESC-II)					Programming Language Courses (PLC)				
1BEST204A	Introduction to Building Sciences	3	0	0	1BPLU205A	Introduction to C Programming (for non-IT programmes)	3	0	2
1BEST204B	Introduction to Electrical Engineering	3	0	0	1BPLU205B	Python Programming (For CSE and allied programmes)	3	0	2
1BEST204C	Introduction to Electronics & Communication Engineering	3	0	0					
1BEST204D	Introduction to Mechanical Engineering	3	0	0					
1BEST204E	Essentials of Information Technology	3	0	0					
The Mathematics/Chemistry courses shall be taught by a single faculty member per session, with no sharing of the course (subject) modules. The Practical sessions for the mathematics course shall be conducted in the laboratory environment using Maxima/Mathematica/ Python/Scilab/MATLAB software to enhance computational understanding and application skills.									
Students admitted to a specific engineering stream are required to select and successfully complete Applied Mathematics-II and Applied Chemistry courses that are aligned to their program stream.									
Engineering Sciences Courses-II(ESC-II): These courses are designed to broaden the technical knowledge of students beyond their core area of study. These courses enable students to gain a foundational understanding of engineering principles from other disciplines. Students are required to select and complete a course under ESC-II that does not belong to their admitted program stream. Students should select a course other than that was selected under ESC-I and other than course not belonging to their stream.									
For the course <i>Interdisciplinary Project (BPR)209</i>, it is mandatory to form a team comprising students from multiple engineering disciplines. For example, a project team may include students from Mechanical Engineering, Electronics and Communication Engineering (ECE), and Computer Science and Engineering (CSE), working collaboratively to design and implement the project.									

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School of Electrical, Electronics Sciences & Engineering
Program: Electronics and Communication Engineering

Semester: I/II

Course Title	INTRODUCTION TO ELECTRONICS AND COMMUNICATION ENGINEERING						
Course Code	1BEST104C/204C						
Course Category	PCC (Professional Core Course)						
Teaching - Learning Scheme & Credit	L	T	P	S	Total	Total Teaching Hours	Credit
	3	0	0	0	3	40+0+0+0=40	3
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hrs	

Course Learning Objectives:	
CLO1	To prepare students with fundamental knowledge/ overview in the field of Electronics and Communication Engineering.
CLO2	To equip students with a foundation in electronic engineering required for comprehending the operation and application of electronic circuits, logic design, embedded systems, and communication systems.
CLO3	Professionalism & Learning Environment: To inculcate in first-year engineering 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.

SYLLABUS	No. of Hours	BTLs
UNIT 1	08	L1-L4
Power Supplies –Block diagram, Half-wave rectifier, Full-wave rectifiers and filters, Voltage regulators, Voltage multipliers. (Numerical on Rectifiers & Regulators) Amplifiers – Bipolar Junction Transistor-Current components and Voltages, Amplifying action, BJT as a switch: Cut-off and saturation modes. (Text 1)		
UNIT 2	08	L1-L4
Operational amplifiers - Ideal op-amp; characteristics of ideal and practical op-amp; Practical op- amp circuits: Inverting and non-inverting amplifiers, voltage follower, summer, Subtractor, integrator, differentiator. (Text 1) Numerical Oscillators – Barkhausen criterion, Ladder network oscillator, Wein bridge oscillator, Crystal controlled oscillators (Only Concepts, working, and waveforms. No mathematical derivations) Numerical		
UNIT 3	08	L1-L4
Binary Systems - Binary numbers, Number Base Conversion, octal & Hexa Decimal Numbers, Complements (1's, 2's, 9's and 10's complements). Boolean Algebra and Logic Circuits - Basic definitions, Axiomatic Definition of Boolean Algebra, Basic Theorems and Properties of Boolean Algebra, Boolean Functions, Digital Logic Gates (Text 2) Combinational logic - Introduction, Design procedure, Adders- Half adder, Full adder (Text 2)		
UNIT 4	08	L1-L4
Embedded Systems - Definition, Embedded systems vs general computing systems, Classification of Embedded Systems, Major application areas of Embedded Systems, Elements of an Embedded System, Core of the Embedded System, Microprocessor vs Microcontroller, RISC vs CISC (Text 3) Sensors and Interfacing - Instrumentation and control systems, Transducers, Sensors, Actuators, LED, 7-Segment LED Display. (Text 3)		

QUESTION PAPER PATTERN (SEE)										
Q. No.	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
UNIT	1		2		3		4		5	
1. Two full questions (each of 20 Marks) are to be set from each unit.										
2. Student shall answer FIVE FULL questions selecting one full question from each unit.										

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Semester: I/II

Course Outcomes: After the completion of the course, the student will be able to:	
CO1	Understand the underlying principles of electronic devices like diode and transistor and analyze their implementation in rectifier, voltage regulator, switches and amplifier circuits.
CO2	Apply and characterize the behavior of analog circuits such as oscillators and operational amplifiers in signal generation and conditioning applications.
CO3	Apply the concepts of Boolean algebra and perform number system conversions to design combinational logic circuits of digital systems.
CO4	Explain the fundamental concepts, components of embedded systems and differentiate various embedded-system processors, memory, sensors, actuators, display devices used in electronic applications
CO5	Interpret the fundamental concepts of communication and describe the analog and digital modulation techniques and multiplexing schemes.

Mapping of CO's, PO's with PSO's														
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	0	2	0	0	1	1	0	1	2	3	1
CO2	3	3	2	0	3	0	0	1	1	0	1	3	3	1
CO3	3	3	2	0	2	0	0	1	1	0	1	2	3	1
CO4	3	2	2	0	3	1	0	1	1	0	2	1	3	1
CO5	3	2	2	0	2	1	0	1	1	0	2	2	3	1

Mapping of CO's with Knowledge and Attitude Profile (WK)										
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0										
CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	
CO1	2	2	3	2	0	2	0	0	0	
CO2	2	2	3	2	0	3	0	0	0	
CO3	0	3	3	2	0	2	0	0	0	
CO4	0	2	3	3	0	3	0	1	0	
CO5	2	2	3	3	0	3	0	1	0	

Mapping of CO's with Sustainable Development Goals (SDG)																	
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0																	
CO/SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1	0	0	0	0	0	0	2	0	3	0	0	1	1	0	0	0	0
CO2	0	0	1	0	0	0	2	0	3	0	0	1	1	0	0	0	0
CO3	0	0	0	0	0	0	1	0	3	0	1	0	0	0	0	0	0
CO4	0	0	2	0	0	0	2	1	3	0	2	1	1	0	0	0	0
CO5	0	0	1	0	0	0	1	1	3	0	1	0	0	0	0	0	0

Course Title	FUNDAMENTALS OF ELECTRONICS AND COMMUNICATION ENGINEERING						
Course Code	1BECT105/205						
Course Category	PCC (Professional Core Course)						
Teaching - Learning Scheme & Credit	L	T	P	S	Total	Total Teaching Hours	Credit
	3	0	0	0	3	40+0+0+0=40	3
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hrs	

Course Learning Objectives:	
CLO1	To make the students familiar with the basics of diodes and their applications.
CLO2	To equip the students with basic knowledge of Bipolar Junction Transistors and Field Effect Transistor characteristics and their working.
CLO3	To instill the fundamental concepts and applications of Op-Amp.
CLO4	To introduce the communication concepts, modulation techniques and applications.
CLO5	To acquaint with the basics of Digital Systems and Boolean Algebra

SYLLABUS	No. of Hours	BTLs
UNIT 1	8	L1-L2
Diodes and Their Application: Introduction, Characteristics and Parameters, Diode Approximation, DC Load Line Analysis, Half Wave Rectifier, Full Wave Bridge Rectifier, Capacitor Filter Circuit (Only Qualitative Approach), Zener Diode and Its Use in Voltage Regulation, Diode Logic Circuit. (Text 1: 2.1, 2.2, 2.3, 2.4, 2.9, 3.1, 3.2, 3.3, 3.7, 3.12)		
UNIT 2	8	L1-L2
Bipolar Junction Transistors: Introduction, BJT Voltages & Currents, BJT Amplification, BJT Switching, Common Base Characteristics, Common Emitter Characteristics, BJT Biasing, Fixed Biasing and Voltage Divider, DC Load Line and Bias Point. Field Effect Transistor: Junction Field Effect Transistor (N-Channel), JFET Characteristics, MOSFETS: Enhancement MOSFETs. Case Study MOSFET as a Switch. (Text 1: 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 5.1, 5.2, 5.4, 9.1, 9.2, 9.5)		
UNIT 3	8	L1-L2
Operational Amplifiers: Introduction, The Operational Amplifier, Block Diagram Representation of Typical OpAmp, Schematic Symbol. Op-Amp Parameters: Gain, Input Resistance, Output Resistance, CMRR, Slew Rate, Bandwidth, Input Offset Voltage, Input Bias Current and Input Offset Current, The Ideal Op-Amp, Equivalent Circuit of Op-Amp, Open Loop Op-Amp Configurations, Differential Amplifier, Inverting & Non Inverting Amplifier. Op-Amp Applications: Inverting Configuration, Non-Inverting Configuration, Differential Configuration, Voltage Follower, Integrator, Differentiator. (Text 2: 1.2, 1.3, 1.5, 2.2, 2.3, 2.4, 2.5, 2.6, 6.5, 6.12, 6.13)		

UNIT 4	8	L1-L2
Fundamentals of Communication: Elements of a Communication System, Communication Channels and Their Characteristics: Wireline, Fiber Optic, Wireless Electromagnetic Channels. Introduction to Analog Modulation Types: Amplitude Modulation, Frequency and Phase Modulation, Waveforms. (Excluding Derivation and Spectral Diagrams) Applications: AM Radio Broadcasting, Superheterodyne FM Receiver, Mobile Wireless Telephone Systems. Case Study of Converting Analog Signal to Digital Signal Using PCM. (Text 3: 1.2, 1.3, 3.1) (Text 4: 3.5, 4.4.1, 4.5, 18.3.1, 18.3.2)		
UNIT 5	8	L1-L2
Digital Systems and Binary Numbers: Digital Systems, Numbering System (Binary, Octal, Decimal and Hexadecimal), Number Base Conversion – (Binary to Decimal, Hexadecimal And Vice Versa), 1's and 2's Complement Operation, Signed Binary Numbers-Arithmetic Addition and Subtraction, Binary Logic. Boolean Algebra: Basic Definitions, Basic Theorems and Properties of Boolean Algebra, Boolean Functions, Canonical and Standard Forms, Digital Logic Gates (Excluding Extension to Multiple Inputs, Positive and Negative Edge) NAND And NOR As Universal Gates (Excluding Multilevel Presentation), Binary Adders. (Half Adder and Full Adder) Case Study with 4-Bit Adder Simulation. (Text 5: 1.1,1.2, 1.3, 1.4, 1.5, 1.6, 1.9, 2.2,2.4, 2.5, 2.6, 2.8, 3.6, 4.5)		

TEXT BOOKS:	
1	David A Bell, Electronic Devices and Circuits, 5th Edition, Oxford University Press, 30th Impression, 2025
2	Ramakanth A Gayakwad, Op-amps and Linear Integrated Circuits, 4th Edition, Pearson Education, 2015.
3	John G. Proakis, Masoud Saleh, Fundamentals of Communication Systems, Second Edition, Pearson Educations, Inc., 2014
4	D.P Kothari and I J Nagrath, Basic electronics, Second Edition, McGraw Hill Education Pvt ltd, 2018.
5	M.Morris Mano and Michael D.Ciletti, Digital Design - With an Introduction to the Verilog HDL, VHDL and System Verilog 6th Edition, Pearson Education Inc, 2024.

REFERENCE BOOKS:	
1	Mike Tooley, Electronic Circuits, Fundamentals & Applications, 5th Edition, Elsevier, 2020.
2	Albert Malvino, Electronic Principles, 9th Edition, McGraw Hill Publications, 2021.
3	Electronic Devices and Circuit Theory, R Nashelsky and L Nashelsky, 11th Edition, Pearson, 2012
e-LEARNING RESOURCES:	
1	Introduction to Basic Electronics: https://nptel.ac.in/courses/122106025
2	Digital Electronic Circuits https://nptel.ac.in/courses/108105132

Assessment Details both (CIE and SEE)			
The weightage of Continuous Internal Evaluation (CIE) and Semester End Exam (SEE) is 50% each. The students have to obtain a minimum of 40% marks individually both in CIE and SEE to pass. CIE: The CIE has three components – CIE - theory component, assignment and group activity. Students have to score a minimum of 40% Marks in the total of CIE - theory, assignment and group activity components put together to take SEE. SEE: Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration) and reduced to 50 Marks. **Self-Study Component should be not included for SEE & CIE.			
CONTINUOUS INTERNAL EVALUATION (CIE)		Max. Marks	Minimum Marks to be scored in CIE, to qualify to take SEE (40% individually)
Theory	Weightage of CIE1 and CIE2 Tests or CIE3	50	20
TOTAL		50	20

QUESTION PAPER PATTERN (SEE)										
Q. No.	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
UNIT	1		2		3		4		5	
1. Two full questions (each of 20 Marks) are to be set from each unit.										
2. Student shall answer five full questions selecting one full question from each unit.										

Course Outcomes: After the completion of the course, the student will be able to:	
CO1	Apply the working principles, fundamental characteristics of various semiconductor devices including diodes, transistors and operational amplifiers in basic electronic circuits.
CO2	Analyze basic rectifier and amplifier circuits using the principles of diodes, BJTs, and operational amplifiers.
CO3	Illustrate the fundamental concepts of communication systems and their applications.
CO4	Design basic combinational circuits using the fundamental principles of digital systems.
CO5	Analyse the fundamental concepts of electronic circuits, communication systems, and digital systems for their role in building basic electronic applications.

Mapping of CO's, PO's with PSO's														
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	0	0	0	1	0	2	1	3	0
CO2	3	3	2	2	2	0	0	1	1	0	2	2	3	0
CO3	3	2	1	1	2	2	1	1	2	0	2	1	3	1
CO4	3	3	3	2	3	1	0	2	2	1	2	1	3	0
CO5	3	3	2	2	2	2	1	2	2	1	3	2	3	2

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School of Electrical, Electronics Sciences and Engineering
Program: Electronics and Communication Engineering

Semester: I/II

Scheme: 2025

Mapping of CO's with Knowledge and Attitude Profile (WK)									
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0									
CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
CO1	2	2	3	3	0	2	0	1	0
CO2	2	3	3	3	1	3	0	1	0
CO3	1	2	3	3	1	3	2	1	1
CO4	1	3	3	3	2	3	1	1	0
CO5	2	3	3	3	2	3	2	2	1

Mapping of CO's with Sustainable Development Goals (SDG)																	
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0																	
CO/SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1	0	0	0	2	0	0	2	1	3	0	1	1	1	0	0	0	0
CO2	0	0	0	1	0	0	2	1	3	0	1	2	1	0	0	0	0
CO3	0	0	0	2	0	0	1	2	3	0	2	1	1	0	0	0	0
CO4	0	0	0	2	0	0	1	2	3	0	2	2	1	0	0	0	0
CO5	0	0	0	2	0	0	2	2	3	0	2	2	2	0	0	0	0

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Program: Electronics and communication Engineering

Semester: I/II

Scheme: 2025

Course Title	Fundamentals of Electronics and Communication Engineering LAB						
Course Code	1BECL107/1BECL207						
Course Category	PCCL (Professional Core Course Laboratory)						
Teaching - Learning Scheme & Credit	L	T	P	TW+SL	Total	Total Teaching Hours	Credit
	00	00	02	28	30	02	01
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hrs	

Course Learning Objectives:	
CLO1	To gain hands on experience in designing and testing of rectifier circuits.
CLO2	To analyze the characteristics of Bipolar Junction Transistors and Field Effect Transistors.
CLO3	To inspect the working of different modes of Op-Amp.
CLO4	To learn the fundamentals of Basic and Universal gates.

Syllabus	
PART: A - CORE/BASIC HARDWARE EXPERIMENTS	
1	Design and Testing of Half-Wave and Full-Wave Rectifiers With and Without Filter for Determining Ripple Factor, Voltage Regulation, and Efficiency.
2	Design and Testing of Bridge Rectifier With and Without Filter for Determining Ripple Factor, Voltage Regulation, and Efficiency.
3	Analysis of Input and Output Characteristics of a Bipolar Junction Transistor in Common Emitter Configuration.
4	Study of Transfer and Drain Characteristics of a MOSFET in Common Source Configuration.
5	Investigation of Op-Amp in Inverting and Non-Inverting Modes with Gain Measurement
6	Study of Truth Tables for OR, AND, NOT, NAND, and NOR Gates Using Basic and Universal Gates
PART: B - TYPICAL OPEN-ENDED HARDWARE EXPERIMENTS	
Open-ended experiments are a type of laboratory activity where the outcome is not predetermined and students are given the freedom to explore, design, and conduct the experiment based on the problem statements as per the concepts defined by the course coordinator. It encourages creativity, critical thinking, and inquiry-based learning. Course Project: Students must do a mandatory course project (group size not more than 4 students) using to realize a functional analog circuit and digital circuit. A maximum of 5 marks shall be awarded for this project (to be evaluated along with the final internal test). Report to be submitted.	
1	Design and Testing of Clipping and Clamping Circuits to obtain desired Transfer Characteristics
2	Design and test a single stage bipolar junction transistor amplifier to obtain desired gain and bandwidth requirements.
3	Testing of Op-Amp as voltage follower and a weighted summer with waveform analysis.

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4	Design and Testing of Integrator and Differentiator Circuits using Op-Amp with Waveform Analysis.
5	Amplitude Modulation using Discrete Components for Given Specifications.
6	Realization of Half/ Full Adder and Subtractor using Logic Gates.

Teaching & Learning Process (Innovative Delivery Methods):

1	Active Learning Techniques
2	Problem-Based Learning (PBL)
3	Team-Based Learning (TBL)
4	Hands-On Experiments and Simulations

TEXT BOOKS:

1	David A Bell, Electronic Devices and Circuits, 5th Edition, Oxford University Press, 30th Impression, 2025
2	Ramakanth A Gayakwad, Op-amps and Linear Integrated Circuits, 4th Edition, Pearson Education, 2015.
3	M.Morris Mano and Michael D.Ciletti, Digital Design - With an Introduction to the Verilog HDL, VHDL and System Verilog 6th Edition, Pearson Education Inc, 2024.
4	John G. Proakis, Masoud Saleh, Fundamentals of Communication Systems, Second Edition, Pearson Educations, Inc., 2014

REFERENCE BOOKS:

1	Mike Tooley, Electronic Circuits, Fundamentals & Applications, 5th Edition, Elsevier, 2020.
2	Albert Malvino, Electronic Principles, 9th Edition, McGraw Hill Publications, 2021.
3	Electronic Devices and Circuit Theory, R Nashelsky and L Nashelsky, 11th Edition, Pearson, 2012

e-LEARNING RESOURCES:

1	Introduction to Basic Electronics: https://nptel.ac.in/courses/122106025
2	Digital Electronic Circuits https://nptel.ac.in/courses/108105132

Assessment Details both (CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) and Semester End Exam (SEE) is 50% each. The students have to obtain a minimum of 40% marks individually both in CIE and SEE to pass. CIE: The CIE has two components – CIE - theory component and CIE – laboratory component. Students have to score a minimum of 40% Marks in the total of CIE - theory and CIE – laboratory components put together, provided students have to score a minimum of 40% marks in CIE laboratory component alone to qualify to take SEE. Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration) and reduced to 50 Marks.

****Self-Study Component should be not included for SEE & CIE.**

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Program: Electronics and communication Engineering

Semester: I/II

Scheme: 2025

CONTINUOUS INTERNAL EVALUATION (CIE)		Max. Marks	Minimum Marks to be scored in CIE, to qualify to take SEE (40% individually)
Laboratory components	Rubrics for each experiment are added, then taken average	30	20
	Lab CIE	20	
TOTAL		50	20

Course Outcomes: After the completion of the course, the student will be able to:

CO1	Apply the operating principles of diodes, transistors, and MOSFETs to construct and test basic analog circuits.
CO2	Implement operational amplifier configurations such as inverting, non-inverting, integrator, and differentiator for analog signal processing applications.
CO3	Analyze the functionality of logic gates and combinational circuits including adders, subtractors, and code converters using digital ICs.
CO4	Investigate amplitude modulation to explore fundamental analog communication techniques.
CO5	Develop solutions to open-ended electronic design problems by selecting appropriate components, constructing circuits, and interpreting results to meet defined objectives.

Mapping of CO's, PO's with PSO's

Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	2	3	0	0	0	1	0	2	2	3	0
CO2	3	2	2	2	3	0	0	0	1	0	2	3	3	0
CO3	3	3	2	2	3	0	0	0	1	0	2	2	3	0
CO4	3	3	2	3	3	1	0	1	2	0	2	3	3	0
CO5	3	3	3	3	3	2	2	3	3	2	3	3	3	1

Mapping of CO's with Knowledge and Attitude Profile (WK)

Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0

CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
CO1	0	1	3	3	1	3	0	1	0
CO2	0	2	3	3	1	3	0	1	0
CO3	0	2	3	3	1	3	0	1	0
CO4	0	2	3	3	1	3	1	2	0
CO5	0	2	3	3	3	3	2	3	2

Mapping of CO's with Sustainable Development Goals (SDG)

Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0

CO/SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1	0	0	0	2	0	0	2	1	3	0	0	1	1	0	0	0	0
CO2	0	0	1	2	0	0	2	1	3	0	0	1	1	0	0	0	0
CO3	0	0	0	2	0	0	1	1	3	0	0	1	0	0	0	0	0
CO4	0	0	0	2	0	0	1	2	3	0	0	1	1	0	0	0	1
CO5	0	0	1	3	1	0	3	2	3	1	2	3	3	0	0	1	2

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Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
B.E. Electronics and Communication Engineering
Scheme of Teaching and Examination effective from the Academic Year 2025 - 26

III SEMESTER															
Sl. No	Course	Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)		Teaching & Learning Scheme				Examination				Credits	
						CI		LI	TW & SL	# TH/S	Duration in hours	CIE Marks	SEE Marks		Total Marks
						L	T	P	SL						
1	ASC/PCC	1BMAT301	Transform Techniques and Optimization Theory	TD /PSB: Mathematics		42	28	0	50	120	3	50	50	100	4
2	IPCC	1BSESU302	Digital System Design Using Verilog	TD: EESE, PSB: ECE		42	0	28	50	120	3	50	50	100	4
3	PCC	1BSEST303	Network Analysis	TD: EESE, PSB: EE		42	0	0	78	120	3	50	50	100	4
4	PCC	1BSEST304	Analog Electronics and Linear Integrated circuits	TD: EESE, PSB: ET		42	28	0	20	90	3	50	50	100	3
5	PCC	1BECT305	Python Programming	TD: EESE, PSB: EESE		42	0	0	48	90	3	50	50	100	3
6	PCCL	1BSESL306	Analog Electronics and Linear Integrated circuits Lab	TD: EESE		0	0	28	2	30	2	50	50	100	1
7	AEC	1BECL307x	Ability Enhancement Course Laboratory**	TD: EESE, PSB: ECE		0	0	28	2	30	2	50	50	100	1
8	SDC	1BECP308	Community Project (Project-Based Learning) / Societal Project	TD: EC/EE/EI/ET/VLSI PSB: EC/EE/EI/ET/VLSI		0	0	0	30	30	2	50	50	100	1
9	MC	1BCDN309	Career Development Skill	Placement Cell		2	0	0			---	50	---	---	PP/NP
10	NCMC	1BNSS310	National Service Scheme (NSS)	Campus	NSS coordinator	0	0	0	28	28	--	100	---	100	PP
		1BPE310	Physical Education (PE) (Sports and Athletics)		Physical Education Director										
		1BYOG310	Yoga		Yoga Teacher										
		1BMUK310	Music		Music Teacher										
Total												500	400	900	21
11	NCMC	1BMATDIP311	Mathematics course for Lateral Entry Students	TD/PSB -Maths Dept		14	0	0	14	28	3	100	---	100	PP
Total										686		600	400	1000	21

TH/S- Total Hours per Semester, TW & SL- Term Work & Self Learning

Ability Enhancement Course (Laboratory) 1BECL307x			
1BECL307A	Analog Electronic Circuit Simulations Lab	1BECL307C	Introduction to Data Structures and OOPs using Python Lab
1BECL307B	Digital Application Lab	1BECL307D	Programming Using JAVA

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Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
B.E. Electronics and Communication Engineering
Scheme of Teaching and Examination effective from the Academic Year 2025 - 26

IV SEMESTER																
Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)		Teaching & Learning Scheme				Examination				Credits		
						CI		LI	# TW & SL	TH/S	Duration in hours	CIE Marks	SEE Marks		Total Marks	
																L
1	ASC/PCC	1BEC401	Mathematics for Machine Learning	TD /PSB: Mathematics		42	0	0	48	90	3	50	50	100	3	
2	IPCC	1BSESU402	Microcontrollers	TD: EESE, PSB: EI		42	0	28	50	120	3	50	50	100	4	
3	PCC	1BSEST403	Control Systems	TD: EESE, PSB: EE		42	28	0	50	120	3	50	50	100	4	
4	PCC	1BECT404	Signals and Systems	TD: EESE, PSB: EESE		42	0	0	48	90	3	50	50	100	3	
5	PCCL	1BECL405	Signals and Analog Communication Lab	TD: EESE, PSB: EESE		0	0	28	02	30	2	50	50	100	1	
6	AEC	1BECL406	Ability Enhancement Course Laboratory**	TD: EESE, PSB: EESE		0	0	28	02	30	2	50	50	100	1	
7	BSC	1BSEST407	Biology for Electrical & Electronics Engineer	TD: EESE, PSB: EC		28	0	0	32	60	3	50	50	100	2	
8	SDC	1BEC408	Environmental Science Project	TD/ PSB: civil		0	0	0	30	30	3	50	50	100	1	
9	PCC/PEC	1BECT409	Introduction to Analog Communication Systems	TD: EESE, PSB: EESE		42	0	0	48	90	3	50	50	100	3	
10	MC	1BCDN409	Career Development Skill	Placement Cell		2	0	0			---	50	---	---	PP/NP	
11	NCMC	1BNSK410	National Service Scheme (NSS)	Campus	NSS coordinator		0	0	0	28	28	--	100	---	100	PP
		Physical Education (PE) (Sports and Athletics)			Physical Education Director											
		Yoga			Yoga Teacher											
		Music			Music Teacher											
Total										688		550	450	1000	22	
12	NCMC	1BMATDIP411	Mathematics course for Lateral Entry Students	TD/PSB -Maths Dept		14	0	0	14	28	--	100	--	100	PP	
Total										716		650	450	1100	22	
	Ability Enhancement Course (Laboratory) 1BECL406x															
1BECL406A		Debugging and Fault Analysis of Analog and Digital Circuits			1BECL406C		Basics of Machine Learning Lab									
1BECL406B		IOT lab			1BECL406D		Control Systems Lab									

Course Title	DIGITAL SYSTEM DESIGN USING VERILOG						
Course Code	1BSESU302						
Course Category	IPCC (Integrated Professional Core Course)						
Teaching - Learning Scheme & Credit	L	T	P	S	Total	Total Teaching Hours	Credit
	3	0	1	4	4	42+0+28+50=120	4
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hrs	

Course Learning Objectives:	
CLO1	To understand and learn the fundamentals of combinational logic circuits, simplification of Boolean expressions using K-map, Quine-McCuskey minimization and Map entered Variable techniques.
CLO2	To analyze and design the combinational logic circuits.
CLO3	To analyze and design sequential logic circuits.
CLO4	To understand the basic concepts of Verilog HDL & data flow model for the design of digital systems.
CLO5	To understand the concepts of Verilog HDL using behavioral and Structural models for the design of digital systems.

SYLLABUS		No. of Hours	BTLs
UNIT 1		9	L1-L4
PRINCIPLES OF COMBINATIONAL LOGIC: Definition of combinational logic, Generation of switching equations from truth tables, Karnaugh maps- up to 4 variables, Quine-McCuskey Minimization Technique. Quine-McCuskey using Don't Care Terms.			
INTRODUCTION TO VERILOG: Typical Design Flow, Data types, Modules, Ports.			
SELF-STUDY COMPONENTS: Boolean Algebra, De Morgan's theorem, Truth table, Canonical forms (SOP and POS).			
UNIT 2		9	L1-L4
LOGIC DESIGN WITH MSI COMPONENTS AND PROGRAMMABLE LOGIC DEVICES: Binary Adders and Subtractors, Comparators, Decoders, Encoders, Multiplexers.			
VERILOG DATA FLOW DESCRIPTION: Continuous assignments, Delays, Expressions, Operators, and operands, operator types, Examples.			
SELF-STUDY COMPONENTS: Practice designing logic functions using Decoders, Encoders, Multiplexers.			
UNIT 3		9	L1-L4
FLIP-FLOPS AND ITS APPLICATIONS: The basic Bistable Element, Latches, JK, SR T and D Flip Flops, The Master-Slave Flip-flops (Pulse-Triggered flip-flops): JK Flip Flop, Characteristic equations, Registers.			

VERILOG BEHAVIORAL DESCRIPTION: Introduction, Procedural Assignments.		
SELF-STUDY COMPONENTS: Design of 4-bit Synchronous Counters using T, JK, D, SR Flip-Flops.		
UNIT 4	9	L1-L4
FLIP-FLOPS AND ITS APPLICATIONS: Binary Ripple Counters, Synchronous Binary Counters, Counters based on Shift Registers,		
VERILOG BEHAVIORAL DESCRIPTION: Conditional statements, Multiway branching, Loops, Examples.		
SELF-STUDY COMPONENTS: Learn to write Verilog code for Sequential circuits using Behavioral Modelling.		
UNIT 5	9	L1-L4
FLIP-FLOPS AND ITS APPLICATIONS: Design of Synchronous mod-n Counter using clocked T, JK, D and SR flip-flops.		
VERILOG STRUCTURAL DESCRIPTION: Gate types, Examples. (Gate level description only)		
SELF-STUDY COMPONENTS: Learn to write Verilog code for Sequential circuits using Behavioral & Structural Modelling.		
PRACTICAL COMPONENTS OF IPCC Using suitable simulation software, demonstrate the operation of the following circuits		
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 b) Binary to Gray 5.To realize using Verilog Behavioral description: 4:1 mux, 8:3 encoder, Priority encoder 6.To realize using Verilog Behavioral description: 1:4 Demux, 3:8 decoder, 2-bit Comparator 7.To realize using Verilog Behavioral description: Flip-flops: a) JK b) SR 8.To realize using Verilog Behavioral description: Flip-flops: a) T b) D		
Demonstration 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.		
TEXT BOOKS:		
1	Digital Logic Applications and Design by John M Yarbrough, Thomson Learning,2006.	

2	Digital Principles and Design by Donald D Givone, McGraw Hill, 2017.
3	Verilog HDL: A Guide to Digital Design and Synthesis by Samir Palnitkar, 2 nd Edition 2003, Prentice Hall.

REFERENCE BOOKS:

1	Fundamentals of logic design, by Charles H Roth Jr., Cengage Learning, 2013.
2	Logic Design, by Sudhakar Samuel, Pearson/Sanguine, 2010.
3	Fundamentals of HDL, by Cyril P R, Pearson/Sanguine, 2010.

e-LEARNING RESOURCES:

1	Hardware Modeling using Verilog https://nptel.ac.in/courses/106105165
2	Digital Design with Verilog https://nptel.ac.in/courses/106103358

Assessment Details both (CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) and Semester End Exam (SEE) is 50% each. The students have to obtain a minimum of 40% marks individually both in CIE and SEE to pass. CIE: The CIE has two components – CIE - theory component and CIE – laboratory component. Students have to score a minimum of 40% Marks in the total of CIE - theory and CIE – laboratory components put together, provided students have to score a minimum of 40% marks in CIE laboratory component alone to qualify to take SEE. Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration) and reduced to 50 Marks.

****Self-Study Component should be not included for SEE & CIE.**

CONTINUOUS INTERNAL EVALUATION (CIE)		Max. Marks		Minimum Marks to be scored in CIE, to qualify to take SEE (40% individually)
Theory	Weightage of CIE1 and CIE2 Tests or CIE3	30		12
Laboratory components	Rubrics for experiment are added, then taken average	10	20	08
	Lab CIE	10		
TOTAL		50		20

QUESTION PAPER PATTERN (SEE)

Q. No.	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
UNIT	1	2	3	4	5	6	7	8	9	10
1. Two full questions (each of 20 Marks) are to be set from each unit.										
2. Student shall answer five full questions selecting one full question from each unit.										

Course Outcomes: After the completion of the course, the student will be able to:	
CO1	Analyze and simplify combinational logic circuits using Boolean algebra, Karnaugh maps, and Quine-McCluskey minimization techniques, and understand the fundamentals of Verilog HDL.
CO2	Design and analyze combinational logic circuits using MSI components such as adders, subtractors, comparators, decoders, encoders, and multiplexers, using Verilog data-flow modeling.
CO3	Analyze and design sequential circuits using latches, flip-flops, and registers, and implement sequential logic using Verilog behavioral modeling.
CO4	Design and analyze ripple counters, synchronous counters, and shift-register-based counters using appropriate sequential design techniques and Verilog behavioral constructs.
CO5	Design and implement synchronous mod-n counters using different types of flip-flops and describe sequential circuits using Verilog structural modeling at the gate level.

Mapping of CO's, PO's with PSO's														
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0														
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PSO 1	PSO 2	PSO 3
CO ₁	3	2	2	0	1	0	0	0	0	0	0	2	2	0
CO ₂	3	3	3	1	3	0	0	0	0	0	0	2	3	0
CO ₃	3	3	3	1	3	0	0	0	0	0	0	2	3	0
CO ₄	3	3	3	2	3	0	0	0	1	0	1	2	3	0
CO ₅	3	3	3	2	3	0	0	0	1	0	2	2	3	0

Mapping of CO's with Knowledge and Attitude Profile (WK)										
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0										
CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	
CO1	0	3	3	2	0	1	0	0	0	
CO2	0	2	3	3	3	2	0	0	0	
CO3	0	2	3	3	3	2	0	0	0	
CO4	0	3	3	3	2	3	0	0	0	
CO5	0	2	3	3	3	3	0	0	0	

Mapping of CO's with Sustainable Development Goals (SDG)																	
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0																	
CO/SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
CO2	0	0	0	2	0	0	0	0	1	0	0	0	0	0	0	0	0
CO3	0	0	0	2	0	0	0	0	1	0	0	0	0	0	0	0	0
CO4	0	0	0	2	0	0	0	0	1	0	0	0	0	0	0	0	0
CO5	0	0	0	2	0	0	0	0	1	0	0	0	0	0	0	0	0

Course Title	NETWORK ANALYSIS						
Course Code	1BSEST303						
Course Category	PCC (Professional Core Course)						
Teaching - Learning Scheme & Credits	L	T	P	S	Total	Total Teaching Hours	Credits
	3	2	0	3	5	42+28+0+50=120	4
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hrs	

Course Learning Objectives:	
CLO1	Understand and apply fundamental circuit laws and theorems, such as Ohm's Law, Kirchhoff's Laws, and network theorems, in the analysis of both DC and AC circuits
CLO2	Analyze and solve electrical networks systematically using mesh and nodal analysis techniques.
CLO3	Examine the transient behavior of RL, RC and RLC circuits under DC excitation and determine initial and final conditions
CLO4	Apply Laplace Transform methods for the analysis of electrical circuits and the solution of circuit-related differential equations
CLO5	Evaluate and interpret two-port network parameters (Z, Y, h, and T) and understand the relationships among them in various electrical systems.

SYLLABUS	No. of Hours	BTLs
UNIT 1	(9L + 5T)	L1-L4
BASIC NETWORK ANALYSIS Active and passive elements, Ideal and practical voltage and current sources, Independent and dependent (controlled) sources, Source transformation and source shifting techniques, Network reduction methods: Star-Delta (Y- Δ) and Delta-Star (Δ -Y) transformation. Loop (Mesh) and Node analysis for DC and AC circuits with independent and dependent sources, Super-mesh and Super-node concepts and applications.		
SELF-STUDY COMPONENTS: • Applications of active and passive circuit elements in electrical systems. • Practical implementation of dependent (controlled) sources. • Software-based analysis of DC and AC networks using MATLAB/Simulink, LTspice, or PSpice. • Applications of Star-Delta transformation in power distribution networks. • Comparative study of Mesh Analysis and Node Analysis techniques. • Real-world applications of Super-mesh and Super-node methods in electrical circuit analysis.		
UNIT 2	(8L + 5T)	L1-L4
NETWORK THEOREMS: Superposition Theorem, Reciprocity Theorem, Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer Theorem, Millman's Theorem. Analysis of linear DC and AC electrical networks using network theorems with independent and dependent sources.		
SELF-STUDY COMPONENTS: • Applications of Superposition, Thevenin's and Norton's Theorems in practical electrical circuits.		

• Millman's Theorem and its applications in multi-source electrical networks. • Comparison of different network theorems and their suitability for circuit analysis. • Application of Maximum Power Transfer Theorem in electrical and electronic systems. • Analysis of DC and AC networks using simulation tools such as MATLAB/Simulink, LTspice or PSpice. • Real-time applications of network theorems in power systems and electrical engineering circuits.		
UNIT 3	(9L+9T)	L1-L4
TRANSIENT BEHAVIOUR AND INITIAL CONDITIONS: Concept of initial conditions in electrical networks, Initial conditions of resistor, inductor and capacitor, Continuity conditions of inductor current and capacitor voltage, procedure for evaluating initial conditions, Behaviour of circuit elements under DC switching conditions and their representation, Evaluation of initial and final values in R-L, R-C and R-L-C circuits, transient response of series R-L, R-C and R-L-C circuits for DC excitation with initial conditions, classical solutions for first and second order differential equations for series R-L, R-C and R-L-C electrical networks.		
SELF-STUDY COMPONENTS: • Applications of transient response in electrical and electronic systems. • Use of MATLAB/Simulink, LTspice or PSpice for transient analysis of electrical circuits. • Comparison of first-order and second-order circuit responses. • Effect of circuit parameters (R, L and C) on transient response. • Practical applications of charging and discharging circuits. • Analysis of natural and forced responses of electrical networks.		
UNIT 4	(9L+5T)	L1-L5
LAPLACE TRANSFORMATION AND ITS APPLICATIONS TO ELECTRIC CIRCUITS: Introduction, properties of Laplace transform, Laplace transform of a derivative, integral, common forcing functions, initial value and final value theorems, time displacement theorem, Laplace Transform of a network and time domain solution for R-L, R-C, and R-L-C networks for DC excitations, and pulse input.		
Waveform Synthesis: Introduction, Basic types of special signals, Laplace transformation of special signal waveforms, Problems.		
SELF-STUDY COMPONENTS: • Analyse the transient response of an RL circuit using both classical and Laplace methods and compare the results. • Simulate an RC charging circuit under step and pulse excitation using MATLAB or LTspice. • Develop a MATLAB program to compute Laplace and inverse Laplace transforms of common functions. • Generate and analyse unit step, ramp, impulse, and pulse waveforms using MATLAB. • Compare analytical and simulation results for first-order and second-order circuits. • Prepare a summary chart of important Laplace transform pairs and theorems.		
UNIT 5	(7L+4T)	L1-L4
TWO PORT NETWORK: Introduction to two-port networks, Characterization in terms of impedance, admittance, hybrid, and transmission parameters, parameter conversions, Interconnection of two-port networks – Symmetry and Reciprocity.		
SELF-STUDY COMPONENTS: • Study the concept, classification, and applications of two-port networks.		

- Simulate a two-port network using MATLAB, LTspice, or Multisim and compare the results with analytical calculations.

TEXT BOOKS:

1	Hayt, Kemmerly and Durbin, “Engineering Circuit Analysis”, 10th Edition, TMH Publication, 2024.
2	M. E. Van Valkenburg, “Network Analysis”, 3rd edition, PHI publisher, 2009.
3	Charles K Alexander Matthew N O Sadiku, “Fundamentals of Electric Circuits”, Mc Graw Hill, 5th Edition, 2022.

REFERENCE BOOKS:

1	Roy Choudhury, “Networks and systems”, 2nd Edition, New Age International Publications, 20
2	Robert L and Boylestad “Introductory Circuit Analysis”, 4TH edition, Pearson publisher, 2010.
3	M Nahvi and J A Edminister, “Electric Circuits”, 2nd Edition, Schaum’s Series , 2002.

e-LEARNING RESOURCES:

1	NPTEL (National Programme on Technology Enhanced Learning) ○ Website: https://nptel.ac.in ○ Courses: – <i>Basic Electrical Circuits</i> by Prof. Nagendra Krishnapura (IIT Madras) – <i>Network Analysis</i> by Prof. M. B. Patil (IIT Bombay)
2	MIT Open CourseWare ○ Website: https://ocw.mit.edu ○ Course: <i>Circuits and Electronics</i> (6.002)
3	All About Circuits • Website: https://www.allaboutcircuits.com • Features: In-depth tutorials, forum discussions, circuit simulation tools, calculators.

Assessment Details both (CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) and Semester End Exam (SEE) is 50% each. The students have to obtain a minimum of 40% marks individually both in CIE and SEE to pass.

CIE: The CIE has three components – CIE - theory component, assignment and group activity. Students have to score a minimum of 40% Marks in the total of CIE - theory, assignment and group activity components put together to take SEE.

SEE: Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration) and reduced to 50 Marks.

****Self-Study** The self-study component shall not be included in the SEE. For the CIE, a **5-mark question** from the self-study component may be included as either **Question 2(b)** or **Question 2(c)**.

CONTINUOUS INTERNAL EVALUATION (CIE)		Max. Marks	Minimum Marks to be scored in CIE, to qualify to take SEE (40% individually)
Theory	Weightage of CIE-1 and CIE-2 Tests or CIE-3	50	20
TOTAL		50	20

QUESTION PAPER PATTERN (SEE)										
Q. No.	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
UNIT	1		2		3		4		5	
1. Two full questions (each of 20 Marks) are to be set from each unit.										
2. Student shall answer five full questions selecting one full question from each unit.										

Course Outcomes: After the completion of the course, the student will be able to:	
CO1	Apply Kirchhoff's laws to perform loop and nodal analysis for resistive and reactive networks.
CO2	Apply the basic electrical laws and theorems to simplify and analyse the complex electric circuits
CO3	Analyse and evaluate the initial and final conditions of RL, RC and RLC circuits and determine the transient response of electrical circuits.
CO4	Apply Laplace Transform techniques to solve first and second-order electrical circuits in the s-domain and analyze the electrical waveforms using standard test signals
CO5	Determine the parameters of two-port networks (Z, Y, h, and T) and analyse their behaviour in interconnected networks.

Mapping of CO's, PO's with PSO's														
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	2	0	0	0	0	0	0	3	2	1
CO2	3	3	2	2	2	0	0	0	0	0	0	3	2	1
CO3	3	3	2	2	2	0	0	0	0	0	0	3	3	1
CO4	3	2	2	2	2	0	0	0	0	0	0	3	3	2
CO5	3	3	2	2	2	0	1	0	0	0	0	3	3	2

Mapping of CO's with Knowledge and Attitude Profile (WK)											
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0											
CO/SDG's	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	WK10	WK11
CO1	3	3	2	1	0	0	0	0	1	0	0
CO2	3	3	3	2	1	0	0	0	1	0	0
CO3	3	3	3	2	2	1	0	0	1	0	0
CO4	3	3	2	2	2	1	1	0	1	0	0
CO5	3	3	3	3	2	1	1	1	1	0	0

Mapping of CO's with Sustainable Development Goals (SDG)																	
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0																	
CO	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1	0	0	0	3	0	0	1	0	2	0	0	0	0	0	0	0	0
CO2	0	0	0	3	0	0	2	0	3	0	1	0	0	0	0	0	0
CO3	0	0	0	3	0	0	3	0	3	0	1	1	1	0	0	0	0
CO4	0	0	0	3	0	0	2	0	3	0	2	1	1	0	0	0	0
CO5	0	0	0	3	0	0	3	0	3	0	2	2	2	0	0	0	0

Dr. Ambedkar Institute of Technology, Bengaluru - 560056
School of Electrical, Electronics Sciences & Engineering
Program: Electronics and Communication Engineering

Semester: III

Scheme: 2025

Course Title	ANALOG ELECTRONICS AND LINEAR INTEGRATED CIRCUITS						
Course Code	1BSEST304						
Course Category	PCC (Professional Core Course)						
Teaching - Learning Scheme & Credit	L	T	P	S	Total	Total Teaching Hours	Credit
	3	0	0	3	3	45+0+0+45=90	3
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hrs	

Course Learning Objectives:	
CLO1	Examine the AC behavior and frequency response of BJT amplifiers and hybrid equivalent model, including the qualitative study frequency effects such as Miller effect.
CLO2	Analyze Power amplifier circuits in different modes of operation.
CLO3	Understand types of MOSFET biasing and demonstrate the use of MOSFET amplifiers.
CLO4	Construct various electronic circuits using OPAMPs and different types of active filters.
CLO5	Explain the working principle, block diagram, and pin configuration of IC 565 PLL, and analyze its applications.

SYLLABUS	No. of Hours	BTLs
UNIT 1	09	L1-L4
BJT AC Analysis: Voltage Divider Configuration, hybrid Equivalent model. BJT Frequency Response: Low frequency analysis, low frequency response of BJT amplifier, Miller effect capacitance, High frequency response of BJT amplifiers- study of capacitors affecting frequency response. (Qualitative analysis).		
SELF-STUDY COMPONENTS: BJT AC Analysis – Voltage Divider Configuration BJT (basic transistor amplifier model) and its comparison with the hybrid model. Effect of load impedance and source resistance on gain. Cascaded BJT amplifier configurations (brief overview).		
UNIT 2	09	L1-L4
Feedback Amplifier: Feedback concepts, feedback amplifier types-- Voltage series, Voltage-shunt, Current Series, and Current Shunt Feedback. Oscillator: Theory of Sinusoidal Oscillation, The Wein-Bridge Oscillator, RC Phase Shift Oscillator, The Colpitts Oscillator, Hartley Oscillator, Crystal Oscillator. Power Amplifiers: Introduction and amplifier types, Transformer – Coupled class A Amplifier, Transformer – coupled Push – Pull circuits, Complementary –Symmetry Circuits, Amplifier distortion, Class C Amplifier.		
SELF-STUDY COMPONENTS: Effect of feedback on input/output impedance (qualitative). Comparison of Class A, B, AB, C amplifiers with efficiency calculations. Heat sinks and thermal considerations in power amplifiers.		
UNIT 3	09	L1-L4
MOSFET Biasing in MOS Amplifier Circuits: Fixing VGS, Fixing VG, Drain to Gate Feedback Resistor. Small Signal Operation and Modelling: The DC Bias Point, Signal Current in Drain, Voltage Gain, Small Signal Equivalent Circuit Models, Transconductance, The T Equivalent Circuit Model.		

MOSFET Amplifier Configuration: Basic Configurations, Characterizing Amplifiers, CS Amplifier with And Without Source Resistance, The Common Gate Amplifier, Source Follower.		
SELF-STUDY COMPONENTS: JFET biasing techniques (fixed bias, self-bias, voltage-divider bias). FET small-signal model and parameters (gm, rd). Applications of MOSFET as a switch in digital circuits.		
UNIT 4	09	L1-L4
Operational amplifier: Introduction, block diagram and parameters definition. Op- amp applications: Difference amplifier, instrumentation amplifier. Sample and Hold circuit, Active filters-LP, HP, BP, BR.		
SELF-STUDY COMPONENTS: Ideal vs practical op-amp characteristics (CMRR, slew rate, offset voltage). Summing and integrator/differentiator circuits. Design considerations for instrumentation amplifiers in sensor applications.		
UNIT 5	09	L1-L4
Op-amp comparator: Zero crossing detectors and Schmitt trigger-inverting mode. Converter: A/D – Successive approximation, flash ADC, D/A - Weighted R-2R ladder DAC. IC 565 – Phase Locked Loop (PLL): Introduction to PLL, Block diagram, Pin diagram and description, Operating Principle, Operation of Principle, Applications.		
SELF-STUDY COMPONENTS: Comparator circuit and applications. Dual-slope ADC working principle (brief). IC 565 PLL pin configuration and practical applications such as Free running Oscillator and FM applications.		
TEXTBOOKS:		
1	Robert L. Boylestad and Louis Nashelsky, “Electronic Devices and Circuit Theory”, 11th Edition, Pearson Education, 2015.	
2	D. Roy Choudhury, Shail B Jain,” Linear Integrated Circuits”, 4th Edition, New Age International limited, 2019.	
3	Adel S. Sedra & Kenneth C. Smith, “Micro Electronic Circuits”, 7th Edition, Oxford University Press, 2017.	
REFERENCE BOOKS:		
1	Muhammad Rashid, “Microelectronics Circuits Analysis and Design”, 2nd edition, Cengage Learning, 2014.	
2	S. Salivahanan N. Suresh, “Electronic Devices and Circuits”,3rd edition, Mc Graw Hill publisher, 2013.	
3	Millman and Halkias, “Electronic Devices and Circuits”, 4th Edition, Mc Graw Hill, 2015.	
4	Op-Amps and Linear Integrated Circuits, Ramakant A Gayakwad, Pearson, 4th Edition 2015	
e-LEARNING RESOURCES:		
1	https://www.tutorialspoint.com/electronic_circuits/electronic_circuits_introduction.htm	
2	https://www.electronicshub.org/tutorials/4 .	
3	https://nptel.ac.in/courses/108102112	

4	http://nptel.vtu.ac.in/econtent/courses/EEE/10EE54/index.php
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Assessment Details both (CIE and SEE)			
The weightage of Continuous Internal Evaluation (CIE) and Semester End Exam (SEE) is 50% each. The students have to obtain a minimum of 40% marks individually both in CIE and SEE to pass. CIE: The CIE has three components – CIE - theory component, assignment and group activity. Students have to score a minimum of 40% Marks in the total of CIE - theory, assignment and group activity components put together to take SEE. SEE: Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration) and reduced to 50 Marks. **Self-Study Component should be not included for SEE & CIE.			
CONTINUOUS INTERNAL EVALUATION (CIE)		Max. Marks	Minimum Marks to be scored in CIE, to qualify to take SEE (40% individually)
Theory	Weightage of CIE1 and CIE2 Tests or CIE3	50	20
TOTAL		50	20

QUESTION PAPER PATTERN (SEE)										
Q. No.	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
UNIT	1	2	3	4	5	6	7	8	9	10
1. Two full questions (each of 20 Marks) are to be set from each unit.										
2. Student shall answer five full questions selecting one full question from each unit.										

Course Outcomes: After the completion of the course, the student will be able to:	
CO1	Describe the working principle, fundamental characteristics of various semiconductor devices such as BJT, FET, MOSFETs, and operational amplifiers in electronic circuits.
CO2	Understand and Analyze various Power Amplifiers and FET biasing Techniques, evaluate performance parameters.
CO3	Analyze and Design FET Amplifier Circuits using Small Signal Models and appropriate Biasing Techniques and Evaluate Parameters.
CO4	Analyze various filter circuits using linear integrated circuits.
CO5	Understand the Structure and Parameters of Op-amp and Analyze its applications in Analog Signal Processing.

Mapping of CO's, PO's with PSO's														
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	0	2	0	0	1	0	0	1	1	0	0	1
CO2	3	2	0	2	0	1	0	2	0	0	0	2	0	0
CO3	0	0	3	0	2	0	1	0	0	0	1	0	0	0
CO4	0	0	3	2	0	0	0	0	1	0	0	0	3	0
CO5	3	3	2	2	0	0	0	0	0	0	2	1	3	0

Mapping of CO's with Knowledge and Attitude Profile (WK)									
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0									
CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
CO1	2	2	3	3	1	1	0	0	2
CO2	2	2	3	3	2	1	0	0	2
CO3	2	1	3	3	1	1	0	0	2
CO4	1	2	2	3	3	2	1	1	1
CO5	1	1	2	3	3	2	1	1	1

Mapping of CO's with Sustainable Development Goals (SDG)																	
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0																	
CO/SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1	0	0	0	3	0	0	1	0	2	0	0	0	0	0	0	0	0
CO2	0	0	0	3	0	0	1	1	2	0	0	0	0	0	0	0	0
CO3	0	0	0	3	0	0	2	0	2	0	0	0	0	0	0	0	0
CO4	0	0	0	3	0	0	2	0	3	0	0	1	0	0	0	0	0
CO5	0	0	0	3	0	0	2	1	3	0	0	1	0	0	0	0	0

Dr. Ambedkar Institute of Technology, Bengaluru - 560056
School of Electrical, Electronics Sciences and Engineering
Program: Electronics and Communication Engineering

Semester: III

Scheme: 2025

Course Title	PYTHON PROGRAMMING						
Course Code	1BECT305						
Course Category	PCC (Professional Core Course)						
Teaching - Learning Scheme & Credit	L	T	P	S	Total	Total Teaching Hours	Credit
	3	0	0	3	6	45+0+0+45=90	3
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hrs	

Course Learning Objectives:	
CLO1	Understand the fundamental concept of python programming.
CLO2	Illustrate the process of structuring the data using lists, dictionaries, tuples and sets
CLO3	Analyse the use of built-in functions to navigate the file system.
CLO4	Infer the Object-oriented Programming concepts in Python.

SYLLABUS	No. of Hours	BTLs
UNIT 1	9	L1-L2
Introduction: Software Development, History of Python Programming Language, Features of Python, Execution of a Python Program, Identifiers, Keywords, Statements and Expressions, Variables, Operators, Precedence and Associativity, Data Types, Indentation, Comments, Reading Input, Print Output, Type Conversions, the type () Function and Is Operator. Control Flow Statements: The if, if...else, if...elif...else, Nested if Statement, while Loop, for Loop, the continue and break Statements.		
SELF-STUDY COMPONENTS: Installing Python Development Environment, creating and running first Python project		
UNIT 2	9	L1-L4
Functions: Built-In Functions, Commonly Used Modules, Function Definition and Calling the Function, The return Statement and void Function, Scope and Lifetime of Variables, Lambda Functions, Recursive functions Strings: Creating and Storing Strings, Basic String Operations, Accessing Characters in String by Index Number, String Slicing and Joining, String Methods.		
SELF-STUDY COMPONENTS: User defined modules, advanced string formatting and executing the programs.		
UNIT 3	9	L1-L4
List: Creating Lists, Basic List Operations, Indexing and Slicing in Lists. Dictionaries: Creating Dictionary, Accessing and Modifying key: value Pairs in Dictionaries, Built-In Functions Used on Dictionaries, Dictionary Methods, The del Statement.		

SELF-STUDY COMPONENTS:

List Methods, Nested Lists, Dictionary Traversal, Nested Dictionaries.

UNIT 4

9

L1-L4

Tuples and Sets: Creating Tuples, Basic Tuples operations, Indexing and slicing in tuples, Relation between tuples and sets, Sets, Set Methods.

Files: Types of Files, Creating and Reading Text Data, File Methods to Read and Write Data.

SELF-STUDY COMPONENTS:

Tuple Packing and Unpacking, Tuple Methods, Set operations, Remove duplicates using Sets, working with file Paths.

UNIT 5

9

L1-L4

Oops Concepts: Classes and Objects, Creating Classes, in Python, Creating Objects in Python, The Constructor Method, Classes with Multiple Objects, Class Attributes versus Data Attributes, Encapsulation, inheritance, polymorphism

SELF-STUDY COMPONENTS:

Student Result Management System Using Python, Bank Management System Using OOP Concepts in Python

TEXT BOOKS:

- | | |
|---|---|
| 1 | Gowrishankar S, Veena A, "Introduction to Python Programming", 1st Edition, CRC Press/Taylor & Francis, 2018. ISBN-13: 978-0815394372 |
| 2 | R Nageswara Rao "Core Python Programming", 2nd Edition, Dream Tech Publishers., 2017 |

REFERENCE BOOKS:

- | | |
|---|---|
| 1 | Wesley J Chun, "Core Python Applications Programming", 3rd Edition, Pearson Education India, 2015. ISBN-13: 978-9332555365. |
| 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) |

e-LEARNING RESOURCES:

- | | |
|---|---|
| 1 | https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_cs109 |
| 2 | https://www.learnbyexample.org/python-lambda-function |
| 3 | https://www.learnpython.org/ |
| 4 | https://www.youtube.com/watch?v=daefaLgNkw0 |

Assessment Details both (CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) and Semester End Exam (SEE) is 50% each. The students have to obtain a minimum of 40% marks individually both in CIE and SEE to pass.

CIE: The CIE has three components – CIE - theory component, assignment and group activity. Students have to score a minimum of 40% Marks in the total of CIE - theory, assignment and group activity components put together to take SEE.

SEE: Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration) and reduced to 50 Marks.

****Self-Study Component should be not included for SEE & CIE.**

CONTINUOUS INTERNAL EVALUATION (CIE)		Max. Marks	Minimum Marks to be scored in CIE, to qualify to take SEE (40% individually)
Theory	Weightage of CIE1 and CIE2 Tests or CIE3	50	20
TOTAL		50	20

QUESTION PAPER PATTERN (SEE)

Q. No.	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
UNIT	1		2		3		4		5	

1. Two full questions (each of 20 Marks) are to be set from each unit.

2. Student shall answer five full questions selecting one full question from each unit.

Course Outcomes: After the completion of the course, the student will be able to:

CO1	Explain the fundamentals of Python programming, including syntax, data types, operators, control flow statements, and input/output operations, to develop simple Python programs.
CO2	Develop modular Python programs using functions, built-in modules, and string manipulation techniques to solve computational problems
CO3	Apply Python lists and dictionaries to organize, manipulate, and process data effectively in programming applications
CO4	Utilize tuples, sets, and file handling techniques to perform data storage, retrieval, and processing using Python programs.
CO5	Design object-oriented Python programs using classes, objects, constructors, encapsulation, inheritance, and polymorphism to develop simple real-world applications.

Mapping of CO's, PO's with PSO's

Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	0	2	0	0	0	0	1	0	2	1	0
CO2	3	3	2	1	2	0	0	0	1	2	1	2	2	1
CO3	3	3	2	2	2	0	0	0	1	1	1	3	2	1
CO4	2	3	2	2	3	0	0	0	1	2	1	2	2	1
CO5	3	3	3	2	2	0	0	1	2	2	2	2	3	2

Mapping of CO's with Knowledge and Attitude Profile (WK)									
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0									
CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
CO1	2	3	3	1	0	3	0	0	0
CO2	1	3	3	3	0	3	0	0	0
CO3	1	3	2	3	0	3	0	0	0
CO4	0	2	2	3	0	3	0	2	0
CO5	0	2	3	3	0	3	1	0	1

Mapping of CO's with Sustainable Development Goals (SDG)																	
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0																	
CO/SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1	0	0	0	3	0	0	0	2	2	0	0	0	0	0	0	0	0
CO2	0	0	0	3	0	0	0	2	3	0	0	1	0	0	0	0	0
CO3	0	0	0	3	0	0	0	2	3	0	0	2	0	0	0	0	0
CO4	0	0	0	3	0	0	0	2	3	0	0	2	0	0	0	1	0
CO5	0	0	0	3	0	0	0	3	3	0	0	1	0	0	0	1	1

Course Title	ANALOG ELECTRONICS AND LINEAR INTEGRATED CIRCUITS LAB LABORATORY						
Course Code	1SESTL306						
Course Category	PCCL (Professional Core Course Laboratory)						
Teaching - Learning Scheme & Credit	L	T	P	TW+SL	Total	Total Teaching Hours	Credit
	00	00	02	28	30	30	01
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hrs	

Course Learning Objectives:	
CLO1	To provide practical exposure to design, setting up, and analyze various analog electronic and Op-Amp circuits.
CLO2	To design, set up, and analyze RC-coupled and feedback BJT amplifiers, and determine their gain, bandwidth, frequency response, and input/output impedance.
CLO3	To design and analyze power amplifier circuits (Class A and Class B) and characterize JFET amplifiers through their input/output characteristics.
CLO4	To measure and evaluate the performance of Op-Amp based circuits such as the difference amplifier and instrumentation amplifier.
CLO5	To design, test, and plot the frequency response of active filters and Examine the working of IC 565 PLL, and analyze its lock range and capture range for applications in FM.

Syllabus	
PART: A - CONVENTIONAL EXPERIMENTS	
1	BJT Amplifiers: Design and Verification of RC-Coupled amplifier, Determine gain, frequency response, input and output impedance.
2	Feedback Amplifiers: Design and Set-up the BJT Common Emitter Voltage Amplifier with Feedback and Determine the Gain, Bandwidth.
3	Power Amplifiers: Design and analysis of power amplifier circuits (Class A, Class B).
4	Characteristics and design of JFET amplifier: Plotting the input/output characteristics of JFET and Design of amplifier.
5	Measurement of Op-Amp parameters: Difference Amplifier and Instrumentation amplifier.
6	Comparators: i) Zero crossing detectors ii) Schmitt trigger circuit using Op-Amps.
7	Converters: Analog to Digital (ADC) i) Successive approximation ii) Flash ADC
8	Converters: Digital to Analog (DAC) Weighted R-2R ladder DAC
9	Active filters: Design and Test the Second Order Active Filters and Plot the Frequency Response: i) Low Pass Filter, ii) High Pass Filter
10	Active filters: i) Band Pass, ii) Band Reject.

11	IC 565: Frequency synthesis using IC 565.
12	IC 565: Applications of IC 565.
PART: B - TYPICAL OPEN-ENDED EXPERIMENTS	
Open-ended experiments are a type of laboratory activity where the outcome is not predetermined and students are given the freedom to explore, design, and conduct the experiment based on the problem statements as per the concepts defined by the course coordinator. It encourages creativity, critical thinking, and inquiry-based learning. Course Project: Students must do a mandatory course project (group size not more than 4 students) using to realize a functional analog circuit on PCB. A maximum of 5 marks shall be awarded for this project (to be evaluated along with the final internal test). Report to be submitted.	
1	Audio amplifier.
2	Electronic Pest Repellent Circuit.
3	Electronic Siren, Audiometer.

Teaching & Learning Process (Innovative Delivery Methods):	
1	Active Learning Techniques
2	Problem-Based Learning (PBL)
3	Team-Based Learning (TBL)
4	Hands-On Experiments and Simulations

TEXT BOOKS:	
1	Boylestad R. L. and L. Nashelsky, Electronic Devices and Circuit Theory, 10/e, Pearson Education India, 2009
2	Choudhury R., Linear Integrated Circuits, New Age International Publishers. 2008.

REFERENCE BOOKS:	
1	Millman J. and C. C. Halkias, Integrated Electronics: Analog and Digital Circuits and Systems, Tata McGraw-Hill, 2010.
2	Gayakward R. A., Op-Amps and Linear Integrated Circuits, PHI Learning Pvt. Ltd., 2012.
e-LEARNING RESOURCES:	
1	Analog Electronic Circuits Virtual Lab, IIT Kharagpur – Studies on BJT CE Amplifier — https://be-iitkgp.vlabs.ac.in/exp/ce-amplifier/simulation.html
2	Electronic Devices and Circuits Virtual Lab, IIT Kharagpur — http://vlabs.iitkgp.ac.in/ssd/index.html
3	Analog Electronic Circuits" by Prof. Shanthi Pavan, IIT Madras — https://onlinecourses.nptel.ac.in/noc26_ee65/preview
4	Multisim / PSpice – for BJT, FET, and Op-Amp circuit design and analysis
5	Proteus Design Suite – for circuit design, PCB layout, and simulation

Assessment Details both (CIE and SEE)			
The weightage of Continuous Internal Evaluation (CIE) and Semester End Exam (SEE) is 50% each. The students have to obtain a minimum of 40% marks individually both in CIE and SEE to pass. CIE: The CIE has two components – CIE - theory component and CIE – laboratory component. Students have to score a minimum of 40% Marks in the total of CIE - theory and CIE – laboratory components put together, provided students have to score a minimum of 40% marks in CIE laboratory component alone to qualify to take SEE. Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration) and reduced to 50 Marks. **Self-Study Component should be not included for SEE & CIE.			
CONTINUOUS INTERNAL EVALUATION (CIE)		Max. Marks	Minimum Marks to be scored in CIE, to qualify to take SEE (40% individually)
Laboratory components	Rubrics for each experiment are added, then taken average	30	20
	Lab CIE	20	
TOTAL		50	20

Course Outcomes: After the completion of the course, the student will be able to:	
CO1	Design and test simple Analog electronic circuits as per the specifications using discrete electronic components
CO2	Design and analyze Power Amplifiers.
CO3	Understand the FET circuits.
CO4	Measure the performance parameters of Op-Amp based difference and instrumentation amplifiers. Design and test the Op-amp applications.
CO5	Implement Timer circuits using IC Timer NE555

Mapping of CO's, PO's with PSO's														
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	1	3	0	0	0	2	2	0	2	0	1
CO2	3	2	3	2	2	0	0	0	1	1	0	2	0	0
CO3	2	2	3	2	2	0	0	0	1	1	0	1	2	0
CO4	2	2	2	3	2	0	0	0	1	1	0	1	3	0
CO5	2	2	3	2	3	0	1	0	2	2	0	1	1	2

Mapping of CO's with Knowledge and Attitude Profile (WK)										
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0										
CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	
CO1	1	1	2	2	2	3	0	1	1	
CO2	1	1	2	3	3	3	0	1	1	
CO3	1	1	2	3	3	3	0	1	1	
CO4	1	1	2	3	2	3	0	1	1	

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CO5	1	1	2	3	3	3	0	2	1
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Mapping of CO's with Sustainable Development Goals (SDG)																	
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0																	
CO/SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1	0	0	0	3	0	0	0	0	2	0	0	0	0	0	0	0	0
CO2	0	0	0	3	0	0	1	0	2	0	0	0	0	0	0	0	0
CO3	0	0	0	3	0	0	2	0	3	0	0	0	0	0	0	0	0
CO4	0	0	0	3	0	0	0	0	2	0	0	0	0	0	0	0	0
CO5	0	0	0	3	0	0	1	0	2	0	0	0	0	0	0	0	0

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Course Title	PROGRAMMING USING JAVA LAB						
Course Code	1BECL307D						
Course Category	AEC (Ability Enhancement Course Laboratory)						
Teaching - Learning Scheme & Credit	L	T	P	S	Total	Total Teaching Hours	Credit
	0	0	30	0	30	30	1
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hrs	

Course Learning Objectives:	
CLO1	To learn primitive constructs JAVA programming language.
CLO2	To be able to learn and apply concepts of Java programming, exceptional handling and inheritance.
CLO3	To understand object-oriented programming features of JAVA.
CLO4	To gain knowledge on: packages, multithreaded programming and exceptions.

Sl. NO	Laboratory Component	No. of hours	BTL
1.	Write a JAVA program to implement 555 Timer Frequency Calculator	2	L1-L4
2.	Write a code snippet for Rock-Paper-Scissors game.	2	L1-L4
3.	Create a JAVA class called AC power with the following details as variables within it. Voltage Current Phase angle Write a JAVA program to create power objects and print the voltage, current, active power, apparent power, reactive power, instantaneous power, and power factor of these objects with suitable headings	2	L1-L4
4.	Write a JAVA program to implement ADC Bit-Resolution Quantizer	2	L1-L4
5.	Design a super class called Staff with details as Staff Id, Name, Phone, Salary. Extend this class by writing three subclasses namely Teaching (domain, publications), Technical (skills), and Contract (period). Write a JAVA program to read and display at least 3 staff objects of all three categories.	2	L1-L4
6.	Write a JAVA Program to Simulate a Multi-Waveform Function Generator using Runtime Polymorphism	2	L1-L4
7.	Write a Java program that works as a simple calculator. Use a grid layout to arrange buttons for the digits and for the +, -, *, % operations. Add a text field to display the result. Handle any possible exceptions like divided by zero.	2	L1-L4
8.	Write a Java Program that simulates a Traffic Light. The program lets the use select one of three lights: red, yellow Green with radio buttons. On selecting radio button, an appropriate message with "stop" or "Ready" or "GO" should appear above the button in selected color. Initially, there is no message shown.	2	L1-L4
9.	Write a JAVA program to demonstrate Hardware Isolation and Signal Access Control using Java Packages	2	L1-L4

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10.	Write a Java program that creates three threads. First thread displays “Good Morning” everyone second, the second thread displays “Hello” every two seconds and the third thread displays “Welcome” every three seconds.	2	L1-L4
11.	Demonstrate with a program to handle File operations for the following: i. Creating a file ii. Writing into the file iii. Read from the file iv. Delete the file	2	L1-L4
12.	Implement JDBC Application program using MySQL connectivity, develop a program to accept book information such as accession number, title, authors, edition and publisher from the stored table in the database. Perform the following: i. Display of Table Contents. ii. Insertion of Values to the Table. iii. Update and Delete contents as and when required.	2	L1-L4

TEXT BOOKS:

1	Java: The Complete Reference, Twelfth Edition, by Herbert Schildt, November 2021, McGraw-Hill, ISBN: 9781260463422
2	Programming with Java, 6th Edition, by E Balagurusamy, Mar-2019, McGraw Hill Education, ISBN: 9789353162337
3	Thinking in Java, Fourth Edition, by Bruce Eckel, Prentice Hall, 2006 (https://sd.blackball.lv/library/thinking_in_java_4th_edition.pdf) Herbert Schildt, Java The Complete Reference, 7th Edition, Tata McGraw Hill, 2007.

e-LEARNING RESOURCES:

1	Java Tutorial: https://www.geeksforgeeks.org/java/
2	Introduction To Programming In Java (by Evan Jones, Adam Marcus and Eugene Wu): https://ocw.mit.edu/courses/6-092-introduction-to-programming-in-java-january-iap-2010/
	Java Tutorial: https://www.w3schools.com/java/
	Java Tutorial: https://www.javatpoint.com/java-tutorial

Assessment Details both (CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) and Semester End Exam (SEE) is 50% each. The students have to obtain a minimum of 40% marks individually both in CIE and SEE to pass. CIE: The CIE has two components – CIE - theory component and CIE – laboratory component. Students have to score a minimum of 40% Marks in the total of CIE - theory and CIE – laboratory components put together, provided students have to score a minimum of 40% marks in CIE laboratory component alone to qualify to take SEE.

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Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration) and reduced to 50 Marks.

****Self-Study Component should be not included for SEE & CIE.**

CONTINUOUS INTERNAL EVALUATION (CIE)		Max. Marks	Minimum Marks to be scored in CIE, to qualify to take SEE (40% individually)
Laboratory components	Rubrics for each experiment are added, then taken average	30	20
	Lab CIE	20	
TOTAL		50	20

Course Outcomes: After the completion of the course, the student will be able to:

CO1	Apply Java programming fundamentals, classes, objects, and control structures to develop engineering and scientific applications
CO2	Develop object-oriented Java applications using inheritance, polymorphism, packages, and exception handling to create modular and maintainable software.
CO3	Design interactive graphical user interface applications using Java Swing and event-driven programming techniques.
CO4	Implement multithreading and file handling techniques to develop efficient and reliable Java applications for concurrent execution and data management.
CO5	Develop database-enabled Java applications using JDBC to perform Create, Read, Update, and Delete (CRUD) operations with relational databases

Mapping of CO's, PO's with PSO's

Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PSO 1	PSO 2	PSO 3
CO 1	3	3	2	1	2	0	0	0	1	2	1	3	2	1
CO 2	3	3	3	2	2	0	0	1	2	2	2	2	3	1
CO 3	2	2	3	1	3	0	0	0	2	2	2	2	2	1
CO 4	2	3	2	3	3	0	0	1	2	2	1	2	3	1
CO 5	3	3	3	2	3	0	0	1	2	2	2	2	3	2

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Mapping of CO's with Knowledge and Attitude Profile (WK)									
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0									
CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
CO1	2	3	3	1	0	3	0	0	0
CO2	0	1	3	3	0	3	0	2	0
CO3	0	1	3	3	0	3	0	2	0
CO4	0	2	3	3	0	3	0	2	0
CO5	0	2	3	3	0	3	2	2	1

Mapping of CO's with Sustainable Development Goals (SDG)																	
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0																	
CO/SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1	0	0	0	3	0	0	0	2	3	0	0	1	0	0	0	0	0
CO2	0	0	0	3	0	0	0	3	3	0	0	2	0	0	0	1	1
CO3	0	0	0	3	0	0	0	2	3	0	0	1	0	0	0	1	1
CO4	0	0	0	3	0	0	0	3	3	0	0	2	0	0	0	2	1
CO5	0	0	0	3	0	0	0	3	3	0	0	2	0	0	0	2	1

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Community Project (Project Based Learning) Societal Project [Common to all disciplines of Engineering]			
Course Code	1BEC308	Scheme	2025
Type of Course	SDC	Semester	III
Teaching Hours/Week(L:T: P)	30(0:0:0)	CIE Marks	50
Total Hours of Pedagogy CI(L:T):LI(P):SL:TW	30(0:0:0:30)	SEE Marks	50
Credits	1	Total Marks	100
Type of Examination	Practical	Exam Hours	02
Course objective: Rapid urbanisation, population growth, environmental concerns, energy demand, water scarcity, waste management, transportation issues and rural development challenges have created practical problems affecting communities and public welfare. This course aims to integrate technical knowledge, field exposure and societal engagement so that students identify real community issues, frame problem statements and attempt appropriate, feasible and sustainable engineering responses within the scope of a one-semester project. Course Outcome (Course Skill Set): At the end of the course, the student will be able to: C01(L2Understand): Identify and analyse societal problems through field interaction and technical assessment. C02(L3-Apply): Develop skills in project planning, field survey, data collection, implementation, documentation, and reporting. C03(L4-Analyse): Formulate feasible engineering problem statements and solutions considering practical constraints and sustainability aspects. C04(L3-Apply): Apply principles of environmental responsibility, ethics, and societal welfare in engineering practice through community-oriented interventions. C05 (L4 - Analyse and Demonstrate): Exhibit multidisciplinary learning and problem-solving ability based on collected data, user feedback, and baseline conditions and implementation skills with real time environmental conditions through prototype with reflections on Societal problems. Community / Societal Projects shall remain academic, socially responsible, technically focused, and politically neutral. Students and faculty shall maintain professionalism, ethical conduct, public respect and institutional integrity while interacting with communities, public groups, organizations and stakeholders. Students and faculty shall avoid the following during project execution: • Association with political party activities, campaigns or propaganda. • Participation in activities that may disturb communal harmony, public order or institutional reputation. • Use of the project platform for personal, political, ideological or commercial promotion. • Disrespectful, discriminatory or unethical interaction with community members or stakeholders. Projects must also recognize constraints related to cost, resources, environment and safety, and Stakeholder behavior/cooperation/acceptance when planning and implementing activities.			

Sustainable Development Goals

The faculty shall encourage students to undertake community projects that align with and contribute towards satisfying the National Board of Accreditation (NBA) Criterion 3.6, namely, Evidence of Addressing Sustainable Development Goals (SDGs), which is a major emphasis of the United Nations (UN). The Sustainable Development Goals (SDGs) are illustrated in the figure shown below:



SET OF PROJECT ACTIVITIES(TW/SL=30HOURS)

Methods for project identification:

Students may identify the project topic using one or more of the following methods:

- Interaction with local rural or urban stakeholders such as local leaders, corporation/municipality personnel, NGOs, panchayat representatives, etc.
- Review of issues highlighted in print and electronic media, and social networks (WhatsApp, Facebook, X, Instagram, etc.).
- After selecting a broad topic, students shall collect data, conduct a feasibility survey, estimate timelines and resources, approximate expenditure, and then define the problem statement and objectives clearly.

List of Project Topics and Engineering Outcomes:

The following structured sequence of activities is to be carried out during the semester:

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Sl. No.	Project title	Measurable engineering outcome	Mapped POs	SDGs
1	Rural and urban water conservation and management systems	Prepare a site-specific water-saving plan, estimate water demand–supply gap, and propose a feasible conservation intervention with quantified savings.	PO1, PO2, PO3, PO4, PO10, PO11	SDG 6, SDG 11, SDG 12
2	Waste management and recycling	Conduct waste audit, classify waste streams, and design a segregation/recycling workflow with measurable reduction in mixed waste.	PO2, PO3, PO4, PO6, PO8, PO10	SDG 11, SDG 12, SDG 13
3	Afforestation	Identify a degraded area, prepare plantation layout, and demonstrate survival-rate tracking and maintenance schedule for saplings.	PO2, PO3, PO4, PO6, PO7, PO11	SDG 11, SDG 13, SDG 15
4	Biogas generation and power generation	Estimate organic waste availability, size a small biogas system, and document expected gas output or energy yield.	PO1, PO2, PO3, PO4, PO5, PO10	SDG 7, SDG 11, SDG 12
5	DPR for solar power rural plant	Prepare a DPR with load assessment, panel sizing, cost estimate, and projected energy generation and payback.	PO1, PO2, PO3, PO4, PO5, PO10	SDG 7, SDG 9, SDG 11
6	DPR for electrification of village/tribal community	Map unserved/underserved households, propose electrification layout, and estimate coverage, losses, and implementation cost.	PO1, PO2, PO3, PO4, PO10, PO11	SDG 7, SDG 9, SDG 10
7	DPR for rural drainage system	Survey drainage bottlenecks, develop a drainage layout, and estimate runoff handling capacity and flood-risk reduction.	PO1, PO2, PO3, PO4, PO6, PO10	SDG 6, SDG 9, SDG 11
8	Sustainability and environmental health projects	Assess local environmental health issues and propose interventions with measurable improvement in hygiene, safety, or resource use.	PO2, PO3, PO4, PO6, PO7, PO8	SDG 3, SDG 6, SDG 11, SDG 12
9	Plastic free campaigns	Measure plastic usage before and after awareness intervention and report percentage reduction or behavioural change.	PO2, PO3, PO6, PO7, PO8, PO10	SDG 11, SDG 12, SDG 13
10	Health and nutrition awareness	Conduct baseline and post-program awareness survey and document improvement in awareness core or adoption of healthier practices.	PO2, PO6, PO7, PO8, PO9, PO10	SDG 2, SDG 3, SDG 11
11	Societal projects involving health wellness	Identify a community health need and develop an awareness/service module with measurable participation and feedback outcomes.	PO2, PO3, PO6, PO8, PO9, PO10	SDG 3, SDG 11, SDG 17

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12	Air quality monitoring system	Collect air-quality data, compare with reference limits, and present trends along with possible mitigation suggestions.	PO2, PO3, PO4, PO5, PO6, PO10	SDG 3, SDG 11, SDG 13
13	Plastic waste reduction campaign	Track collection, segregation, and replacement actions, and quantify reduction in plastic waste generation or littering.	PO2, PO3, PO6, PO7, PO8, PO10	SDG 11, SDG 12, SDG 13
14	Urban greening projects	Prepare greening plan, identify planting locations, and assess environmental benefits such as shade, aesthetics, or heat mitigation.	PO2, PO3, PO4, PO6, PO7, PO11	SDG 11, SDG 13, SDG 15
15	Smart agriculture solution	Design a low-cost monitoring or irrigation support solution and estimate improvement in water use efficiency or crop support.	PO1, PO2, PO3, PO4, PO5, PO10	SDG 2, SDG 6, SDG 9
16	Smart irrigation system	Estimate crop water requirement, propose control logic, and quantify water savings compared with conventional irrigation.	PO1, PO2, PO3, PO4, PO5, PO10	SDG 2, SDG 6, SDG 12
17	Youth mentoring programmes	Deliver a structured mentoring activity and measure participation, engagement, and skill/awareness improvement.	PO6, PO8, PO9, PO10, PO11	SDG 4, SDG 10, SDG 17
18	Adult education	Conduct learner-needs assessment, prepare instructional content, and measure improvement in basic literacy or numeracy indicators.	PO6, PO8, PO9, PO10, PO11	SDG 4, SDG 10, SDG 17
19	Food security initiatives/cold storage system	Estimate storage need, design a simple cold-chain concept, and document reduction in spoilage or wastage.	PO1, PO2, PO3, PO4, PO5, PO10	SDG 2, SDG 9, SDG 12
20	Human rights awareness with legal systems	Prepare and deliver an awareness module and assess increase in legal awareness and access-to-rights understanding.	PO6, PO7, PO8, PO9, PO10	SDG 5, SDG 10, SDG 16
21	House tax collection through digital media	Develop a simple digital workflow or awareness support and measure improvement in compliance, convenience, or response time.	PO2, PO3, PO4, PO5, PO10, PO11	SDG 9, SDG 11, SDG 16
22	Use of application / application program	Build or demonstrate a useful community app and measure usability, adoption, or efficiency improvement.	PO1, PO3, PO4, PO5, PO9, PO10	SDG 9, SDG 11, SDG 17
23	Creation of Panchayat library	Plan the library model, catalogue resources, and measure usage, accessibility, or participation outcomes.	PO6, PO8, PO9, PO10, PO11	SDG 4, SDG 10, SDG 11, SDG 17

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Suggested Learning Resources:

Textbooks:

1. **Phadke N. D.** Community Engagement and Social Innovation. 1st ed., Oxford University Press, New Delhi.
2. **Garg, N. R.** Project-Based Learning in Engineering Education. 1st ed., Pearson India Education Services, Noida.
3. **Gupta A. and P. Singh.** Service Learning and Community Projects. 1st ed., McGraw-Hill Education (India), New Delhi.
4. **Wilson, G.** Practical Guide to Community Development Projects. 2nd ed., Routledge, London.

Reference books:

1. NPTEL courses on Project-Based Learning and Social Innovation.
2. SWAYAM courses on community engagement and sustainability.
3. UN Sustainable Development Goals portal: <https://sdgs.un.org>
4. MyGov India and local civic body portals for community initiatives.
5. YouTube resources on design thinking, social innovation, and community service learning.
6. NGO and government field-action case studies related to sanitation, water, health, education, and environment.

Weblinks and Video Lectures(e-Resources):

1. NPTEL courses on Engineering Geology (IIT Roorkee, IIT Kharagpur).
2. NPTEL courses on Soil Mechanics and Foundation Engineering (IIT Delhi, IIT Bombay).
3. Virtual Labs- Geotechnical Engineering Virtual Lab (IIT Kanpur): <https://vlab.co.in>
4. Geological Survey of India (GSI)-Maps, reports, and publications: <https://www.gsi.gov.in>
5. YouTube channels: Civil Engineering Essentials, The Engineering Classroom (soil mechanics experiments).
6. American Society of Civil Engineers (ASCE)-Geo technical resources and standards

Teaching Learning Process:

The suggested TLP for Community/Societal Project is as follows;

Week/ Phase	Teaching-Learning Activity	Faculty Role	Student Activity	Output/Evidence
1	Course introduction, objectives, ethics, conduct, and assessment briefing	Explain course scope, rules, rubrics, and expected deliverables	Understand course requirements and form teams	Team list, course plan
2	Community problem identification and topic selection	Guide topic framing and feasibility	Identify local issues through discussion and observation	Shortlisted project topic
3	Stakeholder interaction and preliminary survey	Demonstrate survey methods and stakeholder engagement	Collect initial data from community/users	Survey notes, interview record
4	Problem statement and objective Formulation	Review and refine problem statement	Prepare problem statement, scope, and objectives	Approved problem statement

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5	Literature/case study review and baseline analysis	Suggest relevant references and examples	Study existing solutions and compare approaches	Baseline analysis summary
6	Project planning and role assignment	Help teams organize tasks, timeline, and responsibilities	Plan activities, divide roles, and prepare schedule	Workplan/Gantt chart
7	Feasibility analysis and solution brainstorming	Check technical feasibility and practicality	Generate possible engineering solutions	Solution alternatives sheet
8	Selection of final solution and design approach	Review final concept and design logic	Finalize concept, methods, and expected outcome	Concept note/ design outline
9	Data processing / calculations/sizing/ mapping	Support computations and technical review	Analyze data, perform calculations, prepare maps/charts	Technical analysis sheet
10	Prototype/model/ audit / DPR / app development	Monitor progress and correct technical issues	Develop the selected output	Working model/ draft DPR/map/ app
11	Testing, refinement, and implementation planning	Evaluate technical correctness and improvements	Test prototype or validate proposal with users	Test results / revised output
12	Field implementation /demonstration/ awareness activity	Facilitate community interaction and documentation	Conduct implementation nor demonstration	Photos, attendance, implementation record
13	Documentation of outcomes, feedback, and impact	Review report structure and completeness	Compile findings, stakeholder feedback, and observations	Draft report
14	Presentation preparation and viva practice	Conduct mock presentation and feedback	Prepare slides/poster and rehearse	Presentation deck
15	Final presentation, submission, and reflection	Evaluate performance using rubrics	Present project, submit report, reflect on learning	Final report, presentation, viva

Assessment structure:

A. Continuous Internal Evaluation(CIE)-50marks

- Students, in batches of 3-4, shall undertake at least one project (or a combination of two related activities) aiming, as far as possible, at a logical implemented or implementable outcome.
- CIE will be conducted by a departmental committee (HoD/nominee, guide and one senior faculty) using the following rubrics totaling 50 marks:

CIE pass requirement:

- A student shall secure a minimum of 20 marks out of 50 in CIE to become eligible to appear for SEE.

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- Students who fail to earn the required CIE marks may be given additional opportunities before closure of the semester; no re-doing of CIE is permitted after the end of the semester. B. Semester End Examination (SEE)–100marks (scaled to 50) - Examination duration: 2 hours. - Maximum examination marks: 100 - The SEE shall be conducted batch-wise by a committee of three faculty: project guide, one faculty from the same department and one from a different department. SEE pass requirement and overall passing rule: - For a pass in SEE, a student shall secure minimum 35 marks out of 100. - For declaration of a pass grade, the sum of CIE marks (out of 50) and scaled SEE marks (out of 50) shall be ≥ 40; otherwise, the student is awarded grade F (Fail).					
CIE Rubric—Continuous Internal Evaluation (Total 50 marks):					
Criterion	Weight (marks)	Excellent (Full marks)	Good	Fair	Needs Improvement
Problem identification & Relevance to society/industry /community	8	Problem is clearly identified with strong evidence of societal relevance and well-defined scope.	Problem is relevant and scope is clear with adequate supporting evidence.	Problem defined but justification or evidence is weak.	Problem unclear or not relevant; little/no supporting evidence.
Formation of problem statement; Engineering approach, innovation & feasibility	10	Problem statement is precise; approach is sound, innovative and clearly feasible.	Problem statement adequate; approach feasible with minor gaps.	Problem statement partial; approach feasibility is marginal.	Problem statement missing or approach not feasible.
Interaction with stakeholders; Data collection, analysis & interpretation	8	Thorough stakeholder engagement; data collection is comprehensive; Analysis is well-interpreted.	Good engagement; data and analysis adequate with minor gaps.	Limited engagement; data incomplete and analysis superficial.	Little/no stakeholder contact; insufficient or no data/ analysis.
Project documentation; Clarity, organization & problem-solving demonstrated	10	Documentation is complete, well-organized, analytical, and shows strong problem-solving.	Documentation complete and clear. With some analytical content.	Documentation Basic with omissions; problem-solving limited.	Documentation missing/poorly organized; no clear problem-solving.
Communication & Presentation skills	6	Presentation is confident, structured, and answers queries fully; visuals effective.	Presentation clear and satisfactory; responds to most queries.	Presentation acceptable but lacks clarity or confidence; Weak responses.	Presentation poor or absent; unable to respond.
Contribution & Benefit to society (impact, sustainability)	8	Clear, demonstrable societal benefit and sustainability; Realistic path to implementation.	Benefit plausible; sustainability considered with minor gaps.	Limited or unclear societal benefit; sustainability not well addressed.	No evident benefit or sustainability; project not community-oriented.

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Notes for CIE rubric:

- Minimum CIE pass requirement: 20/50 to be eligible for SEE. [Use departmental committee (HoD /guide + senior faculty) to apply the rubric and record marks.]

SEE Rubric—Semester End Examination (Enter marks out of 100; scaled to 50 later):

Criterion	Weight (marks)	Excellent (Full marks)	Good	Fair	Needs Improvement
Problem identification & Relevance to society/industry/ community	16	Problem and relevance are articulated clearly with strong evidence and context.	Problem relevance clear with reasonable evidence.	Problem stated but evidence/ context weak.	Problem poorly defined or irrelevant.
Formation of problem statement; Engineering approach, innovation & feasibility	20	Problem statement is precise; approach demonstrates engineering depth, novelty and feasibility.	Approach is technically sound and feasible with minor limitations.	Approach basic; limited technical depth or feasibility concerns.	No viable engineering approach or infeasible plan.
Interaction with stakeholders; Data collection, analysis & interpretation	16	Excellent stakeholder engagement; rigorous data collection and insightful analysis.	Good engagement and acceptable analysis.	Superficial data collection and limited analysis.	Inadequate or no data; poor analysis.
Project documentation; Clarity, technical rigor & problem-solving demonstrated	20	Report is comprehensive, technically rigorous, and demonstrates systematic problem-solving.	Report is complete and technically correct with minor gaps.	Report lacks technical depth or has notable omissions.	Report missing key elements or technically incorrect.
Communication, Presentation & Viva-voce responses	12	Candidate presents expertly, defends work persuasively and answers all queries correctly.	Good presentation and satisfactory answers to most queries.	Presentation adequate but fails to answer some technical questions.	Poor presentation and unable to defend work.
Contribution & Benefit to society; Impact assessment & sustainability	16	Clear, evidence-based assessment of social impact and Sustainability with scaling recommendations.	Reasonable impact discussion and sustainability considerations.	Limited evaluation of impact or sustainability.	No coherent assessment of impact or sustainability.

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SEE pass rule:

- Student must secure at least 35/100 in SEE itself to be eligible for pass consideration.
- Final passing is based on CIE (out of 50) + SEE (scaled to 50) ≥ 40 . Otherwise, grade F (Fail) is awarded.

Suggested implementation notes (for BoS/exam committees):

- Use numerical scores from the rubric and keep brief evaluator comments for each criterion.
- For team projects: record individual contribution with in the documentation and adjust individual marks using a peer-evaluation sheet or guide's assessment.
- Maintain evidence (field notes, photos, questionnaires, DPRs, reports) as annexures for SEE moderation.
- Use standardized scores sheet (spreadsheet) mapping rubric item to columns for easy aggregation and archival.

Mapping of CO's, PO's with PSO's														
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0														
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1	2	3	1	3	1	3	2	2	2	2	1	3	2	2
CO2	2	2	2	3	2	2	2	1	3	3	3	3	3	3
CO3	3	3	3	2	2	3	3	2	2	2	2	3	2	2
CO4	1	2	2	2	1	3	3	3	2	2	1	3	3	2
CO5	3	3	3	3	3	3	3	2	3	3	3	3	2	2

Mapping of CO's with Knowledge and Attitude Profile (WK)									
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0									
CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
CO1	0	1	2	2	1	3	3	2	2
CO2	0	2	2	2	2	3	2	1	3
CO3	2	3	3	3	2	3	3	2	2
CO4	0	0	1	1	1	2	3	3	2
CO5	1	2	3	3	3	3	3	2	3

Mapping of CO's with Sustainable Development Goals (SDG)																	
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0																	
CO/SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1	2	1	2	2	0	2	0	2	2	2	3	2	2	1	1	3	3
CO2	2	1	1	3	1	2	1	3	3	1	2	2	1	0	0	2	3
CO3	2	1	2	2	0	2	2	3	3	2	3	3	3	1	2	3	2
CO4	2	1	3	2	1	3	2	2	2	2	3	3	3	2	3	3	3
CO5	2	2	2	3	1	3	2	3	3	2	3	3	3	2	2	3	3

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Course Title	MICROCONTROLLER						
Course Code	1BSESU402						
Course Category	IPCC (Integrated Professional Core Course)						
Teaching - Learning Scheme & Credit	L	T	P	S	Total	Total Teaching Hours	Credit
	3	0	1	0	4	42+0+28+50=120	4
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hrs	

Course Learning Objectives:	
CLO1	Understand Basic computer architecture, ARM design philosophy and ARM processor architecture and fundamentals
CLO2	Learn the ARM Instruction set of ARM microcontroller and to learn the assembly programming
CLO3	Understand Thumb instructions of ARM controller
CLO4	Understand Various Input/output device Interfacing with ARM controller
CLO5	Understand Timer, ADC, DAC and communication modules of ARM controller

SYLLABUS	No. of Hours	BTLs
UNIT 1	11	L1-L4
Basic Structure of Computers: Basic Operational Concepts, Bus Structures, Basic Performance Equation, Clock Rate, Performance Measurement Input/ Output Organization: Accessing I/O Devices, Direct Memory Access, Standard I/O Interfaces–PCI Bus, SCSI Bus, USB ARM Embedded Systems: Introduction, RISC design philosophy, ARM design philosophy, Embedded system hardware– AMBA bus protocol, ARM bus technology, Memory, Peripherals, Embedded system software–Initialization (BOOT)code, Operating System, Applications. ARM Processor Fundamentals, ARM core data flow model, registers, current program status register, Pipeline, Core extensions. Self- Study Component: • Study the evolution of ARM processors and compare ARM with other processor architectures(8051, AVR, PIC). • Explore different ARM Cortex series (M, R, A) and their applications. • Read about modern embedded system applications in IoT, automotive, and consumer electronics.		
UNIT 2	9	L1-L4
Introduction to the ARM Instruction set: Introduction, Data processing instructions, Load-Store instruction, Software interrupt instructions, Program status register instructions, Loading constants, ARMv5 Extensions, Conditional Execution. Self- Study Component: • Practice additional ARM assembly programs using an ARM simulator/Keil IDE. • Study ARM addressing modes and compare them with other RISC processors. • Explore optimization techniques using conditional execution.		

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UNIT 3	7	L1-L4
Introduction to the THUMB instruction set: Introduction, THUMB register usage, ARM– THUMB interworking, Other branch instructions, Data processing instructions, Stack instructions, Software interrupt instructions. Efficient C Programming: Overview of C Compilers and optimization, Basic C Data types, C looping structures. Self- Study Component: • Compare ARM and Thumb instruction sets in terms of code size and execution speed. • Learn compiler optimization options in Keil/GCC. • Develop simple embedded C programs demonstrating loops, arrays, and functions.		
UNIT 4	9	L1-L4
General Purpose Parallel I/O: Interface of LED's and switches, Seven Segment Led Display, LCD, Keypad, Relay and Buzzer, DC motor, Stepper motor. Self- Study Component: • Study the datasheets of Different types of LEDs, LCDs, keypads, relays, DC motors, and stepper motors. • Watch demonstrations of ARM-based interfacing using LPC2148 or similar development boards. • Explore real-world applications of GPIO interfacing in automation and robotics.		
UNIT 5	9	L1-L4
TIMER, ADC, DAC, UARTs: Timers and its modes of operations, 10-bit ADC, 10-bit DAC, UARTs, Serial Communication, Exceptions, Interrupts and Vector Table, Interrupt Sources, External Interrupt, I²C interface, SPI Self- Study Component: • Study communication protocols such as UART, SPI, and I²C through manufacturer application notes. • Compare serial communication protocols (UART vs SPI vs I²C vs CAN). • Explore ARM-based applications involving sensors, ADC/DAC, and Internet of Things (IoT).		
PRACTICAL COMPONENTS OF IPCC		
1. Write an ALP to find the sum of first 10 integer numbers. 2. Write an ALP to add an array of 16-bit numbers and store the 32-bit result in internal RAM.. 3. Write an ALP to arrange a series of 32-bit numbers in ascending / descending order. 4. Write an ALP to find factorial of a number. 5. Write an ALP to find the square of a number (1 to 10) using look-up table. 6. Write an ALP to find the largest / smallest number in an array of 32 numbers. 7. Write an ALP to i) multiply two 16-bit binary numbers. ii) add two 64-bit numbers 8. i) Write an ALP to count the number of ones and zeros in two consecutive memory locations. ii) Write an ALP to Scan a series of 32-bit numbers to find how many are negative. 9. Interface a Stepper motor and rotate it in clockwise and anti-clockwise direction. 10. (i) Use internal DAC and generate Triangular and Square wave forms, (ii) Determine Digital output for a given Analog input using Internal ADC of ARM controller. 11. Display the Hex digits 0 to F on a 7-segment LED interface, with a suitable delay in between. 12. (i) Interface a simple Switch and display its status through Relay, Buzzer and LED, (ii) Implement the use of an external interrupt to toggle an LED ON/OFF.		

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TEXT BOOKS:	
1	Andrew N Sloss, Dominic System and Chris Wright, “ARM System Developers Guide”, Elsevier, Morgan Kaufman publisher, 1st Edition, 2008.
2	LPC 2148 User Manual

REFERENCE BOOKS:	
1	ARM Assembly Language – Fundamentals and Techniques, William Hohl, CRC Press, 2009
2	ARM Assembly language An Introduction, J.R. Gibson, Cengage Learning, 2010
e-LEARNING RESOURCES:	
1	Videos and Lecture Notes: http://www.nptel.ac.in

Assessment Details both (CIE and SEE)				
The weightage of Continuous Internal Evaluation (CIE) and Semester End Exam (SEE) is 50% each. The students have to obtain a minimum of 40% marks individually both in CIE and SEE to pass. CIE: The CIE has two components – CIE - theory component and CIE – laboratory component. Students have to score a minimum of 40% Marks in the total of CIE - theory and CIE – laboratory components put together, provided students have to score a minimum of 40% marks in CIE laboratory component alone to qualify to take SEE. Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration) and reduced to 50 Marks. **Self-Study Component should be not included for SEE & CIE.				
CONTINUOUS INTERNAL EVALUATION (CIE)		Max. Marks		Minimum Marks to be scored in CIE, to qualify to take SEE (40% individually)
Theory	Weightage of CIE1 and CIE2 Tests or CIE3	30		12
Laboratory components	Rubrics for experiment are added, then taken average	10	20	08
	Lab CIE	10		
TOTAL		50		20

QUESTION PAPER PATTERN (SEE)										
Q. No.	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
UNIT	1		2		3		4		5	
1. Two full questions (each of 20 Marks) are to be set from each unit.										
2. Student shall answer five full questions selecting one full question from each unit.										

Course Outcomes: After the completion of the course, the student will be able to:	
CO1	Understand basic computer structure, Input output organization, Bus Architecture, RISC and ARM design philosophy, ARM processor architecture

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CO2	Analyze and write ARM instruction set programs including data processing, load-store, software interrupt, and program status register instructions, applying conditional execution and constant-loading techniques.
CO3	Interface general-purpose I/O peripherals — LEDs, switches, seven-segment display, LCD, keypad, relay, buzzer, DC motor, and stepper motor — with an ARM-based microcontroller.
CO4	Configure and program on-chip peripherals (Timers, ADC, DAC, UART, Interrupt Controller, I2C, and SPI)
CO5	Design a system, component or process as per needs and specifications using ARM controller

Mapping of CO's, PO's with PSO's														
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	0	0	0	0	0	1	0	1	0	3
CO2	3	2	2	1	1	0	0	0	0	1	0	1	0	3
CO3	2	2	3	2	2	0	0	0	1	1	0	1	0	3
CO4	2	1	2	3	3	0	0	0	1	1	2	1	1	2
CO5	2	2	2	3	3	0	0	0	1	1	2	1	1	2

Mapping of CO's with Knowledge and Attitude Profile (WK)										
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0										
CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	
CO1	0	1	2	3	0	1	0	0	0	
CO2	0	1	2	3	1	2	0	0	0	
CO3	0	1	2	3	1	2	0	0	0	
CO4	0	0	2	2	2	3	1	0	0	
CO5	0	0	2	2	2	3	1	0	0	

Mapping of CO's with Sustainable Development Goals (SDG)																	
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0																	
CO/SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
CO2	0	0	0	1	0	0	0	0	2	0	0	0	0	0	0	0	0
CO3	0	0	0	1	0	0	0	1	2	0	0	1	0	0	0	0	0
CO4	0	0	0	1	0	0	1	1	2	0	1	1	0	0	0	0	0
CO5	0	0	0	1	0	0	1	1	3	0	1	1	0	0	0	0	0

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Scheme: 2025

Course Title	CONTROL SYSTEMS						
Course Code	1BSEST403						
Course Category	PCC (Professional Core Course)						
Teaching - Learning Scheme & Credit	L	T	P	S	Total	Total Teaching Hours	Credit
	3	2	0	0	5	42+28+0+50=120	4
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hrs	

Course Learning Objectives:	
CLO1	Learn the type of System, dynamics of physical systems, classification of control system, analysis and design objective.
CLO2	Represent the system by a transfer function, block diagram reduction method, and Mason's gain formula.
CLO3	Learn time response analysis and demonstrate their knowledge of frequency response.
CLO4	Learn stability analysis of the system using Root locus, bode plot and Nyquist plot.
CLO5	Learn the concept of Compensator and controller.

SYLLABUS	No. of Hours	BTLs
UNIT 1	9L+5T	L1-L4
Introduction to Control Systems: Types of Control Systems, Effect of Feedback Systems, Differential equation of Physical Systems – Mechanical Systems, Electrical Systems, Analogous Systems. Block diagrams and signal flow graphs: Transfer functions, Block diagram algebra and Signal Flow graphs.		
<u>SELF-STUDY COMPONENTS:</u> AC Servomotor, DC servomotor, Synchro Transmitter and Receiver		
UNIT 2	9L+5T	L1-L4
Time Response of feedback control systems: Standard test signals, Unit step response of First and Second order Systems. Time response specifications, Time response specifications of second order systems, steady state errors and error constants. Introduction to PI, PD and PID Controllers (excluding design).		
<u>SELF-STUDY COMPONENTS:</u> On-Off (Two-Position) Controller, Feedback and Feedforward Control System		
UNIT 3	9L+5T	L1-L4
Stability analysis: Concept of stability, necessary conditions for Stability, Routh- stability criterion, Relative stability criterion Root-Locus Techniques: Root locus concepts, Construction of root loci, Stability of System.		
<u>SELF-STUDY COMPONENTS:</u> Effect of Addition of open loop poles and zeros on root locus and stability, Root contour		
UNIT 4	9L+5T	L1-L4
Frequency domain analysis and stability using Bode plots: Correlation between time and frequency response, Bode Plots, Experimental determination of transfer function.		
<u>SELF-STUDY COMPONENTS:</u> Compensator- RC Lead compensator and RC Lag compensator.		

1. Two full questions (each of 20 Marks) are to be set from each unit.

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2. Student shall answer five full questions selecting one full question from each unit.

Course Outcomes: After the completion of the course, the student will be able to:

CO1	Analyze physical systems and their mathematical models using differential equations, transfer functions, and system analogies.
CO2	Evaluate the effect of feedback on control systems by examining block diagrams, signal flow graphs, and overall system behavior.
CO3	Analyze the time response characteristics and steady-state performance of first- and second order control systems, including the influence of basic controllers.
CO4	Assess the stability and relative stability of control systems using Routh–Hurwitz criterion and root locus techniques.
CO5	Analyze control system stability and performance in the frequency domain using Bode, Polar, and Nyquist plots.

Mapping of CO's, PO's with PSO's

Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	1	2	1	0	0	0	0	0	0	3	2	0
CO2	3	3	2	2	1	0	0	0	0	0	0	3	2	0
CO3	3	3	3	2	2	0	0	0	0	0	0	3	3	1
CO4	3	3	2	3	2	0	0	0	0	0	0	3	3	1
CO5	3	3	2	3	3	0	0	0	0	0	0	3	3	1

Mapping of CO's with Knowledge and Attitude Profile (WK)

Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0

CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
CO1	2	3	3	2	0	1	0	0	0
CO2	0	2	3	3	1	2	0	0	0
CO3	0	2	3	3	2	2	0	0	0
CO4	0	2	3	3	1	2	0	1	0
CO5	0	2	3	3	1	2	0	1	0

Mapping of CO's with Sustainable Development Goals (SDG)

Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0

CO/SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1	0	0	0	3	0	0	2	1	2	0	1	0	1	0	0	0	0
CO2	0	0	0	3	0	0	2	2	3	0	1	0	1	0	0	0	0
CO3	0	0	1	3	0	0	3	2	3	0	2	1	2	0	0	0	0
CO4	0	0	1	3	0	0	3	2	3	0	2	1	2	0	0	0	0
CO5	0	0	1	3	0	0	3	2	3	0	2	1	2	0	0	0	0

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Scheme: 2025

Course Title	SIGNALS AND SYSTEMS						
Course Code	1BEC404						
Course Category	PCC (Professional Core Course)						
Teaching - Learning Scheme & Credit	L	T	P	S	Total	Total Teaching Hours	Credit
	3	0	0	3	3	45+0+0+45=90	3
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hrs	

Course Learning Objectives:	
CLO1	Apply knowledge of mathematics and Engineering fundamentals to Identify and characterize different classes of signals.
CLO2	Compute the response and analyze the properties of an LTI system.
CLO3	Analyze the signals in time and frequency domain for non-periodic signals.
CLO4	Apply Fourier representations to analyze sampling process and mixed signals.
CLO5	Apply ZT for broader characterization of discrete time signals and LTI systems.

SYLLABUS	No. of Hours	BTLs
UNIT 1	8	L1-L4
INTRODUCTION: Definition of signals and systems, Mathematical Representation, Classification of signals, Operation on signals, Elementary signals, Systems viewed as interconnection of operations, Properties of systems.		
SELF-STUDY COMPONENTS: Study real-life examples of continuous-time and discrete-time signals in communication, biomedical, and control systems.		
UNIT 2	9	L1-L4
TIME DOMAIN REPRESENTATION OF LTI SYSTEMS: Introduction, Impulse response representation of LTI systems, Properties of impulse response representation, Difference equation representation of LTI systems.		
SELF-STUDY COMPONENTS: Study practical applications of LTI systems in audio filtering and image processing.		
UNIT 3	9	L1-L4
FOURIER REPRESENTATIONS FOR SIGNALS: Introduction, Discrete Time non-periodic signals: DTFT representation, Continuous Time Non-periodic signals: FT representation, Properties of Fourier transforms and DTFT.		
SELF-STUDY COMPONENTS: Study the significance of orthogonal basis functions in signal representation.		
UNIT 4	8	L1-L4
APPLICATIONS OF FOURIER REPRESENTATIONS: Introduction, Frequency response of LTI systems, Fourier Transform representation of periodic signals, Fourier Transform representation of Discrete time signals, Sampling, reconstruction of continuous time signals.		
SELF-STUDY COMPONENTS: Study the Sampling Theorem and aliasing using simulation tools.		

UNIT 5	8	L1-L4
Z-TRANSFORM: Introduction, Properties of ROC, Properties of Z-transform, Inverse of Z-transform.		
SELF-STUDY COMPONENTS: Study the Transform analysis of LTI systems, causality and stability analysis.		

TEXT BOOKS:	
1	Simon Haykin, Barry Van Ven, Signals and systems. Ed 2, John Wiley. Indian Ed, 2021.

REFERENCE BOOKS:	
1	H.P. HSU. Schaum's Outlines- Signals & Systems, Ed 2, TMH, 2010.
2	Alan V. Oppenheim, Alan S. Willsky, Syed Hamid Nawab, Signals & systems Ed 2, PHI, 2014.
e-LEARNING RESOURCES:	
1	https://nptel.ac.in/courses/117101055
2	https://nptel.ac.in/courses/117104074

Assessment Details both (CIE and SEE)			
The weightage of Continuous Internal Evaluation (CIE) and Semester End Exam (SEE) is 50% each. The students have to obtain a minimum of 40% marks individually both in CIE and SEE to pass. CIE: The CIE has three components – CIE - theory component, assignment and group activity. Students have to score a minimum of 40% Marks in the total of CIE - theory, assignment and group activity components put together to take SEE. SEE: Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration) and reduced to 50 Marks. **Self-Study Component should be not included for SEE & CIE.			
CONTINUOUS INTERNAL EVALUATION (CIE)		Max. Marks	Minimum Marks to be scored in CIE, to qualify to take SEE (40% individually)
Theory	Weightage of CIE1 and CIE2 Tests or CIE3	50	20
TOTAL		50	20

QUESTION PAPER PATTERN (SEE)										
Q. No.	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
UNIT	1	2	3	4	5					
1. Two full questions (each of 20 Marks) are to be set from each unit.										
2. Student shall answer five full questions selecting one full question from each unit.										

Course Outcomes: After the completion of the course, the student will be able to:	
CO1	Classify continuous-time and discrete-time signals and systems, and explain their mathematical representation, elementary signals, signal operations, and fundamental system properties.

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CO2	Analyze Linear Time-Invariant (LTI) systems using impulse response and difference equation representations to determine system characteristics.
CO3	Apply Fourier Transform (FT) and Discrete-Time Fourier Transform (DTFT) techniques to represent and analyze continuous-time and discrete-time signals in the frequency domain.
CO4	Analyze the frequency response of LTI systems using Fourier representations and apply sampling and reconstruction principles to continuous-time signals.
CO5	Analyze and evaluate discrete-time LTI systems using Z-transform techniques, including ROC, stability, causality, inversion, and unilateral Z-transform applications.

Mapping of CO's, PO's with PSO's														
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0														
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	3	3	0	0	0	0	0	0	0	0	1	3	1	0
CO 2	3	3	2	1	0	0	0	0	0	0	1	3	1	0
CO 3	3	3	3	2	1	0	0	0	0	0	1	3	2	0
CO 4	3	3	3	3	2	0	0	0	0	0	1	3	3	0
CO 5	3	3	3	3	2	0	0	0	0	0	2	3	3	0

Mapping of CO's with Knowledge and Attitude Profile (WK)										
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0										
CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	
CO1	3	3	1	1	0	0	0	1	0	
CO2	3	3	2	2	1	0	0	1	0	
CO3	3	3	3	2	2	0	0	1	0	
CO4	3	3	3	3	2	0	0	2	0	
CO5	3	3	3	3	2	0	0	2	0	

Mapping of CO's with Sustainable Development Goals (SDG)																	
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0																	
CO/SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1	0	0	0	3	0	0	0	0	2	0	0	0	0	0	0	0	0
CO2	0	0	0	3	0	0	1	0	3	0	1	0	0	0	0	0	0
CO3	0	0	1	3	0	0	2	0	3	0	2	0	1	0	0	0	0
CO4	0	0	2	3	0	0	3	0	3	0	2	0	2	0	0	0	0
CO5	0	0	2	3	0	0	3	0	3	0	2	0	2	0	0	0	0

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Scheme: 2025

Course Title	SIGNALS AND ANALOG COMMUNICATIONS LABORATORY						
Course Code	1BECL405						
Course Category	PCCL (Professional Core Course Laboratory)						
Teaching - Learning Scheme & Credit	L	T	P	S	Total	Total Teaching Hours	Credit
	0	0	30	0	30	30	1
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hrs	

Course Learning Objectives:	
CLO1	Understand and generate elementary continuous-time and discrete-time signals and perform basic signal operations.
CLO2	Analyze the behavior of Linear Time-Invariant (LTI) systems using convolution, Fourier analysis, and sampling concepts.
CLO3	Apply transform-based concepts to analyze sampling, aliasing, and signal reconstruction in communication systems.
CLO4	Implement analog modulation and demodulation techniques such as AM, DSB-SC, and FM.
CLO5	Implement pulse modulation and multiplexing techniques including PAM, PPM, and TDM using MATLAB for communication system analysis.

Syllabus	
PART: A - CONVENTIONAL EXPERIMENTS	
1	Generation of Elementary Signals and Signal Operations using MATLAB.
2	Response Calculation of Discrete LTI System Using Convolution using MATLAB.
3	Frequency response analysis of LTI systems and demonstration of Sampling Theorem, Aliasing and Signal Reconstruction using MATLAB.
4	Analyze signals in the frequency domain using Fourier Transform techniques using MATLAB.
5	Generate and analyse Amplitude Modulation (AM) and Demodulation using MATLAB.
6	Generate and analyse Double Sideband Suppressed Carrier (DSB-SC) Modulation and Demodulation using MATLAB.
7	Generate and analyse Frequency Modulation (FM) and Demodulation using MATLAB.
8	Implement Pulse Amplitude Modulation (PAM) and analyze its waveform characteristics using MATLAB.
9	Generate and analyse Pulse Position Modulation (PPM) and its Demodulation using MATLAB.
10	Implement Time Division Multiplexing (TDM) for two band-limited signals and analyse the multiplexed output using MATLAB.
PART: B - TYPICAL OPEN-ENDED EXPERIMENTS	
Open-ended experiments are a type of laboratory activity where the outcome is not predetermined, and students are given the freedom to explore, design, and conduct the experiment based on the problem statements as per the concepts defined by the course coordinator. It encourages creativity, critical thinking, and inquiry-based learning.	

Dr. Ambedkar Institute of Technology, Bengaluru - 560056
School of Electricals, Electronics Sciences and Engineering
Program: Electronics and Communication Engineering

Semester: IV

Scheme: 2025

1	Implement and analyse Pulse Width Modulation (PWM) and Demodulation using Simulink.
2	Implement and analyse Pulse Position Modulation (PPM) and Demodulation using Simulink.

Teaching & Learning Process (Innovative Delivery Methods):	
1	Active Learning Techniques
2	Problem-Based Learning (PBL)
3	Team-Based Learning (TBL)
4	Hands-On Experiments and Simulations

Suggested Learning Resources: (Text Book/ Reference Book/ Manuals):	
1	Simon Haykin, Barry Van Ven, Signals and systems. Ed 2, John Wiley. Indian Ed, 2008.
2	Louis E Frenzel, Principles of Electronic Communication Systems, 3rd Edition, Mc Graw Hill Education (India) Private Limited, 2016. ISBN: 978-0-07-066755-6.

Assessment Details both (CIE and SEE)			
The weightage of Continuous Internal Evaluation (CIE) and Semester End Exam (SEE) is 50% each. The students have to obtain a minimum of 40% marks individually both in CIE and SEE to pass. CIE: The CIE has two components – CIE - theory component and CIE – laboratory component. Students have to score a minimum of 40% Marks in the total of CIE - theory and CIE – laboratory components put together, provided students have to score a minimum of 40% marks in CIE laboratory component alone to qualify to take SEE. Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration) and reduced to 50 Marks. **Self-Study Component should be not included for SEE & CIE.			
CONTINUOUS INTERNAL EVALUATION (CIE)		Max. Marks	Minimum Marks to be scored in CIE, to qualify to take SEE (40% individually)
Laboratory components	Rubrics for each experiment are added, then taken average	30	20
	Lab CIE	20	
TOTAL		50	20

Course Outcomes: After the completion of the course, the student will be able to:	
CO1	Generate elementary continuous-time and discrete-time signals and perform basic signal operations.
CO2	Analyze the response of discrete-time LTI systems using convolution, Fourier Transform techniques, sampling theorem, aliasing, and signal reconstruction.
CO3	Implement and analyze analog modulation and demodulation techniques including AM, DSB-SC, and FM using MATLAB.
CO4	Implement and analyze pulse modulation techniques including PAM and PPM using MATLAB.

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CO5	Implement Time Division Multiplexing (TDM) and analyze multiplexed communication signals using MATLAB.
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Mapping of CO's, PO's with PSO's														
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	2	3	0	0	0	0	0	2	3	2	0
CO2	3	3	2	2	3	0	0	0	0	0	2	3	3	1
CO3	3	3	3	2	3	0	0	0	0	0	2	3	3	2
CO4	3	3	3	2	3	0	0	0	0	0	2	3	3	3
CO5	2	3	3	2	3	0	0	0	0	0	2	3	3	3

Mapping of CO's with Knowledge and Attitude Profile (WK)										
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0										
CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	
CO1	3	3	2	1	2	0	0	1	0	
CO2	3	3	3	2	2	0	0	1	0	
CO3	3	3	3	3	2	0	0	1	0	
CO4	3	3	3	3	2	0	0	1	0	
CO5	3	3	3	3	2	0	0	1	0	

Mapping of CO's with Sustainable Development Goals (SDG)																	
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0																	
CO/SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1	0	0	0	3	0	0	0	0	2	0	0	0	0	0	0	0	0
CO2	0	0	1	3	0	0	1	0	3	0	2	0	0	0	0	0	0
CO3	0	0	2	3	0	0	2	0	3	0	2	0	1	0	0	0	0
CO4	0	0	2	3	0	0	2	0	3	0	2	0	1	0	0	0	0
CO5	0	0	2	3	0	0	2	0	3	0	2	0	1	0	0	0	0

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Course Title	Control Systems Lab						
Course Code	1BECL406D						
Course Category	Ability Enhancement Course (Laboratory)						
Teaching - Learning Scheme & Credit	L	T	P	S	Total	Total Teaching Hours	Credit
	0	0	28	2	30	30	1
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hrs	

Course Learning Objectives:	
CLO1	Understand basics of control systems and design mathematical models using block diagram Reduction
CLO2	Understand time domain and frequency domain analysis.
CLO3	Analyze the stability of a system using Root Locus Method
CLO4	Analyze the stability of a system using Bode Plot.
CLO5	Analyze the Stability of the Given System Using Nyquist Plot.

Syllabus	
CONVENTIONAL EXPERIMENTS	
1	Obtain Cascaded, Parallel and Feedback closed loop transfer functions using MATLAB.
2	Convert Transfer function to state space representation and Vice-versa.
3	Obtain 2D and 3D plots of unit step response of 2nd order system.
4	Find the Time Response Specifications of unit step response of 2nd order System
5	Draw root locus using MATLAB
6	Draw BODE PLOTS using MATLAB
7	Draw NYQUIST AND POLAR PLOTS using MATLAB
8	Study the effect of PI controller using MATLAB
9	Study the effect of PD controller using MATLAB
10	Study the effect of PID controller using MATLAB
11	Study of speed characteristics of DC motors using MATLAB.

Teaching & Learning Process (Innovative Delivery Methods):	
1	Active Learning Techniques
2	Problem-Based Learning (PBL)
3	Team-Based Learning (TBL)
4	Hands-On Experiments and Simulations

TEXT BOOKS:	
1	J. Nagarath and MGopal,” ControlSystemsEngineering”, NewAge International(p) Limited Publishers, 5 th Edition- 2005, ISBN:81-224-2008-7
2	Analysis and design of Control system using MATLAB by Rao V Dukkupati, New Age international (p) Limited Publishers,2006 Publication

e-LEARNING RESOURCES:	
1	https://nptel.ac.in/courses/108106098
2	Videos and Lecture Notes: http://www.nptel.ac.in

Assessment Details both (CIE and SEE)			
The weightage of Continuous Internal Evaluation (CIE) and Semester End Exam (SEE) is 50% each. The students have to obtain a minimum of 40% marks individually both in CIE and SEE to pass. CIE: The CIE has two components – CIE - theory component and CIE – laboratory component. Students have to score a minimum of 40% Marks in the total of CIE - theory and CIE – laboratory components put together, provided students have to score a minimum of 40% marks in CIE laboratory component alone to qualify to take SEE. Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration) and reduced to 50 Marks. **Self-Study Component should be not included for SEE & CIE.			
CONTINUOUS INTERNAL EVALUATION (CIE)		Max. Marks	Minimum Marks to be scored in CIE, to qualify to take SEE (40% individually)
Laboratory components	Rubrics for each experiment are added, then taken average	30	20
	Lab CIE	20	
TOTAL		50	20

Course Outcomes: After the completion of the course, the student will be able to:	
CO1	Apply MATLAB to model and analyze control systems using transfer functions, block diagram reduction and state-space representation.
CO2	Analyze time-domain response characteristics of second-order systems using MATLAB.
CO3	Evaluate system stability using Root Locus, Bode, Nyquist and Polar plots.
CO4	Design and analyze PI, PD and PID controllers for control system performance improvement.
CO5	Analyze the speed characteristics of DC motors using MATLAB simulations.

Mapping of CO's, PO's with PSO's														
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	2	3	0	0	0	0	0	0	2	2	0
CO2	3	3	2	2	3	0	0	0	0	0	0	2	2	0
CO3	3	3	3	3	3	0	0	0	0	0	0	2	2	1
CO4	3	3	3	3	3	0	0	0	0	0	0	3	2	1
CO5	3	2	2	2	3	0	0	0	0	0	0	2	3	1

Mapping of CO's with Knowledge and Attitude Profile (WK)										
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0										
CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	
CO1	3	2	2	1	2	0	0	1	0	
CO2	3	3	2	2	2	0	0	1	0	
CO3	3	3	3	2	2	1	0	1	0	
CO4	3	3	3	2	3	1	0	1	0	
CO5	3	2	2	2	3	1	0	1	0	

Mapping of CO's with Sustainable Development Goals (SDG)																	
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0																	
CO/SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1	0	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0
CO2	0	0	0	2	0	0	0	0	3	0	0	0	0	0	0	0	0
CO3	0	0	0	2	0	0	0	0	3	0	0	1	0	0	0	0	0
CO4	0	0	0	2	0	0	1	0	2	0	0	0	0	0	0	0	0
CO5	0	0	0	2	0	0	2	0	2	0	0	0	0	0	0	0	0

Course Title	BIOLOGY FOR ELECTRICAL AND ELECTRONICS ENGINEERS						
Course Code	1SEST407						
Course Category	BSC (Professional Core Course) EEE, ECE, EIE, ETE, ECE(VLSI)						
Teaching - Learning Scheme & Credit	L	T	P	S	Total	Total Teaching Hours	Credit
	2	0	0	2	5	28+0+0+32=60	02
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 02 Hrs	

Course Learning Objectives:	
CLO1	To convey that Biology is as important a scientific discipline as Physics, Chemistry and Mathematics.
CLO2	Introduce biological concepts relevant to electrical/electronic systems.
CLO3	Apply bio design principles to sensors, circuits, and biomedical devices.
CLO4	Explore biomimetic for signal processing, control, and energy systems.
CLO5	Motivate interdisciplinary innovation between biology and electronics.

SYLLABUS	No. of Hours	BTLs
UNIT 1	05	L1-L4
INTRODUCTION TO BIOLOGY: The cell (as an information-processing unit): the basic unit of life, Structure and functions of a cell. The Plant Cell and animal cell, Prokaryotic and Eukaryotic cell, Stem cells (inspiration for regenerative bioelectronics) and their application. Importance of special biomolecules: Enzymes, vitamins and hormones. (Classification with one example each, Properties and functions)		
SELF-STUDY COMPONENTS: Cell organelle functions in detail, cell cycle/division, plant vs. animal cell comparison, stem cell types and ethics.		
UNIT 2	05	L1-L4
BIOMOLECULES AND THEIR APPLICATIONS (QUALITATIVE): DNA/RNA for bio-computing and molecular electronics, Forensics – DNA fingerprinting, lipids (biodiesel, cleaning agents/detergents), Enzymes (glucose-oxidase in biosensors, lignolytic enzyme in bio bleaching). Human Blood substitutes - hemoglobin-based oxygen carriers (HBOCs) and perfluorocarbons (PFCs).		
SELF-STUDY COMPONENTS: Carbohydrate/protein structure, DNA fingerprinting case studies, PCR, lipid-based drug delivery.		
UNIT 3	06	L1-L4
HUMAN ORGAN SYSTEMS AND BIO DESIGNS (QUALITATIVE): Brain as a CPU system (architecture, CNS and Peripheral Nervous System, signal transmission, EEG, Robotic arms for prosthetics. Engineering solutions for Parkinson's disease). Eye as a Camera system (architecture of rod and cone cells, optical corrections, cataract, lens materials, bionic eye). Heart as a pump system (architecture, electrical signaling - ECG monitoring and heart related issues, reasons for blockages of blood vessels, design of stents, pacemakers, defibrillators). Lungs as purification system (architecture, gas exchange mechanisms, spirometry, abnormal lung physiology - COPD, Ventilators, Heart-lung machine). Kidney as a filtration system (architecture, mechanism of filtration, CKD, dialysis systems).		

SELF-STUDY COMPONENTS: Skin as a sensor system, cochlear implants, muscular system/exoskeletons, deep brain stimulation.		
UNIT 4	06	L1-L4
NATURE-BIOINSPIRED MATERIALS AND MECHANISMS (QUALITATIVE): Echolocation (ultrasonography, sonars), Photosynthesis (photovoltaic cells, bionic leaf). Bird flying (GPS and aircraft), Lotus leaf effect (Super hydrophobic and self-cleaning surfaces), Plant burrs (Velcro), Shark skin (Friction reducing swimsuits), Kingfisher beak (Bullet train).		
SELF-STUDY COMPONENTS: Gecko adhesion, spider silk, termite mound architecture, butterfly wing structural colour.		
UNIT 5	06	L1-L4
TRENDS BIOENGINEERING (QUALITATIVE): Bioprinting techniques and materials, 3D printing of ear, bone and skin. 3D printed foods. Electrical tongue and electrical nose in food science, DNA origami and Biocomputing, Bioimaging and Artificial Intelligence for disease diagnosis. Bioremediation and Bio mining. Medical imaging technologies—X-ray, CT, MRI and Ultrasound (overview).		
SELF-STUDY COMPONENTS: Wearable biosensors, organ-on-chip, nanorobots in drug delivery, bioremediation applications.		

TEXTBOOKS:	
1	Engineering with Biology- Fundamentals and Applications , 2nd Edition, S. Fatima, R. S. Deshpande, M. Ziaullah, Mahantesh Mattada, Santosh Nejekar and Sadashiv Halbhavi, Najekar Publications, 2026.
2	Biology for Engineers , Dr.Rajendra Singh C.,Dr.N Shankar Rao, IBOP Physics Facilitators, JIRS, Bangalore,2023.
3	Biology for Engineers ,Wiley Precise Textbook series,1 st Edition,2022.

REFERENCE BOOKS:	
1	Biology for Engineers , Molecular Biology and Biotechnology 2 nd Edition. J.M.Walker and E.B.Gingold.T Johnson, CRC press, 2011.
2	Biology: A global approach ,N.A.Campbell,J.B. Reece,L.Urry,M.L.Cain and S A.Wasserman,Wiley Precise Textbook series,1st edition, Pearson Education Ltd,2018.
e-LEARNING RESOURCES:	
1	https://www.classcentral.com/subject/biology
2	https://ocw.mit.edu/courses/20-020-introduction-to-biological-engineering-design-spring-2009
3	https://www.futurelearn.com/courses/biology-basic-concepts
4	Videos and Lecture Notes: http://www.nptel.ac.in

Assessment Details both (CIE and SEE)			
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CONTINUOUS INTERNAL EVALUATION (CIE)		Max. Marks	Minimum Marks to be scored in CIE, to qualify to take SEE (40% individually)
Theory	Weightage of CIE1 and CIE2 Tests or CIE3	50	20
TOTAL		50	20

QUESTION PAPER PATTERN (SEE)										
Q. No.	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
UNIT	1	2	3	4	5	6	7	8	9	10
1. Two full questions (each of 20 Marks) are to be set from each unit.										
2. Student shall answer five full questions selecting one full question from each unit.										

Course Outcomes: After the completion of the course, the student will be able to:	
CO1	Elucidate the basic biological concepts via relevant industrial applications and case studies.
CO2	Evaluate the principles of design and development, for exploring novel bioengineering projects.
CO3	Corroborate the concepts of biomimetics for specific requirements.
CO4	Think critically towards exploring innovative biobased solutions for socially relevant problems.
CO5	Collaborate interdisciplinary Engineering design thinking for open end projects.

Mapping of CO's, PO's with PSO's														
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	0	0	0	0	0	0	1	1	0	3	1	0
CO2	2	2	3	2	2	0	0	0	0	0	0	1	3	1
CO3	2	3	3	2	1	0	0	0	0	0	0	2	2	1
CO4	1	3	2	1	0	2	3	1	0	0	0	0	1	2
CO5	0	1	2	0	1	1	1	0	3	3	2	0	1	3

Mapping of CO's with Knowledge and Attitude Profile (WK)									
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0									
CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
CO1	3	0	2	1	0	0	0	0	0
CO2	2	0	2	2	1	0	0	1	0
CO3	2	0	1	3	2	2	0	1	0
CO4	0	0	0	1	1	2	3	2	0
CO5	0	0	0	1	2	1	2	2	3

Mapping of CO's with Sustainable Development Goals (SDG)																	
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0																	
CO/SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0
CO2	0	0	3	0	0	0	0	0	2	0	0	0	0	0	0	0	0
CO3	0	0	2	0	0	0	0	0	3	1	0	0	0	0	0	0	0
CO4	0	0	3	0	0	1	2	0	2	1	0	0	0	0	0	0	0
CO5	0	0	2	2	0	0	0	0	3	0	0	0	0	0	0	0	1

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Course Title	ENVIRONMENTAL SCIENCE PROJECT						
Course Code	1BEC408						
Course Category	Societal Development Course (SDC)						
Teaching - Learning Scheme & Credits	L	T	P	S	Total	Total Teaching Hours	Credits
	0	0	0	0	5	30+0+0+0=30	1
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hrs	

Course Learning Objectives:

The Environmental Science Project is a practical, applied-learning course that builds students' environmental awareness and responsibility. It focuses on real issues such as climate change, pollution, biodiversity, resource use, soil erosion, and thermal comfort, using field surveys, case studies, data collection, audits, and analysis to develop feasible and sustainable solutions. Students may work individually or in groups of up to four, including interdisciplinary topics, and assessment is based on the prescribed rubrics.

Course outcome (Course Skill Set):

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

1. **C01 (L2 – Understand):** Identify and analyse environmental problems through field interaction and technical assessment.
2. **C02 (L3 – Apply):** Develop skills in project planning, field survey, data collection, implementation, documentation and reporting and Apply principles of environmental responsibility, ethics and societal welfare in engineering practice through community-oriented interventions.
3. **C03 (L4 – Analyze):** Formulate feasible environmental problem statements and solutions considering practical constraints and sustainability aspects.
4. **C04 (L4 – Analyze):** Exhibit multidisciplinary learning and problem-solving ability based on collected data, user feedback and baseline conditions.
5. **C05 (L5 – Evaluate):** Demonstrate teamwork and communication skills while interacting with technical and non-technical stakeholders and reflect on project impact on society.

Restrictions and professional conduct:

Environmental Science Projects should be academic, socially responsible, technically focused, and politically neutral. Students and faculty must maintain professionalism, ethical conduct, and respect while working with communities and stakeholders, and avoid any political, ideological, commercial, or disruptive activities. Projects should also consider practical constraints such as cost, resources, safety, environmental impact, and stakeholder cooperation.

SET OF PROJECT ACTIVITIES (TW/SL = 30 HOURS)

Methods for project identification:

Students may identify the project topic using one or more of the following methods: interaction with local rural or urban stakeholders such as local leaders, corporation/municipality personnel, NGOs, panchayat representatives, etc.; review of issues highlighted in print and electronic media, and social networks; and, after selecting a broad topic, collect data, conduct a feasibility survey, estimate timelines and resources, approximate expenditure, and define the problem statement and objectives clearly.

List of Project Topics and Engineering Outcomes:

The following structured sequence of activities is to be carried out during the semester:

Sl. No.	Project title	Measurable engineering outcome	Mapped POs	SDGs
1	Rural and urban water conservation and management systems	Prepare a site-specific water-saving plan, estimate water demand-supply gap, and propose a feasible conservation intervention with quantified savings.	PO1, PO2, PO3, PO4, PO10, PO11	SDG 6, SDG 11, SDG 12
2	Waste management and recycling	Conduct waste audit, classify waste streams, and design a segregation/recycling workflow with measurable reduction in mixed waste.	PO2, PO3, PO4, PO6, PO8, PO10	SDG 11, SDG 12, SDG 13

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3	Afforestation	Identify a degraded area, prepare plantation layout, and demonstrate survival-rate	PO2, PO3, PO4, PO6, PO7,	SDG 11, SDG 13,
		tracking and maintenance schedule for saplings.	PO11	SDG 15
4	Biogas generation and power generation	Estimate organic waste availability, size a small biogas system, and document expected gas output or energy yield.	PO1, PO2, PO3, PO4, PO5, PO10	SDG 7, SDG 11, SDG 12
5	DPR for solar power rural plant	Prepare a DPR with load assessment, panel sizing, cost estimate, and projected energy generation and payback.	PO1, PO2, PO3, PO4, PO5, PO10	SDG 7, SDG 9, SDG 11
6	DPR for electrification of village/tribal community	Map unserved/underserved households, propose electrification layout, and estimate coverage, losses, and implementation cost.	PO1, PO2, PO3, PO4, PO10, PO11	SDG 7, SDG 9, SDG 10
7	DPR for rural drainage system	Survey drainage bottlenecks, develop a drainage layout, and estimate runoff handling capacity and flood-risk reduction.	PO1, PO2, PO3, PO4, PO6, PO10	SDG 6, SDG 9, SDG 11
8	Sustainability and environmental health projects	Assess local environmental health issues and propose interventions with measurable improvement in hygiene, safety, or resource use.	PO2, PO3, PO4, PO6, PO7, PO8	SDG 3, SDG 6, SDG 11, SDG 12
9	Plastic free campaigns	Measure plastic usage before and after awareness intervention and report percentage reduction or behavioural change.	PO2, PO3, PO6, PO7, PO8, PO10	SDG 11, SDG 12, SDG 13
10	Health and nutrition awareness	Conduct baseline and post-program awareness survey and document improvement in awareness score or adoption of healthier practices.	PO2, PO6, PO7, PO8, PO9, PO10	SDG 2, SDG 3, SDG 11
11	Societal projects involving health wellness	Identify a community health need and develop an awareness/service module with measurable participation and feedback outcomes.	PO2, PO3, PO6, PO8, PO9, PO10	SDG 3, SDG 11, SDG 17
12	Air quality monitoring system	Collect air-quality data, compare with reference limits, and present trends along with possible mitigation suggestions.	PO2, PO3, PO4, PO5, PO6, PO10	SDG 3, SDG 11, SDG 13
13	Plastic waste reduction campaign	Track collection, segregation, and replacement actions, and quantify reduction in plastic waste generation or littering.	PO2, PO3, PO6, PO7, PO8, PO10	SDG 11, SDG 12, SDG 13
14	Urban greening projects	Prepare greening plan, identify planting locations, and assess environmental benefits such as shade, aesthetics, or heat mitigation.	PO2, PO3, PO4, PO6, PO7, PO11	SDG 11, SDG 13, SDG 15
	Smart agriculture solution	Design a low-cost monitoring or irrigation support solution and estimate improvement in	PO1, PO2, PO3, PO4, PO5, PO10	SDG 2, SDG 6, SDG 9

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15		water use efficiency or crop support.		
16	Smart irrigation system	Estimate crop water requirement, propose control logic, and quantify water savings compared with conventional irrigation.	PO1, PO2, PO3, PO4, PO5, PO10	SDG 2, SDG 6, SDG 12
17	Food security initiatives / cold storage system	Estimate storage need, design a simple cold-chain concept, and document reduction in	PO1, PO2, PO3, PO4, PO5,	SDG 2, SDG 9, SDG 12
		spoilage or wastage.	PO10	

Suggested Learning Resources

Particulars	Titles and Publishers
Textbooks	1. Phadke, N. D., <i>Community Engagement and Social Innovation</i>, Oxford University Press, New Delhi. 2. Garg, N. R., <i>Project-Based Learning in Engineering Education</i>, Pearson India Education Services, Noida. 3. Gupta, A. and P. Singh, <i>Service Learning and Community Projects</i>, McGraw-Hill Education (India), New Delhi. 4. Wilson, G., <i>Practical Guide to Community Development Projects</i>, Routledge, London.
Reference books	1. NPTEL courses on Project-Based Learning and Social Innovation. 2. SWAYAM courses on community engagement and sustainability. 3. UN Sustainable Development Goals portal. 4. MyGov India and local civic body portals for community initiatives. 5. YouTube resources on design thinking, social innovation, and community service learning. 6. NGO and government field-action case studies related to sanitation, water, health, education, and environment.
Web links and Video Lectures (e-Resources)	1. NPTEL courses on Engineering Geology. 2. NPTEL courses on Soil Mechanics and Foundation Engineering. 3. Virtual Labs – Geotechnical Engineering Virtual Lab. 4. Geological Survey of India. 5. YouTube channels on civil engineering experiments. 6. American Society of Civil Engineers (ASCE) – Geotechnical resources and standards.

Teaching Learning Process:

The suggested TLP for Community / Societal Project is as follows;

Week / Phase	Teaching-Learning Activity	Faculty Role	Student Activity	Output / Evidence
1	Course introduction, objectives, ethics, conduct, and assessment briefing	Explain course scope, rules, rubrics, and expected deliverables	Understand course requirements and form teams	Team list, course plan
2	Community problem identification and topic selection	Guide topic framing and feasibility	Identify local issues through discussion and observation	Shortlisted project topic

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3	Stakeholder interaction and preliminary survey	Demonstrate survey methods and stakeholder engagement	Collect initial data from community/users	Survey notes, interview record
4	Problem statement and objective formulation	Review and refine problem statement	Prepare problem statement, scope, and objectives	Approved problem statement
5	Literature/case study review and baseline analysis	Suggest relevant references and examples	Study existing solutions and compare approaches	Baseline analysis summary
6	Project planning and role assignment	Help teams organize tasks, timeline, and Responsibilities	Plan activities, divide roles, and prepare Schedule	Work plan / Gantt chart
7	Feasibility analysis and solution brainstorming	Check technical feasibility and practicality	Generate possible engineering solutions	Solution alternatives sheet
8	Selection of final solution and design approach	Review final concept and design logic	Finalize concept, methods, and expected outcome	Concept note / design outline
9	Data processing / calculations / sizing / mapping	Support computations and technical review	Analyze data, perform calculations, prepare maps/charts	Technical analysis sheet
10	Prototype / model / audit / DPR / app development	Monitor progress and correct technical issues	Develop the selected output	Working model / draft DPR / map / app
11	Testing, refinement, and implementation planning	Evaluate technical correctness and improvements	Test prototype or validate proposal with users	Test results / revised output
12	Field implementation / demonstration / awareness activity	Facilitate community interaction and documentation	Conduct implementation or demonstration	Photos, attendance, implementation record
13	Documentation of outcomes, feedback, and impact	Review report structure and completeness	Compile findings, stakeholder feedback, and observations	Draft report
14	Presentation preparation and viva practice	Conduct mock presentation and feedback	Prepare slides/poster and rehearse	Presentation deck
15	Final presentation, submission, and reflection	Evaluate performance using rubrics	Present project, submit report, reflect on learning	Final report, presentation, viva

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Assessment structure:

A. Continuous Internal Evaluation (CIE) – 50 marks

- Students, in batches of 3–4, shall undertake at least one project (or a combination of two related activities) aiming, as far as possible, at a logical implemented or implementable outcome.
- CIE will be conducted by a departmental committee (HoD/nominee, guide and one senior faculty) using the following rubrics totalling 50 marks:

CIE pass requirement:

A student shall secure a minimum of 20 marks out of 50 in CIE to become eligible to appear for SEE.

- Students who fail to earn the required CIE marks may be given additional opportunities before closure of the semester; no re-doing of CIE is permitted after the end of the semester.

B. Semester End Examination (SEE) – 100 marks (scaled to 50)

- Examination duration: 2 hours.
- Maximum examination marks: 100 (entered as 100 in the VTU portal; the ITI-SMU module automatically scales 100 → 50 for result processing).
- The SEE shall be conducted batch-wise by a committee of three faculty: project guide, one faculty from the same department and one from a different department.

SEE pass requirement and overall passing rule:

- For a pass in SEE, a student shall secure minimum 35 marks out of 100.
- For declaration of a pass grade, the sum of CIE marks (out of 50) and scaled SEE marks (out of 50) shall be ≥ 40 ; otherwise, the student is awarded grade F (Fail).

CIE Rubric — Continuous Internal Evaluation (Total 50 marks):

Criterion	Weight (marks)	Excellent (Full marks)	Good	—	Needs improvement
Problem identification & relevance to society/environment	8	Problem clearly identified with strong evidence of relevance and well-defined scope.	Relevant problem with clear scope and adequate evidence.	Problem defined but justification is weak.	Problem unclear or not relevant.
Formation of problem statement; engineering approach, innovation & feasibility	10	Precise statement; sound, innovative, feasible approach.	Adequate statement; feasible with minor gaps.	Partial statement; marginal feasibility.	Missing or infeasible.
Interaction with stakeholders; data collection, analysis & interpretation	8	Thorough engagement; comprehensive data and well-interpreted analysis.	Good engagement; adequate data and analysis.	Limited engagement; incomplete data and superficial analysis.	Little or no stakeholder contact; no data/analysis.
Project documentation; clarity, organization & problem-solving demonstrated	10	Complete, well-organized, analytical, and strong problem-solving.	Complete and clear with some analytical content.	Basic with omissions; problem-solving limited.	Missing/poorly organized; no clear problem-solving.

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Communication & presentation skills	6	Confident, structured, and answers queries fully; visuals effective.	Clear and satisfactory; responds to most queries.	Acceptable but lacks clarity or confidence; weak responses.	Poor or absent; unable to respond.
Contribution & benefit to society (impact, sustainability)	8	Clear, demonstrable societal benefit and realistic sustainability path.	Benefit plausible; sustainability considered with minor gaps.	Limited or unclear benefit; sustainability weak.	No evident benefit or sustainability.

Notes for CIE rubric:

- Minimum CIE pass requirement: 20/50 to be eligible for SEE. [Use departmental committee (HoD/guide + senior faculty) to apply the rubric and record marks.]

SEE Rubric — Semester End Examination (Enter marks out of 100; scaled to 50 later):

Criterion	Weight (marks)	Excellent (Full marks)	Good	Fair	Needs Improvement
Problem identification & relevance to society/environment	16	Clearly articulated with strong evidence and context.	Clear with reasonable evidence.	Problem stated but evidence/context weak.	Poorly defined or irrelevant.
Formation of problem statement; engineering approach, innovation & feasibility	20	Precise; demonstrates engineering depth, novelty and feasibility.	Technically sound and feasible with minor limitations.	Basic; limited technical depth or feasibility concerns.	No viable engineering approach or infeasible plan.
Interaction with stakeholders; data collection, analysis & interpretation	16	Excellent engagement; rigorous data collection and insightful analysis.	Good engagement and acceptable analysis.	Superficial data collection and limited analysis.	Inadequate or no data; poor analysis.
Project documentation; clarity, technical rigor & problem-solving demonstrated	20	Comprehensive, technically rigorous, and systematic.	Complete and technically correct with minor gaps.	Lacks technical depth or has notable omissions.	Missing key elements or technically incorrect.
Communication, presentation & viva-voce responses	12	Presents expertly, defends work persuasively and answers all queries correctly.	Good presentation and satisfactory answers to most queries.	Adequate but fails to answer some technical questions.	Poor presentation and unable to defend work.
Contribution & benefit to society; impact assessment & sustainability	16	Clear, evidence-based impact assessment with scaling recommendations	Reasonable impact discussion and sustainability considerations.	Limited evaluation of impact or sustainability.	No coherent assessment of impact or sustainability.

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SEE pass rule:

- Student must secure at least 35/100 in SEE itself to be eligible for pass consideration.
- Final passing is based on CIE (out of 50) + SEE (scaled to 50) ≥ 40 . Otherwise, grade F (Fail) is awarded.

Suggested implementation notes (for BoS / exam committees):

- Use numerical scores from the rubric and keep brief evaluator comments for each criterion.
- For team projects: record individual contribution within the documentation and adjust individual marks using a peer-evaluation sheet or guide's assessment.
- Maintain evidence (field notes, photos, questionnaires, DPRs, reports) as annexures for SEE moderation.
- Use standardized score sheet (spreadsheet) mapping rubric items to columns for easy aggregation and archival.

- **Awareness Campaign on Single-Use Plastic and E-Waste Management**

Suggested Learning Resources:

Text Books:

1. Benny Joseph, Environmental Studies, Tata McGraw-Hill, 2nd Edition.
2. R. Rajagopalan, Environmental Studies: From Crisis to Cure, Oxford University Press, 2005.
3. Erach Bharucha, Textbook of Environmental Studies, University Press, latest edition as available in library.
4. M. P. Poonia and S.C.Sharma, Environmental Studies, Vikas Publishing House, latest edition as available

Reference Books:

1. R. Sivakumar, Principles of Environmental Science and Engineering, Cengage Learning, 2nd Edition.
2. G. Tyler Miller Jr., Environmental Science: Working with the Earth, Thomson Brooks/Cole, 11th Edition.
3. Pratibha Singh, Anoop Singh, and Piyush Malaviya, Text Book of Environmental and Ecology, Acme Learning 1st Edition.
4. S.M. Prakash, Environmental Studies, Elite Publishing House, Mangalore, 3rd Edition, 2018.

Weblinks and Video Lectures(e-Resources):

1. VTU e-Learning Centre: <http://elearning.vtu.ac.in>
2. VTU e-Resources/e-Content: <http://elearning.vtu.ac.in/e-Res.php>
3. VTU e-Shikshana Lecture Videos: <http://elearning.vtu.ac.in/esk3.php>
4. VTU Consortium Digital Resources: <https://access.vtuconsortium.com/msec>
5. VTU e-Learning Centre: <http://elearning.vtu.ac.in>
6. VTU e-Resources/e-Content: <http://elearning.vtu.ac.in/e-Res.php>
7. VTU e-Shikshana Lecture Videos: <http://elearning.vtu.ac.in/esk3.php>
8. VTU Consortium Digital Resources: <https://access.vtuconsortium.com/msec>

Assessment Structure:

Continuous Internal Evaluation (CIE) shall be conducted by the Departmental Project Review Committee consisting of a Senior Professor, the Project Guide, and one additional faculty member nominated by the Head of the Department. Semester End Evaluation (SEE) shall be conducted by university-appointed examiners. The evaluation shall be based on rubrics designed to assess the attainment of NBA-defined graduate attributes, including problem analysis, investigation, design of solutions, communication, teamwork, and professionalism.

The weightage of marks for CIE and SEE is 50% each.

Pass Criteria: A candidate shall secure a minimum of 40% of the total marks prescribed for Project Work, subject to the required minimum in Continuous Internal Evaluation and Semester End Evaluation as per VTU regulations.

Sample Rubrics for Campus water-quality and development of a water-conservation plan.

Criterion	Weight (%)	4 - Excellent	3 - Good	2 - Satisfactory	1 - Needs improvement
Problem definition and campus context	10	Clearly defines campus water issue, boundaries, water sources, and purpose.	Defines issue and context with minor gaps.	Basic problem stated, but scope is incomplete.	Vague or incorrect problem definition.
Water-quality data collection	15	Uses appropriate sampling points, methods, and frequency; data are well documented.	Methods are mostly appropriate with minor omissions.	Limited methods or incomplete documentation.	Weak or unclear data collection.
Water-quality parameters and analysis	20	Correctly analyzes key physical, chemical, and microbiological parameters and interprets results.	Analyzes most parameters correctly with minor interpretation gaps.	Some parameters analyzed, but interpretation is weak.	Minimal or incorrect analysis.
Evidence and standards comparison	15	Compares results against relevant standards/guidelines and draws valid conclusions.	Compares most results with reasonable conclusions.	Comparison is partial or uneven.	No meaningful comparison with standards.
Diagnosis of issues and causes	10	Identifies likely causes of poor quality or water loss using evidence.	Identifies main causes with some support.	Causes are mentioned, but weakly supported.	Causes are speculative or absent.
Conservation plan objectives and measures	15	Plan includes clear goals, realistic measures, prioritization, and campus suitability.	Plan is relevant and mostly realistic.	Plan has some useful measures but limited prioritization.	Plan is generic or impractical.
Feasibility and implementation	10	Addresses resources, responsibilities, timeline, and implementation steps clearly.	Covers most implementation aspects.	Implementation is partial or underdeveloped.	Little or no implementation planning.

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Cost, savings, and sustainability	5	Provides reasonable cost-benefit thinking and expected savings.	Includes some cost or savings discussion.	Limited financial/savings analysis.	No cost or savings consideration.
Presentation and documentation	0-10	Clear structure, tables/figures, references, and professional report quality.	Well organized with minor issues.	Acceptable but uneven formatting or writing.	Poorly organized and difficult to follow.

Mapping of CO's, PO's with PSO's Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
C01	0	3	0	3	0	3	0	0	0	0	0	2	0	3
C02	0	2	0	3	0	3	3	3	3	3	0	2	1	3
C03	2	3	3	0	2	3	0	0	0	2	0	3	2	3
C04	0	3	0	3	2	2	0	3	0	0	3	3	2	2
C05	0	0	0	0	0	3	3	3	3	2	2	0	1	3

Mapping of CO's with Knowledge and Attitude Profile (WK)									
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0									
CO/SDG's	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
C01	3	2	0	0	3	0	3	2	0
C02	2	2	0	0	3	2	3	2	3
C03	2	3	2	0	3	2	3	2	1
C04	2	3	1	0	2	2	2	3	0
C05	0	0	0	0	1	0	3	2	3

Mapping of CO's with Sustainable Development Goals (SDG)																	
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0																	
CO	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1	1	2	3	1	1	3	2	1	2	2	3	3	3	2	3	1	2
CO2	1	2	3	2	2	3	3	2	2	2	3	3	3	1	2	1	3
CO3	2	3	2	1	1	3	3	2	3	2	3	3	3	2	3	1	2
CO4	2	3	3	2	1	3	3	2	3	2	3	3	3	2	2	1	2
CO5	2	2	3	3	2	2	1	2	2	3	3	2	2	1	2	2	3

Course Title	INTRODUCTION TO ANALOG COMMUNICATION SYSTEMS						
Course Code	1BECT409						
Course Category	PCC (Professional Core Course)						
Teaching - Learning Scheme & Credit	L	T	P	S	Total	Total Teaching Hours	Credit
	3	0	0	3	3	45+0+0+45=90	3
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hrs	

Course Learning Objectives:	
CLO1	Understand the fundamentals of probability, random variables, and random processes and apply statistical concepts in the analysis of communication systems.
CLO2	Explain the principles and operation of analog modulation techniques, including Amplitude Modulation (AM) and Frequency Modulation (FM), along with their modulation and demodulation circuits.
CLO3	Analyze communication receivers and multiplexing techniques, including superheterodyne receivers, frequency conversion, and frequency division multiplexing (FDM).
CLO4	Understand the principles of digital communication, including sampling, quantization, pulse modulation techniques (PAM, PPM, PCM), line coding, and time-division multiplexing (TDM).
CLO5	Evaluate the performance of communication systems by analyzing baseband digital transmission, intersymbol interference, Nyquist criterion, eye patterns, and the effects of noise and signal-to-noise ratio (SNR).

SYLLABUS	No. of Hours	BTLs
UNIT 1	8	L1-L3
Random Variables and Processes: Introduction, Probability, Conditional Probability, Random variables. Statistical Averages: Function of a random variable, Moments, Random Processes, Mean, Correlation and Covariance function: Properties of autocorrelation function, Cross-correlation functions, Gaussian Process: Gaussian Distribution Function.		
SELF-STUDY COMPONENTS: Applications of Random Variables and Random Processes in Modern Communication Systems (e.g., mobile communication, radar, and satellite communication)		
UNIT 2	9	L1-L3
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. SSB Modulation: Time and Frequency domain equations with waveforms, (no derivation.) Frequency Translation, Frequency Division Multiplexing.		
SELF-STUDY COMPONENTS: Quadrature Carrier Multiplexing, Time and Frequency domain equations VSB Modulation , Comparison of Analog Modulation Techniques (AM, DSB-SC, SSB, and VSB).		
UNIT 3	9	L1-L3
ANGLE MODULATION: Basic definitions, Frequency Modulation: Narrow Band FM, Wide Band FM, Transmission bandwidth of FM Signals, Generation of FM Signals-direct method, Demodulation of FM		

Signals-Nonlinear model of PLL, Linear model of PLL.		
SELF-STUDY COMPONENTS: Comparison between FM and PM, Comparison between NBFM and WBFM, The Super Heterodyne Receiver, and FM Stereo Multiplexing		
UNIT 4	9	L1-L3
Digital Representation of Analog Signals: Introduction, Why Digitize Analog Sources?, The Sampling process, Pulse Amplitude Modulation, Time-Division Multiplexing, Pulse Position Modulation: Generation and Detection of PPM wave. The Quantization Process. Pulse Code Modulation: Sampling, Quantization, Encoding, line Codes, Differential encoding, Regeneration, Decoding, filtering, multiplexing.		
SELF-STUDY COMPONENTS: Applications of PCM, PAM, PPM, and TDM in Digital Telephony, Voice over IP (VoIP), and Optical Communication Systems		
UNIT 5	9	L1-L3
Baseband Transmission of Digital signals: Introduction, Inter symbol Interference, Eye Pattern, Nyquist criterion for distortion less Transmission, Baseband M-ary PAM Transmission. NOISE: Shot Noise, Thermal noise, White Noise, Noise Equivalent Bandwidth.		
SELF-STUDY COMPONENTS: Noise Reduction Techniques and Nyquist Criterion in High-Speed Digital Communication Systems (5G, Optical Fiber, and Ethernet)		

TEXT BOOKS:	
1	Simon Haykin & Michael Moher, Communication Systems, 5th Edition, John Wiley, India Pvt. Ltd, 2010, ISBN: 978-81-265-2151-7.

REFERENCE BOOKS:	
1	B P Lathi, Zhi Ding, "Modern Digital and Analog Communication Systems", Oxford University Press., 4th edition, 2010, ISBN: 97801980738002
2	Herbert Taub, Donald L Schilling, Goutam Saha, "Principles of Communication systems", 4th Edition, Mc Graw Hill Education (India) Private Limited, 2016. ISBN: 978-1-25-902985-1

e-LEARNING RESOURCES:	
1	https://nptel.ac.in/courses/108104091
2	https://nptel.ac.in/courses/117102059

Assessment Details both (CIE and SEE)
The weightage of Continuous Internal Evaluation (CIE) and Semester End Exam (SEE) is 50% each. The students have to obtain a minimum of 40% marks individually both in CIE and SEE to pass. CIE: The CIE has three components – CIE - theory component, assignment and group activity. Students have to score a minimum of 40% Marks in the total of CIE - theory, assignment and group activity components put together to take SEE. SEE: Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration) and reduced to

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50 Marks. **Self-Study Component should be not included for SEE & CIE.			
CONTINUOUS INTERNAL EVALUATION (CIE)		Max. Marks	Minimum Marks to be scored in CIE, to qualify to take SEE (40% individually)
Theory	Weightage of CIE1 and CIE2 Tests or CIE3	50	20
TOTAL		50	20

QUESTION PAPER PATTERN (SEE)										
Q. No.	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
UNIT	1		2		3		4		5	
1. Two full questions (each of 20 Marks) are to be set from each unit.										
2. Student shall answer five full questions selecting one full question from each unit.										

Course Outcomes: After the completion of the course, the student will be able to:	
CO1	Explain the concepts of random variables, random processes and their statistical properties used in analog communication systems.
CO2	Analyze amplitude modulation techniques, AM transmitters, receivers and frequency division multiplexing.
CO3	Analyze frequency modulation techniques, FM circuits and superheterodyne receiver operation.
CO4	Apply sampling, pulse modulation, quantization and PCM techniques for digital representation of analog signals.
CO5	Evaluate the performance of baseband digital communication systems under the influence of noise and inter symbol interference.

Mapping of CO's, PO's with PSO's														
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	0	0	0	0	0	0	0	0	1	2	—	1
CO2	3	3	2	0	2	0	0	0	0	0	1	3	2	1
CO3	3	3	2	2	3	0	0	0	0	0	1	3	2	1
CO4	3	2	2	0	2	0	0	0	0	0	1	3	2	1
CO5	3	3	2	2	2	1	0	0	0	0	2	3	2	1

Mapping of CO's with Knowledge and Attitude Profile (WK)										
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0										
CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	
CO1	3	3	2	0	0	0	0	1	0	
CO2	3	3	3	2	1	0	0	1	0	
CO3	3	3	3	2	1	0	0	1	0	
CO4	3	3	2	3	2	0	0	1	0	
CO5	3	3	3	2	2	0	0	2	1	

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Mapping of CO's with Sustainable Development Goals (SDG)																	
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0																	
CO/SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1	0	0	0	3	0	0	0	0	2	0	0	0	0	0	0	0	0
CO2	0	0	0	3	0	0	0	0	3	0	1	0	0	0	0	0	0
CO3	0	0	0	3	0	0	0	0	3	0	1	0	0	0	0	0	0
CO4	0	0	0	3	0	0	0	0	3	0	1	0	0	0	0	0	0
CO5	0	0	0	3	0	0	0	0	3	0	1	0	0	0	0	0	0

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B.E. Name of the programme: Electronics and Communication Engineering
Tentative Scheme of Teaching and Examination effective from the Academic Year 2024-25
(Applicable to 2024 batch)

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	ECT501	Technological Innovation Management and Entrepreneurship	ECE	3	0	0		03	50	50	100	3
2	IPCC	ECU502	ARM Microcontroller	ECE	3		2		03	50	50	100	4
3	PCC	ECT503	Digital Signal Processing	ECE	3	0	0		03	50	50	100	4
4	PCCL	ECL504	Digital Signal Processing Laboratory	ECE	0	0	2		03	50	50	100	1
5	PEC	ECT505x	Professional Elective Course	ECE	3	0	0		03	50	50	100	3
6	PROJ	ECM506	Mini Project	ECE	0	0	4		03	100		100	2
7	AEC	RMT507	Research Methodology and IPR	EEE department	2	2	0		02	50	50	100	3
8	MC	CVT508	Environmental Studies	TD: CV PSB: CV	2	0	0		02	50	50	100	2
9	HS	CDN509	Aptitude and Verbal Ability Skills	Placement Cell	2	0	0		--	50	--	50	PP/ NP
10	MC	NSN510	National Service Scheme (NSS)	NSS coordinator	0	0	2			100		100	PP/ NP
		PEN510	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		YON510	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= Self-Study 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 Elective Course ECT505x			
ECT505A	System Verilog for verification	ECT505D	Multicore Architecture
ECT505B	Artificial Intelligence	ECT505E	Advanced Control Systems
ECT505C	Fundamentals of Virtual Reality	ECT505F	Programming with Python

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 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 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 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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(Applicable to 2024 batch)

VI SEMESTER

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	
1	IPCC	ECU601	Microwave and Antenna	ECE	3	0	2		03	50	50	100	4
2	PCC	ECT602	CMOS VLSI Design	ECE	3	2	0		03	50	50	100	4
3	PEC	ECT603x	Professional Elective Course	ECE	3	0	0		03	50	50	100	3
4	OEC	ECT604x	Open Elective Course	ECE	3	0	0		03	50	50	100	3
5	PROJ	ECP605	Major Project Phase I	ECE	0	0	4		03	100	--	100	2
6	PCCL	ECL606	VLSI Laboratory	ECE	0	0	2		03	50	50	100	1
7	AEC/SDC	ECT607x OR ECL607x	Ability Enhancement Course/Skill Development Course V	ECE	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	HS	CDN608	Analytical and Reasoning Skills	Placement Cell	2	0	0		--	50	--	50	PP/ NP
9	MC	NSN609	National Service Scheme (NSS)	NSS coordinator	0	0	2			100	---	100	PP/ NP
		PEN609	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		YON609	Yoga	Yoga Teacher									
Total									500	300	800	18	

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=** Self-Study, **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 Elective Course ECT603x			
ECT603A	Satellite Communication	ECT603D	Digital Image Processing
ECT603B	Cryptography	ECT603E	Robotics and Machine Vision System
ECT603C	Machine Learning	ECT603F	Adaptive Signal Processing
Open Elective Course ECT604x			
ECT604A	Mechatronics	ECT604C	RTOS
ECT604B	MEMS	ECT604D	Robotics Mechanics and Control

Ability Enhancement Course / Skill Enhancement Course-V ECT607x OR ECL607x			
ECT607A	Automotive Electronics	ECT607C	Real Time Embedded Systems
ECT607B	Introduction to E-Vehicles	ECT607D	Introduction to Unmanned Aerial Vehicle (UAV)
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 help he/she has to complete the literature survey and prepare the report and finally define the problem statement for the project work.

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Course Title	TECHNOLOGICAL INNOVATION MANAGEMENT AND ENTREPRENEURSHIP						
Course Code	ECT501						
Course Category	Humanities and Social Science and Management Course (HSMS)						
Teaching - Learning Scheme & Credit	L	T	P	S	Total	Total Teaching Hours	Credit
	3	0	0	0	3	39+0+0+0=39	3
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hrs	

Course Learning Objectives:	
CLO1	Understand basic skills of Management.
CLO2	Understand the need for Entrepreneurs and their skills.
CLO3	Identify the Management functions and Social responsibilities.
CLO4	Understand the Ideation Process, creation of Business Model.

SYLLABUS	No. of Hours	BTLs
UNIT 1	8	L1-L2
Management: Nature and Functions of Management- Importance, Definition, Management Functions, Levels of Management, Roles of Manager, Managerial Skills, Management & Administration, Management as a Science, Art & Profession (Selected topics of Chapter 1, Text 1). Planning: Planning-Nature, Importance, Types, Steps and Limitations of Planning; Decision Making-Meaning, Types and Steps in Decision Making (Selected topics from Chapters 4 & 5, Text 1). L1,L2		
UNIT 2	7	L1-L3
Organizing and Staffing: Organization-Meaning, Characteristics, Process of Organizing, Principles of Organizing, Span of Management (meaning and importance only), Departmentalisation, Committees-Meaning, Types of Committees; Centralization Vs Decentralization of Authority and Responsibility; Staffing-Need and Importance, Recruitment and Selection Process (Selected topics from Chapters 7, 8 & 11, Text 1). Directing and Controlling: Meaning and Requirements of Effective Direction, Giving Orders; Motivation-Nature of Motivation, Motivation Theories (Maslow's Need-Hierarchy Theory and Herzberg's Two Factor Theory); Communication - Meaning, Importance and Purposes of Communication; Leadership-Meaning, Characteristics, Behavioural Approach of Leadership. (Selected topics from Chapters 15 to 18 and 9, Text 1).		
UNIT 3	8	L1-L4
Social Responsibilities of Business: Meaning of Social Responsibility, Social Responsibilities of Business towards Different Groups, Social Audit, Business Ethics and Corporate Governance (Selected topics from Chapter 3, Text 1). Entrepreneurship: Definition of Entrepreneur, Importance of Entrepreneurship, concepts of Entrepreneurship, Characteristics of successful Entrepreneur, Classification of Entrepreneurs, Myths of Entrepreneurship, Entrepreneurial Development models, Entrepreneurial development cycle, Problems faced by Entrepreneurs and capacity building for Entrepreneurship (Selected topics from Chapter 2, Text 2).		

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UNIT 4	8	L1-L4
Family Business: Role and Importance of Family Business, Contributions of Family Business in India, Stages of Development of a Family Business, Characteristics of a Family-owned Business in India, Various types of family businesses (Selected topics from Chapter 4, (Page 71-75) Text 2). Idea Generation and Feasibility Analysis- Idea Generation; Creativity and Innovation; Identification of Business Opportunities; Market Entry Strategies; Marketing Feasibility. (Selected topics from Chapter 6(Page No. 111-117) & Chapter 7(Page No. 140-142), Text 2)		
UNIT 5	8	L1-L4
Business model- Meaning, designing, analyzing and improvising; Business Plan - Meaning, Scope and Need; Financial, Marketing, Human Resource and Production/Service Plan; Business plan Formats; Project report preparation and presentation; Why some Business Plan fails? (Selected topics from Chapter 8 (Page No 159-164, Text 2)		

TEXT BOOKS:	
1	Principles of Management - P.C Tripathi, P.N Reddy, McGraw Hill Education, fYhEdition, 2017. ISBN-13:978-93-5260-5354.
2	Entrepreneurship Development Small Business Enterprises- Poomima MCharantimath, Pearson Education 2008, ISBN 978-81-7758-260-4.

REFERENCE BOOKS:	
1	Dynamics ofEntrepreneurial Development and Management byVasant Desai. HPH 2007, ISBN: 978-81-8488-801-2.
2	Robert D. Hisrich, Mathew J. Manimala, Michael PPeters and DeanA. Shepherd, "Entrepreneurship", S1h Edition, Tata Mc-Graw HillPublishing Co.Ltd.- New Delhi, 2012
3	Essentials of Management: An International, Innovation and Leadership perspective by Harold Koontz, Heinz Weihrich McGraw Hill Education, I01h Edition 2016. ISBN- 978-93-392-2286-4.

Assessment Details both (CIE and SEE)			
The weightage of Continuous Internal Evaluation (CIE) and Semester End Exam (SEE) is 50% each. The students have to obtain a minimum of 40% marks individually both in CIE and SEE to pass. CIE: The CIE has three components – CIE - theory component, assignment and group activity. Students have to score a minimum of 40% Marks in the total of CIE - theory, assignment and group activity components put together to take SEE. SEE: Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration) and reduced to 50 Marks. **Self-Study Component should be not included for SEE & CIE.			
CONTINUOUS INTERNAL EVALUATION (CIE)		Max. Marks	Minimum Marks to be scored in CIE, to qualify to take SEE (40% individually)
Theory	Weightage of CIE1 and CIE2 Tests or CIE3	50	20
TOTAL		50	20

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QUESTION PAPER PATTERN (SEE)										
Q. No.	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
UNIT	1		2		3		4		5	
1. Two full questions (each of 20 Marks) are to be set from each unit.										
2. Student shall answer five full questions selecting one full question from each unit.										

Course Outcomes: After the completion of the course, the student will be able to:	
CO1	Explain the fundamental concepts of management, managerial functions, managerial roles and skills, planning, and decision-making processes in organizational contexts.
CO2	Apply the principles of organizing, staffing, directing, motivation, communication, leadership, and controlling to address organizational and managerial situations.
CO3	Analyze the social responsibilities of business, business ethics, corporate governance, and entrepreneurial concepts to understand their impact on organizations and society.
CO4	Evaluate entrepreneurial opportunities by applying creativity, innovation, idea-generation techniques, feasibility analysis, market-entry strategies, and family-business concepts.
CO5	Develop a business model and comprehensive business plan incorporating financial, marketing, human resource, and production/service aspects, and prepare and present a project report.

Mapping of CO's, PO's with PSO's														
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0														
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	2	3	2	1	1	1	1	2	2	3	2	1	0	2
CO 2	2	3	2	1	1	1	2	3	3	3	2	1	0	2
CO 3	1	3	2	2	1	3	3	2	2	2	3	1	0	3
CO 4	2	3	3	2	2	3	2	2	2	3	3	2	0	3
CO 5	2	3	3	2	2	2	2	3	3	3	3	2	0	3

Mapping of CO's with Knowledge and Attitude Profile (WK)									
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0									
CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
CO1	3	2	0	0	1	0	2	2	1
CO2	3	1	0	0	1	0	2	2	2
CO3	3	1	0	0	2	0	3	2	3
CO4	3	2	0	0	2	0	2	3	2
CO5	3	3	0	0	3	0	2	3	2

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Mapping of CO's with Sustainable Development Goals (SDG)																	
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0																	
CO/SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1	0	0	0	2	1	0	0	2	1	1	0	1	0	0	0	2	2
CO2	0	0	0	2	2	0	0	3	1	2	0	1	0	0	0	2	3
CO3	0	0	0	2	3	0	0	3	2	3	0	2	0	0	0	3	3
CO4	0	0	0	2	2	0	0	3	3	2	0	2	0	0	0	2	3
CO5	0	0	0	2	2	0	0	3	3	2	0	3	0	0	0	2	3

Course Title	ARM Microcontrollers						
Course Code	ECU502						
Course Category	IPCC (Integrated Professional Core Course)						
Teaching - Learning Scheme & Credit	L	T	P	S	Total	Total Teaching Hours	Credit
	3	0	2	0	5	39+0+26+0=65	4
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hrs	

Course Learning Objectives:	
CLO1	Describe the architectural features and instructions of 32-bit microcontroller ARM Cortex M3.
CLO2	Program ARM Cortex M3 for different applications.
CLO3	Analyze the Thumb instruction set and different C-Programming concepts.
CLO4	Describe Cortex M Architecture
CLO5	Program ARM Cortex M3/M4 MCUs

SYLLABUS	No. of Hours	BTLs
UNIT 1	7	L1-L4
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. Text 1		
UNIT 2	7	L1-L4
Introduction to the ARM Instruction set: Introduction, Data processing instructions, Load - Store instruction, Software interrupt instructions, Program status register instructions, Loading constants, ARMv5E extensions, Conditional Execution. Text 1		
UNIT 3	7	L1-L4
Introduction to the THUMB instruction set: Introduction, THUMB register usage, ARM – THUMB interworking, other branch instructions, Data processing instructions, Stack instructions, Software interrupt instructions. Efficient C Programming: Overview of C Compilers and optimization, Basic C Data types, C looping structures. Text 1		
UNIT 4	8	L1-L4
Cortex M Architecture: Advantages of Cortex M CPUs, Programmer's model: Operation modes & states, Registers, Special Registers, APSR, Memory System, Low power modes,		

Instruction Set: Memory access instructions, Arithmetic, Logical, Shift, Program flow control instructions, Programming examples, IDEs. Text 2		
UNIT 5	10	L1-L4
ARM Cortex M3/M4 MCUs: Architecture, Memory organization, GPIO, Programming: Assembly level, Interfacing LEDs, Relay and Push buttons, Analog to digital converters (ADC), Digital to Analog Converter (DAC), Interfacing LCD, Interfacing keyboard, Programming UART, PWM, DC and stepper motor control, RTC interfacing. Text 3		
PRACTICAL COMPONENTS OF IPCC		
Conduct the following experiments by writing Assembly Language Program (ALP) using ARM Cortex M3 Registers using an evaluation board/simulator and the required software tool		
Experiments		
Sl. No.	Experiments	12 hrs
1.	Write an ALP to find the sum of first 10 integer numbers.	
2.	Write an ALP to calculate the value of the polynomial function.	
3.	Write an ALP to store data in desired Memory location.	
4.	Write a C program to Output the message using UART of LPC1768.	
5.	Write a C Program to interface LED using LPC 1768.	
6.	Write a C Program to interface Relay using LPC 1768.	
7.	Write a C Program for DC motor/Stepper motor rotation using LPC 1768.	
8.	Write a C Program to interface a DAC and generate Triangular and Square waveforms.	
9.	Write a C program to demonstrate the use of an External interrupt in LPC 1768	
Demonstration Experiments (For CIE only not for SEE)		
Conduct the following experiments on an ARM CORTEX M3 evaluation board using evaluation version of Embedded 'C' & Keil µvision-4 tool/compiler.		
10.	Write a C program to interface a Real Time Clock (RTC) of LPC 1768.	
11.	Write a program to read on-chip ADC value and display it on UART terminal using LPC 1768	
12.	Write a C program to interface Keypad using LPC 1768.	

TEXT BOOKS:

1	Andrew N Sloss, "ARM System Developer's guide", Elsevier Publications, 2016
2	Joseph Yiu, "The Definitive Guide to the ARM Cortex-M3 and Cortex-M4 Processors", Newnes, Elsevier
3	STM32 Arm Programming for Embedded Systems, Shujen Chen, Eshragh Ghaemi, Muhammad Ali Mazidi, Microdigitaled, ISBN: 978-0997925944.

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REFERENCE BOOKS:	
1	Reference manuals: STM32F411, LPC1768.

Assessment Details both (CIE and SEE)			
The weightage of Continuous Internal Evaluation (CIE) and Semester End Exam (SEE) is 50% each. The students have to obtain a minimum of 40% marks individually both in CIE and SEE to pass. CIE: The CIE has two components – CIE - theory component and CIE – laboratory component. Students have to score a minimum of 40% Marks in the total of CIE - theory and CIE – laboratory components put together, provided students have to score a minimum of 40% marks in CIE laboratory component alone to qualify to take SEE. Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration) and reduced to 50 Marks. **Self-Study Component should be not included for SEE & CIE.			
CONTINUOUS INTERNAL EVALUATION (CIE)		Max. Marks	Minimum Marks to be scored in CIE, to qualify to take SEE (40% individually)
Theory	Weightage of CIE1 and CIE2 Tests or CIE3	30	12
Laboratory components	Rubrics for experiment are added, then taken average	10	08
	Lab CIE	10	
TOTAL		50	20

QUESTION PAPER PATTERN (SEE)										
Q. No.	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
UNIT	1	2	3	4	5	6	7	8	9	10
1. Two full questions (each of 20 Marks) are to be set from each unit.										
2. Student shall answer five full questions selecting one full question from each unit.										

Course Outcomes: After the completion of the course, the student will be able to:	
CO1	Analyze and explain the architectural features, programmer's model, memory organization, and instruction set of 32-bit ARM Cortex-M3/M4 microcontrollers.
CO2	Apply and develop ARM Cortex-M3/M4 instruction set programs for different embedded system applications.
CO3	Analyze and apply the Thumb/Thumb-2 instruction set and C-programming concepts for developing ARM Cortex-M3/M4 based applications

CO4	Analyze and design embedded system solutions using Cortex-M architecture, memory system, interrupts, and peripheral resources
CO5	Design and implement ARM Cortex-M3/M4 based applications for interfacing sensors, actuators, and peripheral devices.

Mapping of CO's, PO's with PSO's														
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0														
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PSO 1	PSO 2	PSO 3
CO 1	3	3	2	2	1	0	0	0	0	0	0	3	2	1
CO 2	3	3	3	2	3	0	0	0	1	1	1	3	3	2
CO 3	3	3	3	2	3	0	0	0	1	1	1	3	3	2
CO 4	3	3	3	3	3	0	0	0	1	1	2	3	3	2
CO 5	3	3	3	3	3	1	1	0	3	2	2	3	3	3

Mapping of CO's with Knowledge and Attitude Profile (WK)									
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0									
CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
CO1	0	3	3	2	0	1	0	0	0
CO2	0	2	3	3	3	2	0	0	0
CO3	0	2	3	3	3	2	0	0	0
CO4	0	3	3	3	2	3	0	0	0
CO5	0	2	3	3	3	3	0	0	0

Mapping of CO's with Sustainable Development Goals (SDG)																	
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0																	
CO/SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1	0	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0
CO2	0	0	0	2	0	0	1	1	3	0	1	1	0	0	0	0	0
CO3	0	0	0	2	0	0	1	1	3	0	1	1	0	0	0	0	0
CO4	0	0	0	2	0	0	2	1	3	0	2	2	1	0	0	0	0
CO5	0	0	0	2	0	0	2	2	3	0	3	2	2	0	0	0	0

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Course Title	DIGITAL SIGNAL PROCESSING						
Course Code	ECT503						
Course Category	PCC (Professional Core Course)						
Teaching - Learning Scheme & Credit	L	T	P	S	Total	Total Teaching Hours	Credit
	4	0	0	0	4	52+0+0+0=52	4
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hrs	

Course Learning Objectives:	
CLO1	To learn and understand Discrete Fourier Transforms, Fast Fourier Transforms, IIR filters, FIR filters and their structures.
CLO2	To apply the concept of sampling theorem, DFT, FFT algorithms, IIR and FIR filters.
CLO3	To illustrate the DFT, FFT algorithms, IIR and FIR filters.
CLO4	To design the analog IIR, digital IIR and FIR filters.
CLO5	To interpret the introduction to machine learning and classification.

SYLLABUS	No. of Hours	BTLs
UNIT 1	10	L1-L4
Discrete Fourier Transform (DFT) and its Properties: Frequency domain sampling and reconstruction of discrete time signals: DFT and IDFT, Numerical examples. Properties of DFT: Periodicity, linearity, Symmetry properties, Circular folding, Circular Convolution, Circular time shift, Circular frequency shift, Complex conjugate property, Multiplication of two sequences, Use of DFT in linear filtering, overlap-save and overlap-add method. TEXT 1 and TEXT 2		
UNIT 2	10	L1-L4
Fast-Fourier-Transform (FFT) Algorithms: Direct computation of DFT, need for efficient computation of the DFT (FFT algorithms). Radix-2 FFT algorithm for the computation of DFT and IDFT: Decimation-in-time (DIT) and Decimation-in-frequency (DIF) algorithms. TEXT 1		
UNIT 3	10	L1-L4
IIR Filter Design: Characteristics of commonly used analog filters – Butterworth and Chebyshev filters, analog to analog frequency transformation. Design of IIR Digital filters from analog filters (Butterworth and Cheyshev Type): Impulse Invariance method and Bilinear transformation method, Derivation and design problems. TEXT 1		

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UNIT 4	10	L1-L4
FIR Filter Design: Introduction to FIR filters, Design of FIR filters using Rectangular, Hamming and Hanning windows. TEXT 1 and TEXT 2		
UNIT 5	12	L1-L4
Implementation of Discrete-Time Systems: Structures for IIR systems: Direct form I & II, Cascade & Parallel form realization. Structures for FIR systems: Direct form, Linear phase, Cascade form. Introduction to Multirate Digital Signal Processing: Introduction, Decimation by factor D, Interpolation by factor I TEXT 1 and TEXT 2		

TEXT BOOKS:	
1	Proakis & Monalakis , “Digital Signal Processing-Principles, Algorithms & Applications”, Fourth Edition, Pearson Education, New Delhi, 2009
2	Emmanuel C Ifeachor and Barrie W Jervis , “Digital Signal Processing: A Practical Approach”, Second edition, Pearson Education, New Delhi, 2002

REFERENCE BOOKS:	
1	Alan V. Oppenheim and Schaffer, “Discrete Time Signal Processing”, 2nd edition, PHI, 2007
2	Sanjit K. Mitra, “Digital Signal Processing”, 3rd edition, Tata Mc-Graw Hill, 2010
3	Lee Tan, “Digital Signal Processing”, edition, Elsevier publications, 2007
4	Shenoy, “Introduction to Digital Signal Processing and Filter Design”, 1st edition, John Wiley & Sons, 2010
5	Lonnie C. Ludeman, “Fundamentals of Digital Signal Processing”, International edition, John Wiley & Sons, 1988
e-LEARNING RESOURCES:	
1	https://nptel.ac.in/courses/117102060
2	https://ocw.mit.edu/courses/res-6-008-digital-signal-processing-spring-2011/
3	https://github.com/openlists/DSPResources
4	https://www.youtube.com/watch?v=gH48z-aAaRw

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Assessment Details both (CIE and SEE)			
The weightage of Continuous Internal Evaluation (CIE) and Semester End Exam (SEE) is 50% each. The students have to obtain a minimum of 40% marks individually both in CIE and SEE to pass. CIE: The CIE has three components – CIE - theory component, assignment and group activity. Students have to score a minimum of 40% Marks in the total of CIE - theory, assignment and group activity components put together to take SEE. SEE: Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration) and reduced to 50 Marks.			
CONTINUOUS INTERNAL EVALUATION (CIE)		Max. Marks	Minimum Marks to be scored in CIE, to qualify to take SEE (40% individually)
Theory	Weightage of CIE1 and CIE2 Tests or CIE3	50	20
TOTAL		50	20

QUESTION PAPER PATTERN (SEE)										
Q. No.	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
UNIT	1	2	3	4	5	6	7	8	9	10
1. Two full questions (each of 20 Marks) are to be set from each unit.										
2. Student shall answer five full questions selecting one full question from each unit.										

Course Outcomes: After the completion of the course, the student will be able to:	
CO1	Define Discrete Fourier Transforms and their properties.
CO2	Analyse the digital signals using various digital transforms DFT, FFT.
CO3	Apply design steps in Butterworth and Chebyshev Filter design.
CO4	Apply different windowing techniques and analyze their performance.
CO5	Theory behind machine learning and its classification.

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Mapping of CO's, PO's with PSO's														
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0														
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PSO 1	PSO 2	PSO 3
CO1	3	3	3	1	2	2	2	0	0	0	1	3	2	1
CO2	3	2	3	1	2	2	2	0	0	0	1	3	2	1
CO3	3	3	3	1	2	2	2	0	0	0	1	3	2	1
CO4	3	2	3	1	2	2	2	0	0	0	1	2	2	1
CO5	3	2	2	1	2	2	2	0	0	0	2	2	1	2

Mapping of CO's with Knowledge and Attitude Profile (WK)									
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0									
CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
CO1	0	3	2	3	0	0	0	0	0
CO2	0	3	2	3	0	2	0	2	0
CO3	0	3	2	3	2	3	0	1	0
CO4	0	3	2	3	2	3	0	2	0
CO5	0	3	2	3	1	3	0	2	1

Mapping of CO's with Sustainable Development Goals (SDG)																	
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0																	
CO/SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1	0	0	0	3	0	0	0	1	2	0	0	0	0	0	0	0	0
CO2	0	0	0	3	0	0	0	2	3	0	0	1	0	0	0	0	0
CO3	0	0	0	3	0	0	0	2	3	0	0	1	0	0	0	0	0
CO4	0	0	0	3	0	0	0	2	3	0	0	1	0	0	0	0	0
CO5	0	0	0	3	0	0	0	3	3	0	0	1	0	0	0	0	1

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Program: Electronics and communication Engineering

Semester: V

Course Title	DIGITAL SIGNAL PROCESSING LAB						
Course Code	ECL504						
Course Category	PCCL (Professional Core Course Laboratory)						
Teaching - Learning Scheme & Credit	L	T	P	TW+SL	Total	Total Teaching Hours	Credit
	00	00	02	00	02	26	01
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hrs	

Course Learning Objectives:	
CLO1	To analyze the sampling process, impulse response, convolution, frequency domain response of LTI systems
CLO2	To analyze and design of digital IIR and FIR filters
CLO3	To demonstrate the DSP algorithms using Matlab software
CLO4	To demonstrate the DSP algorithms using Code Composer Studio and DSP kit TMS320C6748

Syllabus	
EXPERIMENTS	
1	Impulse response of a given system
2	Linear convolution of two given sequences.
3	Circular convolution of two given sequences
4	Linear convolution of two sequences using DFT and IDFT.
5	Circular convolution of two given sequences using DFT and IDFT
6	Design and implementation of FIR filter to meet given specifications.
7	Design and implementation of IIR Butterworth filter to meet given specifications.
8	Design and implementation of IIR Chebyshev filter to meet given specifications
HARDWARE PROGRAMS USING TMS320C6748 DSK	
9	Linear convolution of two given sequences.
10	Circular convolution of two given sequences.
11	Computation of N- Point DFT of a given sequence.
12	Impulse response of first order system.

Teaching & Learning Process (Innovative Delivery Methods):	
1	Active Learning Techniques
2	Problem-Based Learning (PBL)
3	Team-Based Learning (TBL)
4	Hands-On Experiments and Simulations

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Semester: V

TEXT BOOKS:	
1	John G. Proakis and Dimitris G. Manolakis, Digital Signal Processing: Principles, Algorithms and Applications, 4th Edition, Pearson Education, New Delhi, 2009.
2	Emmanuel C. Ifeachor and Barrie W. Jervis, Digital Signal Processing: A Practical Approach, 2nd Edition, Pearson Education, New Delhi, 2002.

REFERENCE BOOKS:	
1	Sanjit K. Mitra, Digital Signal Processing: A Computer-Based Approach, 3rd Edition, Tata McGraw-Hill Education, 2010.
2	Shenoy K. V., Introduction to Digital Signal Processing and Filter Design, 1st Edition, John Wiley & Sons, 2010.
e-LEARNING RESOURCES:	
1	https://www.nptel.ac.in/courses/117102060
2	SWAYAM – Digital Signal Processing
3	DSP Virtual Lab – IIT Kharagpur
4	DSP Virtual Lab Experiments
5	Code Composer Studio Academy

Assessment Details both (CIE and SEE)			
The weightage of Continuous Internal Evaluation (CIE) and Semester End Exam (SEE) is 50% each. The students have to obtain a minimum of 40% marks individually both in CIE and SEE to pass. CIE: The CIE has two components – CIE - theory component and CIE – laboratory component. Students have to score a minimum of 40% Marks in the total of CIE - theory and CIE – laboratory components put together, provided students have to score a minimum of 40% marks in CIE laboratory component alone to qualify to take SEE. Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration) and reduced to 50 Marks.			
CONTINUOUS INTERNAL EVALUATION (CIE)		Max. Marks	Minimum Marks to be scored in CIE, to qualify to take SEE (40% individually)
Laboratory components	Rubrics for each experiment are added, then taken average	30	20
	Lab CIE	20	
TOTAL		50	20

Course Outcomes: After the completion of the course, the student will be able to:	
CO1	Define and verify the sampling theorem, impulse response, convolution and frequency response of the system
CO2	Understand basic algorithms of DSP
CO3	Design an IIR and FIR digital filter
CO4	Implementation of DSP algorithms using Matlab software and using Code Composer Studio (CCS) on DSP processor.
CO5	Conduction of DSP experiments on virtual laboratory

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Semester: V

Mapping of CO's, PO's with PSO's														
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	3	2	2	2	0	0	0	0	0	1	1	1
CO2	3	2	3	2	2	2	0	0	0	0	0	1	1	1
CO3	3	2	3	2	2	2	0	0	0	0	0	1	1	1
CO4	3	2	3	2	2	2	0	0	0	0	0	1	1	1
CO5	3	2	3	2	2	2	0	0	0	0	0	1	1	1

Mapping of CO's with Knowledge and Attitude Profile (WK)										
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0										
CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	
CO1	3	2	2	2	1	2	0	2	0	
CO2	3	3	2	2	1	3	0	2	0	
CO3	3	3	2	2	3	3	0	2	0	
CO4	2	3	2	2	2	3	0	3	0	
CO5	2	3	2	2	2	3	0	3	0	

Mapping of CO's with Sustainable Development Goals (SDG)																	
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0																	
CO/SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1	0	0	0	3	0	0	0	1	2	0	0	0	0	0	0	0	0
CO2	0	0	0	3	0	0	1	2	3	0	0	0	0	0	0	0	0
CO3	0	0	0	3	0	0	2	2	3	0	0	0	0	0	0	0	0
CO4	0	0	0	3	0	0	0	3	3	0	0	0	0	0	0	0	1
CO5	0	0	0	3	0	0	1	2	3	0	0	0	0	0	0	0	2

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Program: Electronics and Communication Engineering

Semester: V

Course Title	SYSTEM VERILOG FOR VERIFICATION						
Course Code	ECT505A						
Course Category	PEC (Professional Elective Course)						
Teaching - Learning Scheme & Credit	L	T	P	S	Total	Total Teaching Hours	Credit
	3	0	0	0	3	39+0+0+0=39	3
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hrs	

Course Learning Objectives:	
CLO1	Insight to apply System Verilog concepts to do synthesis, analysis and architecture design.
CLO2	Understanding of System Verilog and SVA for verification, and understand the improvements in verification efficiency.
CLO3	Analyze coverage driven verification for given design under test (DUT).
CLO4	Understand advanced verification features, such as the practical use of classes, randomization, checking, and coverage.
CLO5	Knowledge to communicate the purpose and results of a design experiment in written and oral presentations.

SYLLABUS	No. of Hours	BTLs
UNIT 1	08	L1-L3
Verification Guidelines: Introduction, Verification Process, Verification Plan, Verification Methodology Manual, Basic Test bench Functionality, Directed Testing, Methodology Basics, Constrained-Random Stimulus, Functional Coverage. Text 1		
UNIT 2	08	L1-L3
Data Types: Built-in Data Types, Fixed-Size Arrays, Dynamic Arrays, Queues, Creating New Types with typedef, Creating User-Defined Structures, Enumerated Types, Constants, Strings. Text 1		
UNIT 3	08	L1-L3
Basic Object-Oriented Programming: Where to Define a Class, OOP Terminology, Understanding Dynamic Objects. System Verilog Assertions: Types of Assertions and examples. Text 1		
UNIT 4	08	L1-L3
Threads and Inter-process Communication: Working with Threads, Inter-process Communication, Events, Semaphores, Mailboxes, Building a Test bench with Threads and IPC Functional Coverage: Coverage Types, Functional Coverage Strategies, Simple Functional Coverage Example, Coverage Options, Parameterized Cover Groups. Text 1 and Text 2		
UNIT 5	07	L1-L3
Introduction to formal verification: Introduction to formal techniques and property specification, Reachability analysis, Elements of property languages, Property language layers, PSL basics, Formal test plan process. Text 2 and Text 3		

Semester: V

TEXT BOOKS:	
1	Chris Spear, “ System Verilog for Verification: A Guide to Learning the Test bench Language Features ”, Springer 2006.
2	Janick Bergeron, “ Writing Test benches Using System Verilog ”, Springer, 2006.
3	Stuart Sutherland, Simon Davidman and Peter Flake, “ System Verilog for Design: A Guide to Using System Verilog for Hardware Design and Modeling ”, 2 nd Edition, Springer.

REFERENCE BOOKS:	
1	Janick Bergeron, “ Writing Test benches: Functional Verification of HDL Models ”, Second edition, Kluwer Academic Publishers, 2003.

Assessment Details both (CIE and SEE)			
The weightage of Continuous Internal Evaluation (CIE) and Semester End Exam (SEE) is 50% each. The students have to obtain a minimum of 40% marks individually both in CIE and SEE to pass. CIE: The CIE has three components – CIE - theory component, assignment and group activity. Students have to score a minimum of 40% Marks in the total of CIE - theory, assignment and group activity components put together to take SEE. SEE: Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration) and reduced to 50 Marks. **Self-Study Component should be not included for SEE & CIE.			
CONTINUOUS INTERNAL EVALUATION (CIE)		Max. Marks	Minimum Marks to be scored in CIE, to qualify to take SEE (40% individually)
Theory	Weightage of CIE1 and CIE2 Tests or CIE3	50	20
TOTAL		50	20

QUESTION PAPER PATTERN (SEE)										
Q. No.	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
UNIT	1		2		3		4		5	
1. Two full questions (each of 20 Marks) are to be set from each unit.										
2. Student shall answer five full questions selecting one full question from each unit.										

Course Outcomes: After the completion of the course, the student will be able to:	
CO1	Develop correct, efficient, and reusable digital-design models using SystemVerilog.
CO2	Develop and implement SystemVerilog testbenches for functional verification of digital designs.
CO3	Apply and evaluate advanced SystemVerilog constructs for effective digital-design verification.
CO4	Implement threads and inter-process communication mechanisms in SystemVerilog-based verification environments.
CO5	Explain and apply the fundamental concepts and processes of formal verification for digital systems.

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Semester: V

Mapping of CO's, PO's with PSO's														
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	3	1	3	0	0	1	1	1	2	3	2	3
CO2	3	3	2	3	3	0	0	1	1	2	2	3	3	2
CO3	3	3	2	3	3	0	0	1	1	1	3	3	3	2
CO4	3	3	2	3	3	0	0	1	2	1	2	3	3	2
CO5	3	3	2	3	2	1	2	2	1	1	3	3	3	2

Mapping of CO's with Knowledge and Attitude Profile (WK)										
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0										
CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	
CO1	1	2	3	3	3	3	0	2	1	
CO2	1	2	3	3	3	3	0	2	1	
CO3	1	2	3	3	2	3	0	3	1	
CO4	1	2	3	3	2	3	0	2	1	
CO5	1	3	3	3	2	3	1	3	2	

Mapping of CO's with Sustainable Development Goals (SDG)																	
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0																	
CO/SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1	0	0	0	3	0	0	0	2	3	0	0	2	0	0	0	0	0
CO2	0	0	0	3	0	0	0	2	3	0	0	1	0	0	0	0	0
CO3	0	0	0	3	0	0	0	2	3	0	0	2	0	0	0	0	0
CO4	0	0	0	3	0	0	0	2	3	0	0	1	0	0	0	0	0
CO5	0	0	0	3	0	0	0	2	3	0	0	2	0	0	0	0	0

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Semester: V

Course Title	ARTIFICIAL INTELLIGENCE						
Course Code	ECT505B						
Course Category	PCC (Professional Core Course)						
Teaching - Learning Scheme & Credits	L	T	P	S	Total	Total Teaching Hours	Credits
	3	0	0	0	3	39+0+0+0=39	3
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hrs	

Course Learning Objectives:	
CLO1	Identify the problems where AI is required and the different methods available
CLO2	Compare and contrast different AI techniques available.
CLO3	Network-based AI concepts
CLO4	Explain the basic concepts and principles of game playing in Artificial Intelligence.
CLO5	Define and explain learning algorithms

SYLLABUS	No. of Hours	BTLs
UNIT 1	08	L1-L4
INTRODUCTION TO ARTIFICIAL INTELLIGENCE AI Problems, AI Techniques, Tic-Tac-Toe, Question Answering, The level of the Model, Problems, Problem Spaces And Search: Defining The Problem As A State Space Search, Control Strategies, Heuristic Search, Problem Characteristics, Issues In The Design Search Programs. Text Book1: Ch 1,2		
UNIT 2	08	L1-L4
KNOWLEDGE REPRESENTATION ISSUES: Representation and Mappings, Approaches to Knowledge Representation, Issues in Knowledge Representation, Relationships among Attributes, Finding the Right Structures as Needed. Representing Simple Facts In Logic, Representating Instance and ISA Relationships, Computable Functions and Predicates, Natural Deduction. Procedural versus Declarative Knowledge, Logic Programming, Forward Versus Backward Reasoning. Text Book1: Ch 4,5,6		
UNIT 3	08	L1-L4
SYMBOLIC REASONING UNDER UNCERTAINTY : Introduction to Non- Monotonic Reasoning, Default Reasoning, Minimalist Reasoning, Implementation Issues. Statistical Reasoning: Probability and Bayers Theorem, Certainty Factors and Rule- Based Systems, Bayesian Networks, Dempster-Shafer Theory. Text Book1: Ch 7,8		
UNIT 4	08	L1-L4
GAME PLAYING: Overview, The MINMAX search procedure, Adding Alpha-Beta cutoffs, Iterative deepening Introduction and steps in process, syntactic processing, Grammers and parsers, ATN, SNLP, Corpora Text Book1: Ch12 & 15		

QUESTION PAPER PATTERN (SEE)										
Q. No.	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
UNIT	1		2		3		4		5	
1. Two full questions (each of 20 Marks) are to be set from each unit.										
2. Student shall answer five full questions selecting one full question from each unit.										

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Semester: V

Course Outcomes: After the completion of the course, the student will be able to:	
CO1	Explain the fundamental concepts of Artificial Intelligence, problem formulation, state-space representation, control strategies, and heuristic search techniques.
CO2	Apply knowledge representation techniques, logic, inference mechanisms, and reasoning strategies to represent and solve AI problems.
CO3	Analyze uncertain knowledge using probability, Bayes' theorem, certainty factors, Bayesian networks, and Dempster-Shafer theory.
CO4	Implement and analyze AI techniques for game playing and natural language processing, including MINIMAX, Alpha-Beta pruning, iterative deepening, grammars, and parsing.
CO5	Evaluate and apply machine learning and expert-system techniques, including inductive learning, version spaces, neural learning, genetic learning, knowledge acquisition, and expert system shells.

Mapping of CO's, PO's with PSO's														
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	0	0	0	1	1	0	3	0	1
CO2	3	3	3	2	3	1	0	1	1	2	0	3	0	1
CO3	3	3	2	3	3	1	1	1	1	2	0	3	1	2
CO4	3	3	3	2	3	1	1	1	2	2	1	3	1	2
CO5	3	3	3	3	3	2	2	2	2	2	2	2	1	3

Mapping of CO's with Knowledge and Attitude Profile (WK)										
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0										
CO/SDG's	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	
CO1	0	3	3	3	2	2	0	1	1	
CO2	0	3	3	3	3	3	1	2	1	
CO3	0	3	2	3	2	3	1	3	1	
CO4	0	2	3	3	3	3	1	2	2	
CO5	0	3	3	3	3	3	2	3	2	

Mapping of CO's with Sustainable Development Goals (SDG)																	
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0																	
CO	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1	0	0	0	3	0	0	0	1	2	1	1	0	0	0	0	0	0
CO2	0	0	0	3	0	0	0	2	3	2	1	1	1	0	0	0	0
CO3	0	0	0	3	0	0	0	2	3	2	2	1	2	0	0	0	0
CO4	0	0	0	2	0	0	0	2	3	2	2	1	1	0	0	0	0
CO5	0	0	0	3	0	0	0	3	3	2	3	2	2	0	0	0	0

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Semester: V

Course Title	FUNDAMENTALS OF VIRTUAL REALITY						
Course Code	ECT505C						
Course Category	PEC (Professional Elective Course)						
Teaching - Learning Scheme & Credit	L	T	P	S	Total	Total Teaching Hours	Credit
	3	0	0	0	3	39+0+0+0=39	3
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hrs	

Course Learning Objectives:	
CLO1	To become familiar with the basic concepts of virtual reality Technology and input devices
CLO2	To understand the output devices.
CLO3	To study the concepts of Modeling in virtual
CLO4	To understand the human factors in VR
CLO5	To become familiar with the applications of VR

SYLLABUS	No. of Hours	BTLs
UNIT 1	08	L1-L2
INTRODUCTION: Three I's of virtual reality, commercial VR technology, five classic components of a VR system. Input Devices: 3D position trackers: Tracker Performance Parameters, Ultrasonic Trackers, Optical Trackers Navigation and Manipulation interfaces: Tracker-Based Navigation/Manipulation Interfaces, Trackballs, 3D Probes. Text book1: 1.1, 1.3, 1.5, 2.1: 2.1.1, 2.1.4,2.1.5,2.1.6, 2.2: 2.2.1, 2.2.2,2.2.3		
UNIT 2	08	L1-L2
OUTPUT DEVICES: Graphics displays: Human Visual System. Personal Graphics Displays: Head-Mounted, Hand-Supported, Floor-Supported and Desk Supported Displays. Large-Volume Displays: Monitor-Based, Large-Volume, and projector Based Displays. Sound displays: Human Auditory System, Convolvotron, Speaker-Based 3D Sound. Text book1: 3.1: 3.1.1,3.1.2, 3.1.3, 3.2: 3.2.1, 3.2.2, 3.2.3		
UNIT 3	08	L1-L2
MODELING: Geometric modeling: Virtual Object Shape, Kinematics modeling: Homogeneous Transformation Matrices, Physical modeling: Collision Detection Text book1: 5.1: 5.1.1, 5.2:5.2.1 and 5.3: 5.3.1		
UNIT 4	08	L1-L2
HUMAN FACTORS: Methodology and terminology: Data Collection and Analysis, Usability Engineering Methodology User performance studies: Testbed Evaluation of Universal VR Tasks. VR health and safety issues: Direct Effects of VR, Simulations on Users, Cyber sickness, Text book1: 7.1:7.1.1,7.1.2, 7.2:7.2.1 and 7.3:7.3.1,7.3.2,7.3.3,7.3.4.		

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UNIT 5	09	L1-L2
APPLICATIONS: Medical applications, Education, arts and entertainment, Military applications, Robotics applications. Text book1: 8.1,8.2, 8.3 and 9.2		

TEXT BOOKS:	
1	Virtual Reality Technology, Second Edition, Gregory C. Burdea& Philippe Coiffet, John Wiley & Sons. 3 rd edition 2024
2	Introduction to Virtual Reality, John Vince, Springer, London, Springer-Verlag London Limited 2004

REFERENCE BOOKS:	
1	Virtual Reality Systems. John Vince, Pearson Education, 2007

Assessment Details both (CIE and SEE)			
The weightage of Continuous Internal Evaluation (CIE) and Semester End Exam (SEE) is 50% each. The students have to obtain a minimum of 40% marks individually both in CIE and SEE to pass. CIE: The CIE has three components – CIE - theory component, assignment and group activity. Students have to score a minimum of 40% Marks in the total of CIE - theory, assignment and group activity components put together to take SEE. SEE: Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration) and reduced to 50 Marks. **Self-Study Component should be not included for SEE & CIE.			
CONTINUOUS INTERNAL EVALUATION (CIE)		Max. Marks	Minimum Marks to be scored in CIE, to qualify to take SEE (40% individually)
Theory	Weightage of CIE1 and CIE2 Tests or CIE3	50	20
TOTAL		50	20

QUESTION PAPER PATTERN (SEE)										
Q. No.	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
UNIT	1		2		3		4		5	
1. Two full questions (each of 20 Marks) are to be set from each unit.										
2. Student shall answer five full questions selecting one full question from each unit.										

Course Outcomes: After the completion of the course, the student will be able to:	
CO1	Describe the fundamental concepts of Virtual Reality (VR) and various VR input devices.
CO2	Compare and evaluate different VR input and output devices based on their characteristics and applications
CO3	Apply Virtual Reality modeling techniques to develop and represent virtual environments.

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Semester: V

CO4	Explain and analyze human factors and ergonomic considerations in Virtual Reality systems.
CO5	Identify and explain various applications of Virtual Reality in different domains.

Mapping of CO's, PO's with PSO's														
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	3	0	0	1	0	1	1	3	2	1
CO2	3	3	2	2	3	1	0	1	1	2	1	3	3	2
CO3	3	3	3	3	3	1	1	1	1	1	2	3	3	3
CO4	3	3	2	3	2	2	2	2	1	2	1	3	3	2
CO5	3	3	3	3	3	2	2	1	1	2	2	3	3	3

Mapping of CO's with Knowledge and Attitude Profile (WK)										
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0										
CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	
CO1	1	2	3	3	2	2	1	1	1	
CO2	1	2	3	3	2	3	1	2	1	
CO3	1	3	3	3	3	3	1	3	1	
CO4	2	2	3	3	2	3	3	2	3	
CO5	1	2	3	3	3	3	3	3	2	

Mapping of CO's with Sustainable Development Goals (SDG)																	
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0																	
CO/SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1	0	0	0	3	0	0	0	2	3	1	1	0	0	0	0	0	0
CO2	0	0	0	3	0	0	0	3	3	1	1	0	0	0	0	0	0
CO3	0	0	0	3	0	0	0	3	3	2	2	0	0	0	0	0	0
CO4	0	0	0	3	0	0	0	2	2	3	2	0	0	0	0	0	0
CO5	0	0	0	3	0	0	0	3	3	3	3	0	0	0	0	0	0

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Course Title	MULTICORE ARCHITECTURE						
Course Code	ECT505D						
Course Category	PCC (Professional Core Course)						
Teaching - Learning Scheme & Credit	L	T	P	S	Total	Total Teaching Hours	Credit
	3	0	0	0	3	39+0+0+0=39	3
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hrs	

Course Learning Objectives:	
CLO1	Provide the knowledge of Multi-core Architecture.
CLO2	Understand the importance of Threading in systems.
CLO3	Cover the Fundamental Concepts of Parallel Programming.
CLO4	Understand the Threading and Parallel Programming Constructs.
CLO5	Explain the different aspects of OpenMP in the context of threading.

SYLLABUS	No. of Hours	BTLs
UNIT 1	08	L1-L4
Introduction to Multi-core Architecture: Motivation for Concurrency in software, Parallel Computing Platforms, Parallel Computing in Microprocessors, Differentiating Multi-core Architectures from Hyper- Threading Technology, Multithreading on Single-Core versus Multi-Core Platforms Understanding Performance, Amdahl's Law, Growing Returns: Gustafson's Law.		
UNIT 2	07	L1-L4
System Overview of Threading: Defining Threads, System View of Threads, Threading above the Operating System, Threads inside the OS, Threads inside the Hardware, What Happens When a Thread Is Created, Application Programming Models and Threading, Virtual Environment: VMs and Platforms, Runtime Virtualization, System Virtualization.		
UNIT 3	07	L1-L4
Fundamental Concepts of Parallel Programming: Designing for Threads, Task Decomposition, Data Decomposition, Data Flow Decomposition, Implications of Different Decompositions, and Challenges You will Face, Parallel Programming Patterns. A Motivating Problem: Error Diffusion, Analysis of the Error Diffusion Algorithm. An Alternate Approach: Parallel Error Diffusion, Other Alternatives.		

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UNIT 4	07	L1-L4
Threading and Parallel Programming Constructs: Synchronization, Critical Sections, Deadlock, Synchronization Primitives, Semaphores, Locks, Condition Variables, Messages, Flow Control-based Concepts, Fence, Barrier, Implementation dependent Threading Features.		
UNIT 5	10	L1-L4
OpenMP: A Portable Solution for Threading, Challenges in Threading a Loop, Loop-carried Dependence, Data-race Conditions, Managing Shared and Private Data, Loop Scheduling and Portioning, Effective Use of Reductions, Minimizing Threading Overhead, Work-sharing Sections, Performance-oriented Programming, Using Barrier and No wait, Interleaving Single-thread and Multi-thread Execution, Data Copy-in and Copy-out, Protecting Updates of Shared Variables, Intel Task queuing Extension to OpenMP, OpenMP Library Functions, OpenMP Environment Variables, Compilation, Debugging, performance.		

TEXTBOOKS:	
1	Shameem Akhter and Jason Roberts “Multicore Programming, Increased Performance through Software Multi-threading” Intel Press, 2006.ISBN 0-9764832-4-6.

REFERENCE BOOKS:	
1	Calvin Lin, Lawrence Snyder, “Principles of Parallel Programming” Pearson Education, 2009. ISBN-13: 978-0321487902.
2	Michael J. Quinn, “Parallel Programming in C with MPI and OpenMP”, Tata McGraw Hill, 2004. ISBN 13: 9780070582019.
3	David E, Culler, Jaswinder Pal Singh with Anoop Gupta “Parallel Computer Architecture A Hardware/ Software Approach”, eBook ISBN: 9780080573076 Hardcover ISBN: 9781558603431

Assessment Details both (CIE and SEE)
The weightage of Continuous Internal Evaluation (CIE) and Semester End Exam (SEE) is 50% each. The students have to obtain a minimum of 40% marks individually both in CIE and SEE to pass. CIE: The CIE has three components – CIE - theory component, assignment and group activity. Students have to score a minimum of 40% Marks in the total of CIE - theory, assignment and group activity components put together to take SEE. SEE: Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration) and reduced to 50 Marks.

CONTINUOUS INTERNAL EVALUATION (CIE)		Max. Marks	Minimum Marks to be scored in CIE, to qualify to take SEE (40% individually)
Theory	Weightage of CIE1 and CIE2 Tests or CIE3	50	20
TOTAL		50	20

QUESTION PAPER PATTERN (SEE)										
Q. No.	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
UNIT	1	2	3	4	5					
1. Two full questions (each of 20 Marks) are to be set from each unit.										
2. Student shall answer five full questions selecting one full question from each unit.										

Course Outcomes: After the completion of the course, the student will be able to:	
CO1	Describe the working principle, fundamental characteristics of various semiconductor devices such as BJT, FET, MOSFETs, and operational amplifiers in electronic circuits.
CO2	Understand and Analyze various Power Amplifiers and FET biasing Techniques, evaluate performance parameters.
CO3	Analyze and Design FET Amplifier Circuits using Small Signal Models and appropriate Biasing Techniques and Evaluate Parameters.
CO4	Analyze various filter circuits using linear integrated circuits.
CO5	Understand the Structure and Parameters of Op-amp and Analyze its applications in Analog Signal Processing.

Mapping of CO's, PO's with PSO's														
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0														
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PSO 1	PSO 2	PSO 3
CO 1	3	3	2	2	0	1	0	0	1	1	1	3	2	1
CO 2	3	3	3	2	0	1	0	0	1	1	1	3	3	1
CO 3	3	3	3	3	2	1	0	0	2	1	1	3	3	2
CO 4	3	3	3	3	0	1	0	1	2	1	1	3	3	2

CO 5	3	3	3	3	0	1	0	1	2	2	2	3	3	3
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Mapping of CO's with Knowledge and Attitude Profile (WK) Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0									
CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
CO1	0	3	3	2	2	2	0	0	0
CO2	0	3	3	3	2	2	0	0	0
CO3	0	2	3	3	3	3	0	0	0
CO4	0	2	3	3	3	3	0	0	0
CO5	0	2	3	3	3	3	0	0	0

Mapping of CO's with Sustainable Development Goals (SDG) Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0																	
CO/SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1	0	0	0	2	0	0	2	2	3	0	1	1	1	0	0	0	0
CO2	0	0	0	2	0	0	2	3	3	0	2	1	1	0	0	0	0
CO3	0	0	0	2	0	0	2	3	3	0	2	2	1	0	0	0	0
CO4	0	0	0	2	0	0	2	3	3	0	2	2	1	0	0	0	0
CO5	0	0	0	2	0	0	2	3	3	0	3	2	2	0	0	0	0

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Course Title	ADVANCED CONTROL SYSTEMS						
Course Code	ECT505E						
Course Category	PCC (Professional Core Course)						
Teaching - Learning Scheme & Credit	L	T	P	S	Total	Total Teaching Hours	Credit
	3	0	0	0	3	39+0+0+0=39	3
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hrs	

Course Learning Objectives:	
CLO1	Basic concepts of state space representation and analysis.
CLO2	Designing of state feedback controllers.
CLO3	Analysing non-linear systems
CLO4	Stability analysis of linear and non-linear systems.

SYLLABUS	No. of Hours	BTLs
UNIT 1	8	L1-L4
State Variable Description Introduction, The concept of state, state equations for dynamic systems, time invariance and linearity, nonuniqueness of state model. State diagram, linear continuous time models, nonlinear models, local linearization of nonlinear models.		
UNIT 2	8	L1-L4
Solution of state equations Introduction, Existence and uniqueness of solution to continuous time state equations, solution of nonlinear continuous time state equations, solution of linear time varying continuous time state equations, solution of linear time invariant continuous time state equations.		
UNIT 3	8	L1-L4
Controllability and observability Introduction, General Concept of controllability, general concept of observability, controllability and observability test for continuous time systems. Controllability and observability state model in Jordan canonical form.		
UNIT 4	8	L1-L4
Stability Introduction, equilibrium points, stability concepts and definitions, Stability of LTI Systems, Stability of nonlinear continuous autonomous systems, the direct method of Lyapunov and the linear continuous time autonomous systems. Use of Lyapunov functions to estimate transients.		
UNIT 5	7	L1-L4
Model Control Introductions, controllable and observable companion forms, the effect of state feedback on controllability and observability, pole placement of state feedback, full order observers, reduced order observers, deadbeat control by state feedback, deadbeat observers.		

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TEXT BOOKS:	
1	Gopal M, Modern Control System Theory, 2/e, New Age Publishers, Reprint 2005.

Assessment Details both (CIE and SEE)			
The weightage of Continuous Internal Evaluation (CIE) and Semester End Exam (SEE) is 50% each. The students have to obtain a minimum of 40% marks individually both in CIE and SEE to pass. CIE: The CIE has three components – CIE - theory component(40Marks), assignment (5Marks) and group activity(5Marks). Students have to score a minimum of 40% Marks in the total of CIE - theory, assignment and group activity components put together to take SEE. SEE: Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration) and reduced to 50 Marks.			
CONTINUOUS INTERNAL EVALUATION (CIE)		Max. Marks	Minimum Marks to be scored in CIE, to qualify to take SEE (40% individually)
Theory	Weightage of CIE1 and CIE2 Tests or CIE3	50	20
TOTAL		50	20

QUESTION PAPER PATTERN (SEE)										
Q. No.	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
UNIT	1		2		3		4		5	
1. Two full questions (each of 20 Marks) are to be set from each unit.										
2. Student shall answer five full questions selecting one full question from each unit.										

Course Outcomes: After the completion of the course, the student will be able to:	
CO1	Explain and analyze the fundamentals of VLSI technology, fabrication processes, and CMOS device structures.
CO2	Analyze the VLSI circuit design process and MOS transistor characteristics for CMOS circuit implementation.
CO3	Analyze and evaluate the electrical and performance parameters of MOS-based VLSI components and circuits.
CO4	Analyze and compare different CMOS logic structures based on speed, power, area, and implementation requirements.
CO5	Design and evaluate arithmetic circuits using MOS transistors and CMOS logic structures considering area, power, and performance constraints.

Mapping of CO's, PO's with PSO's														
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	2	2	1	1	1	0	1	1	1	1	2
CO2	3	3	2	3	3	1	1	1	0	1	1	1	1	2
CO3	3	3	3	3	3	1	1	1	1	1	1	1	1	2
CO4	3	3	3	3	3	1	1	1	1	1	1	1	1	2
CO5	3	3	3	3	3	1	1	1	1	2	3	1	1	2

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Mapping of CO's with Knowledge and Attitude Profile (WK)									
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0									
CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
CO1	2	2	3	3	1	2	1	1	2
CO2	2	3	3	3	2	3	1	2	3
CO3	2	3	3	3	3	3	1	3	3
CO4	1	3	3	3	3	3	1	2	3
CO5	1	3	3	3	3	3	1	3	3

Mapping of CO's with Sustainable Development Goals (SDG)																	
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0																	
CO/SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1	0	0	0	3	0	0	1	2	3	0	0	1	1	0	0	0	0
CO2	0	0	0	3	0	0	2	3	3	0	0	2	1	0	0	0	0
CO3	0	0	0	3	0	0	3	3	3	0	0	3	2	0	0	0	0
CO4	0	0	0	3	0	0	3	3	3	0	0	3	2	0	0	0	0
CO5	0	0	0	3	0	0	3	3	3	0	0	3	3	0	0	0	0

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Semester: V

Course Title	PROGRAMMING WITH PYTHON						
Course Code	ECT505F						
Course Category	PCC (Professional Core Course)						
Teaching - Learning Scheme & Credit	L	T	P	S	Total	Total Teaching Hours	Credit
	3	0	0	0	3	39+0+0+0=39	3
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hrs	

Course Learning Objectives:	
CLO1	To acquire the fundamentals of Python programming language.
CLO2	To attain an understanding of functions and collection types.
CLO3	To familiarize the concepts of sequence types, data structures, and error handling in Python.
CLO4	To realize the concepts of object-oriented in Python.
CLO5	To get familiarized with the concepts of file handling and regular expressions.

SYLLABUS	No. of Hours	BTLs
UNIT 1	8	L1-L4
Introduction: Introducing Python, Setting Up Python in Windows, introducing IDLE. Parts of Python programming: Identifiers, Variables, Keywords, statements and expressions, variables, operators, datatypes-Built-in datatypes, sequences in Python, indentation, comments, Input and Output statements. Control Flow - if, if-elif-else, while loop, for loop, infinite loop, break, continue, return, and pass statements.		
UNIT 2	8	L1-L4
Functions - Defining Functions, Calling Functions, positional Arguments, Keyword Arguments, Default Arguments, Variable-length arguments, Recursive Functions, Anonymous Functions, and Function Decorators. Strings and Lists: Creation, Basic operations, built-in methods, del statement.		
UNIT 3	8	L1-L4
Tuples, and Dictionaries: Creating Tuples, Accessing the Tuple Elements, Basic Operations on Tuples, Operations on Dictionaries, Dictionary methods, using for loop with dictionaries, converting lists into dictionaries, Converting Strings into Dictionary, Data Structures in Python: Linked Lists, Stacks, Queues, Deques. Programming Examples. Exceptions: Errors in a Python Program, Exception Handling, The Except Block, User Defined Exceptions.		
UNIT 4	8	L1-L4
Object Oriented Programming in Python: Features of Object -Oriented Programming System (OOPS), Creating a class, The Self Variable, constructor, Types of variables, Namespaces, Types of Methods, passing members of one class to another class, Inner classes.		

Inheritance and Polymorphism: Constructors in Inheritance, overriding Super class constructors and methods, The super() method, Types of Inheritance: Single/Multiple, Method Resolution order, Polymorphism, Operator Overloading, Method overloading, Method Overriding. Programming Examples		
UNIT 5	7	L1-L4
Files in Python: Types of files, Opening and closing file, Working with Text files, Working with Binary Files, with statements, Pickle in Python, The seek() and tell() methods, Random accessing Binary files, zipping, and unzipping Files, reading and writing to CSV files. Regular Expressions: Regular Expression, Sequence Characters in Regular Expression, Quantifiers in Regular Expression, Special Characters in Regular Expression, Using Regular Expression on Files, Retrieving Information from a HTML File.		

TEXT BOOKS:	
1	Core Python Programming: Dr. R. Nageshwara Rao, Dream Tech Press,2018
2	Introduction to Python Programming, Gowrishankar S, Veena A, CRC Press,2019

REFERENCE BOOKS:	
1	Think Python, Allen Downey, Green Tea Press.
2	Core Python Programming, W.Chun, Pearson.
3	Introduction to Python, Kenneth A. Lambert, Cengage
e-LEARNING RESOURCES:	
1	https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_cs109
2	https://www.learnbyexample.org/python-lambda-function
3	https://www.learnpython.org/

Assessment Details both (CIE and SEE)			
The weightage of Continuous Internal Evaluation (CIE) and Semester End Exam (SEE) is 50% each. The students have to obtain a minimum of 40% marks individually both in CIE and SEE to pass. CIE: The CIE has three components – CIE - theory component(40Marks), assignment (5Marks) and group activity(5Marks). Students have to score a minimum of 40% Marks in the total of CIE - theory, assignment and group activity components put together to take SEE. SEE: Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration) and reduced to 50 Marks.			
CONTINUOUS INTERNAL EVALUATION (CIE)		Max. Marks	Minimum Marks to be scored in CIE, to qualify to take SEE (40% individually)
Theory	Weightage of CIE1 and CIE2 Tests or CIE3	50	20
TOTAL		50	20

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QUESTION PAPER PATTERN (SEE)										
Q. No.	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
UNIT	1		2		3		4		5	
1. Two full questions (each of 20 Marks) are to be set from each unit.										
2. Student shall answer five full questions selecting one full question from each unit.										

Course Outcomes: After the completion of the course, the student will be able to:	
CO1	Apply the knowledge of Python scripting elements, Python constructs, datatypes, to solve engineering problems.
CO2	Identify the problem to apply the concepts of control structures, functions and error handling to solve them using the Python programming language
CO3	Apply the knowledge of Python and use the language scripting elements to manage the data, build the data structures, and handle errors.
CO4	Designing the solution to real-world problems through object-oriented concepts such as Inheritance, Polymorphism, and operator overloading.
CO5	Demonstrating the concepts of file handling and regular expressions

Mapping of CO's, PO's with PSO's														
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	3	0	0	0	1	0	2	1	1	2
CO2	3	3	1	1	3	0	0	0	1	0	2	1	1	2
CO3	3	2	2	2	3	0	1	0	1	0	2	1	1	2
CO4	3	3	3	1	3	1	1	1	1	1	2	1	1	2
CO5	3	2	2	2	3	0	1	0	2	0	2	1	1	2

Mapping of CO's with Knowledge and Attitude Profile (WK)									
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0									
CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
CO1	0	3	2	1	0	3	0	0	0
CO2	0	3	2	1	0	3	0	1	0
CO3	0	3	2	2	0	3	0	1	0
CO4	0	3	2	3	1	3	1	1	0
CO5	0	3	1	2	0	3	0	1	0

Mapping of CO's with Sustainable Development Goals (SDG)																	
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0																	
CO/SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1	0	0	0	3	0	0	0	2	3	0	0	1	0	0	0	0	0
CO2	0	0	0	3	0	0	0	2	3	0	0	1	0	0	0	0	0
CO3	0	0	0	3	0	0	0	2	3	0	0	1	0	0	0	0	0
CO4	0	0	0	3	0	0	0	3	3	0	0	2	0	0	0	0	0
CO5	0	0	0	3	0	0	0	3	3	0	0	1	0	0	0	0	0

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Semester: V

Course Title	MINI PROJECT						
Course Code	ECM506						
Course Category	Project						
Teaching - Learning Scheme & Credits	L	T	P	S	Total	Total Teaching Hours	Credits
	0	0	2	0	2	2+0+0+0=2	2
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hrs	

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.

Course outcome (Course Skill Set):

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

- CO1 (L2 – Analyze):** Identify a real-world engineering problem through literature survey and define appropriate project objectives and requirements.
- CO2 (L3 – Create):** Design a hardware/software-based solution using appropriate engineering principles, components, and modern tools.
- CO3 (L4 – Apply):** Develop and test a functional prototype by applying engineering knowledge and modern engineering tools..
- CO4 (L4 – Evaluate):** Evaluate the performance of the developed prototype through experimentation, analysis, and validation of results.
- CO5 (L5 –:Apply):** Communicate the project outcomes effectively through technical reports, presentations, and teamwork while demonstrating professional ethics.

Mapping of CO's, PO's with PSO's														
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	3	0	2	0	0	0	0	0	0	3	2	2	1
CO2	3	2	3	1	3	2	0	0	0	2	1	3	3	1
CO3	3	2	3	3	3	1	0	2	0	1	1	3	3	1
CO4	2	3	2	3	3	2	0	0	0	1	2	3	3	1
CO5	0	0	0	0	0	2	3	3	3	2	2	1	1	3

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Mapping of CO's with Knowledge and Attitude Profile (WK) Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0									
CO/SDG's	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
C01	2	2	3	2	1	1	1	3	0
C02	1	2	3	3	2	3	1	2	1
C03	1	3	3	3	2	3	1	2	1
C04	1	3	2	3	2	3	1	3	1
C05	0	1	0	1	1	1	3	2	3

Mapping of CO's with Sustainable Development Goals (SDG) Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0																	
CO	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
C01	0	0	1	2	0	1	1	1	3	1	2	1	1	0	0	1	2
C02	0	0	1	1	0	1	3	1	3	1	2	2	1	0	0	0	1
C03	0	1	1	1	0	1	3	1	3	1	3	2	1	0	0	0	1
C04	0	0	1	1	0	0	2	1	3	1	3	2	2	0	0	0	1
C05	1	0	1	3	2	0	0	2	2	2	2	1	1	0	0	2	3

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Semester: VI

Course Title	MICROWAVE AND ANTENNA						
Course Code	ECU601						
Course Category	IPCC (Integrated Professional Core Course)						
Teaching - Learning Scheme & Credit	L	T	P	S	Total	Total Teaching Hours	Credit
	3	0	2	0	5	39+0+26+0=65	4
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hrs	

Course Learning Objectives:	
CLO1	Understanding the basics of microwave and waveguides.
CLO2	Understanding the concepts of microwave networks, microwave passive devices and semiconductor devices.
CLO3	Understanding microwave tubes, microwave design principles and antenna basics.
CLO4	Understanding the importance of point sources, arrays and radiations from wires.
CLO5	To understand different types of antennas like aperture, reflector, broadband and Microstrip antennas.

SYLLABUS	No. of Hours	BTLs
UNIT 1	8	L1-L4
Introduction to Microwaves -History of Microwaves, Microwave Frequency bands, applications of Microwaves, Losses associated with microwave transmission, Concept of Impedance in Microwave transmission. Waveguides -Rectangular waveguide, Introduction to Circular waveguide (No derivations and Numerical examples), Strip line, Micro strip line.		
UNIT 2	8	L1-L4
Microwave Network Analysis - Network parameters for microwave circuits, Scattering Parameters. Microwave Passive devices and semiconductor Devices - Microwave passive devices - Power Divider, Magic Tee, Directional Coupler, Attenuator. Microwave Semiconductor Devices - Gunn Diodes, IMPATT diodes, PIN diodes.		
UNIT 3	8	L1-L4
Microwave Tubes: Klystron- two cavity klystron amplifier and reflex klystron (klystron oscillator) Antenna Basics - Physical concept of radiation, near and far field regions, basic antenna parameters: radiation patterns, beam area, radiation Intensity, beam efficiency, reciprocity, directivity and gain, antenna apertures, effective aperture, bandwidth ,radiation efficiency, radio communication Link and antenna field zones.		
UNIT 4	8	L1-L4
Radiations from wires: Short electric dipole, resistance of dipole, half wave dipole antenna, folded dipole antennas. Point Sources & their arrays - Arrays, Point source, Power theorem and its application, Examples of power patterns, Field patterns, Phase patterns, Array of isotropic point sources different cases, non-isotropic sources, principle of pattern multiplication, linear arrays of n elements of equal amplitude & spacing, broad side, end fire arrays		

UNIT 5	7	L1-L4
Aperture and Reflector Antennas- Babinet's principle, Radiation from sectoral and pyramidal horns: design concepts, parabolic reflector. Broadband Antennas- Log-periodic and Yagi-Uda antennas, frequency independent antennas, broadcast antennas. Micro strip Antennas- Basic characteristics of micro strip antennas, feeding methods		
PRACTICAL COMPONENTS OF IPCC Using suitable simulation software, demonstrate the operation of the following circuits		
Demonstration Experiments		
1. Measurement of frequency, guide wavelength and attenuation in a microwave Test bench. 2. Measurement of VSWR and reflection coefficient and attenuation in a microwave test bench setup. 3. Measurement of Coupling and Isolation characteristics of directional coupler 4. To perform S - matrix characterization of E-Plane Tee and H-Plane Tee 5. To perform S – matrix characterization of Magic Tee 6. To perform an experiment to Calculate the aperture of a Dipole Antenna.		
Simulation Experiments (Virtual Labs)		
1. To study the characteristics of Reflex Klystron 2. To plot the V- I characteristics of GUNN diode 3. To study the basic properties of E-plane Tee, H-plane Tee and Magic Tee 4. To measure the scattering parameters of Circulators 5. To study the characteristics of Multi hole Directional coupler by measuring coupling factor & directivity of coupler 6. To study the properties of Magic Tee & determining the scattering parameters of Magic Tee		
Study Experiments		
1. Measurement of directivity and gain of micro strip patch antenna using printed dipole. 2. Measurement of directivity and gain of Yagi antenna (printed) using printed dipole.		

TEXT BOOKS:	
1	Collin RE. Foundations for microwave engineering. John Wiley & Sons; 2007.
2	Annapurna Das, Sisir K Das, Microwave Engineering, TMH Publication, 2009
3	J.D. Kraus, Antennas and wave propagation, McGraw Hill, 5 th edition 2017.
4	C.A. Balanis, Antenna Theory - Analysis and Design, John Wiley, 2007.

REFERENCE BOOKS:	
1	Microwave Devices and circuits- Liao / Pearson Education. 1992
2	M.Kulkarni., "Microwave devices and Radar Engg."Umesh Publications, 2011
3	R.E. Collin, Antennas and Radio Wave Propagation, McGraw Hill, 1985.
4	I.J. Bahl and P. Bhartia, Micro Strip Antennas, Artech House, 1980.

e-LEARNING RESOURCES:	
1	www.nptel.in
2	https://www.academia.edu/12559664/Collin_Foundations_for_Microwave_Engineering
3	https://www.academia.edu/13759443/Basic_Antennas_Understanding_Practical_Antennas_and_Design_Joel_R_Hallas_2009
4	www.youtube.com/microwave , www.youtube.com/antennas

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Assessment Details both (CIE and SEE)					
The weightage of Continuous Internal Evaluation (CIE) and Semester End Exam (SEE) is 50% each. The students have to obtain a minimum of 40% marks individually both in CIE and SEE to pass. CIE: The CIE has two components – CIE - theory component and CIE – laboratory component. Students have to score a minimum of 40% Marks in the total of CIE - theory and CIE – laboratory components put together, provided students have to score a minimum of 40% marks in CIE laboratory component alone to qualify to take SEE. Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration) and reduced to 50 Marks. **Self-Study Component should be not included for SEE & CIE.					
CONTINUOUS INTERNAL EVALUATION (CIE)			Max. Marks		Minimum Marks to be scored in CIE, to qualify to take SEE (40% individually)
Theory	Weightage of CIE1 and CIE2 Tests or CIE3		30		12
Laboratory components	Rubrics for experiment are added, then taken average		10	20	08
	Lab CIE		10		
TOTAL			50		20

QUESTION PAPER PATTERN (SEE)										
Q. No.	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
UNIT	1	2	3	4	5	6	7	8	9	10
1. Two full questions (each of 20 Marks) are to be set from each unit.										
2. Student shall answer five full questions selecting one full question from each unit.										

Course Outcomes: After the completion of the course, the student will be able to:	
CO1	Identify the microwave frequency band, its applications and different types of waveguides
CO2	Analyse microwave networks, microwave passive devices and semiconductor devices.
CO3	Apply microwave design principle, microwave tubes and antenna basics.
CO4	Be able to analyse the radiation patterns from different types of wires, point sources and their arrays.
CO5	Illustrate and design antennas like aperture, reflector, and broadband. Microstrip antenna.

Mapping of CO's, PO's with PSO's														
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1	0	0	0	0	0	0	0	0	0	0	2	0
CO2	3	3	2	0	0	0	0	0	0	0	0	0	2	0
CO3	3	2	3	2	0	0	1	0	0	0	1	2	2	0
CO4	3	3	2	2	0	0	1	0	0	0	1	2	2	0
CO5	3	3	2	2	0	0	1	0	0	0	1	2	2	0

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Mapping of CO's with Knowledge and Attitude Profile (WK)									
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0									
CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
CO1	1	1	3	3	1	2	1	1	1
CO2	1	2	3	3	1	3	1	2	1
CO3	1	2	3	3	3	3	1	2	1
CO4	1	2	3	3	2	3	1	2	1
CO5	1	2	3	3	3	3	1	2	1

Mapping of CO's with Sustainable Development Goals (SDG)																	
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0																	
CO/SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1	0	0	0	1	0	0	2	1	3	0	2	1	1	0	0	0	1
CO2	0	0	0	1	0	0	2	2	3	0	2	1	1	0	0	0	1
CO3	0	0	0	1	0	0	3	2	3	0	2	2	1	0	0	0	1
CO4	0	0	0	1	0	0	2	1	3	0	3	1	1	0	0	0	1
CO5	0	0	0	1	0	0	3	2	3	0	3	2	2	0	0	0	1

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Course Title	CMOS VLSI DESIGN						
Course Code	ECT602						
Course Category	PCC (Professional Core Course)						
Teaching - Learning Scheme & Credit	L	T	P	S	Total	Total Teaching Hours	Credit
	4	0	0	0	4	52+0+0+0=52	4
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hrs.	

Course Learning Objectives:	
CLO1	Impart knowledge of MOS transistor theory and CMOS technology
CLO2	Learn the operation principles and analysis of inverter circuits.
CLO3	Infer the operation of Semiconductor memory circuits.
CLO4	Demonstrate the concept of CMOS testing.

SYLLABUS	No. of Hours	BTLs
UNIT 1	10	L1-L3
Introduction: MOS Transistors, CMOS Logic (1.3 to 1.4 of TEXT1) MOS Transistor Theory: Introduction, Long-channel I-V Characteristics, Nonideal I-V Effects (2.1, 2.2, 2.4 TEXT3).		
UNIT 2	10	L1-L3
Fabrication: CMOS Fabrication and Layout(1.5 TEXT1) CMOS Inverter DC Characteristics, Beta Ratio Effect, Noise Margin, Pass Transistors (2.5 TEXT1) Delay: RC Delay Model, Linear Delay Model, Logical Efforts of Paths (4.3 to 4.5 of TEXT1)		
UNIT 3	11	L1-L3
CMOS Logic Structures: Dynamic CMOS Logic, CMOS Domino Logic, BiCMOS Circuit Operation, Cascaded Voltage Switch Logic (CVSL). Semiconductor Memories: Operation of Three Transistor DRAM, Operation of One Transistor DRAM Cell, DRAM Operation Modes and Read/Write Operation of SRAM, Non-volatile Memory(4*4 NOR AND NAND Based ROM array) (Text 2)		
UNIT 4	11	L1-L3
Datapath Subsystem I: Single bit addition, carry generation & propagation, PG Carry-Ripple Addition, Manchester carry chain adder, carry skip adder, and carry select, conditional sum adders. DataPath Subsystems II: Unsigned Array Multiplication, 2's Complement Array Multiplication (Modified Baugh-W34eooley two's complement Multiplier), Booth encoding (Radix 4). (Text 1).		
UNIT 5	10	L1-L3
Sequential MOS Logic Circuitry: SR Latch Circuitry, Clocked latch and Flip Flop Circuitry, CMOS D-Latch and Edge Triggered Flip-Flop. (Text 2)		

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Course Outcomes: After the completion of the course, the student will be able to:	
CO1	Understand MOS transistor theory and CMOS technology, construction, operation, and characteristics of MOS transistors, CMOS fabrication processes and basic VLSI technology.
CO2	Analyze CMOS inverter circuits, operating principles of CMOS inverters, voltage transfer characteristics, noise margins, power dissipation, and propagation delay.
CO3	Understand semiconductor memory circuits, operation and organization of semiconductor memories. Understand basic SRAM, DRAM, ROM, and related memory-cell structures.
CO4	Understand and design the Data path Subsystem adder, multiplier
CO5	Design and implement Sequential MOS Logic Circuitry latches and flip flop

Mapping of CO's, PO's with PSO's														
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	0	2	2	0	0	0	0	0	1	3	2	1
CO2	3	3	3	2	3	0	0	0	0	0	1	3	3	2
CO3	3	3	2	2	2	0	0	0	0	0	1	3	2	1
CO4	3	3	3	2	3	0	0	0	0	1	1	2	3	1
CO5	3	3	3	2	3	0	0	0	1	1	2	3	3	3

Mapping of CO's with Knowledge and Attitude Profile (WK)										
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0										
CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	
CO1	0	3	3	2	0	1	0	0	0	
CO2	0	2	3	3	3	2	0	0	0	
CO3	0	2	3	3	3	2	0	0	0	
CO4	0	3	3	3	2	3	0	0	0	
CO5	0	2	3	3	3	3	0	0	0	

Mapping of CO's with Sustainable Development Goals (SDG)																	
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0																	
CO/SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1	0	0	0	3	0	0	0	0	2	0	0	0	0	0	0	0	0
CO2	0	0	0	3	0	0	0	0	3	0	0	0	0	0	0	0	0
CO3	0	0	0	3	0	0	2	0	2	0	0	0	0	0	0	0	0
CO4	0	0	0	3	0	0	2	0	3	0	0	0	0	0	0	0	0
CO5	0	0	0	3	0	0	0	0	3	0	0	0	0	0	0	0	0

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Course Title	SATELLITE COMMUNICATION						
Course Code	ECT603A						
Course Category	PEC (Professional Elective Course)						
Teaching - Learning Scheme & Credits	L	T	P	S	Total	Total Teaching Hours	Credits
	3	0	0	0	3	39+0+0+0=39	3
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hrs	

Course Learning Objectives:	
CLO1	Familiar with satellite systems and laws governing satellite orbit.
CLO2	Understand concept of geostationary orbit and various losses on signal transmission in satellite system.
CLO3	Evaluate link power budget estimation, system noise and various space segment subsystems.
CLO4	Study earth segment, interference between satellite circuits and multiple access systems.
CLO5	Understand direct broadcast system, satellite mobile and specialized services.

SYLLABUS	No. of Hours	BTLs
UNIT 1	8	L1-L3
Over View Of Satellite Systems: Introduction, frequency allocation, INTELSAT, Orbits and launching methods: Kepler's laws, definitions of terms for earth orbiting satellites. Orbital element, apogee and perigee heights, orbit perturbations, inclined orbits, calendars, universal time, sidereal time, orbital plane, local mean time and sun synchronous orbits. Numerical problems. Text 1		
UNIT 2	8	L1-L3
Geostationary Orbit: Introduction, antenna, look angles, polar mount antenna, Limits of visibility, earth eclipse of satellite, sun transit outage, launching orbits. Numerical problems. Text 1		
UNIT 3	8	L1-L3
Space Segment: Introduction, power supply unit, attitude control: spinning satellite stabilization, momentum wheel stabilization. Station keeping, thermal control, TT&C subsystem. Space Link: Introduction, EIRP, transmission losses: free space transmission, feeder losses, and antenna misalignment losses. Text 1		
UNIT 4	8	L1-L4
Earth Segment: Introduction, receive only home TV system: out-door unit, indoor unit, MATV, CATV, Tx – Rx earth station. Interference And Satellite Access: Introduction, interference between satellite circuits. Text 1		
UNIT 5	7	L1-L4
Direct Broadcast Satellite Services: Introduction, orbital spacing, power rating and number of transponders, frequency and polarization, transponder capacity, bit rates for digital TV, Satellite Services: satellite mobile services, VSAT, RadarSat, Global positioning satellite system. Text 1		

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TEXT BOOKS:	
1	Dennis Roddy, “Satellite Communications”, 4th Edition, McGraw- Hill International edition, 2006.
REFERENCE BOOKS:	
1	Timothy Pratt, Charles Bostian and Jeremy Allnutt, “Satellite Communications”, 2nd Edition, John Wiley Pvt. Ltd & Sons, 2008.
2	W. L. Pitchand, H. L. Suyderhoud, R. A. Nelson. , “Communication Systems”, 2nd Edition, Pearson Education , 2007

Assessment Details both (CIE and SEE)			
The weightage of Continuous Internal Evaluation (CIE) and Semester End Exam (SEE) is 50% each. The students have to obtain a minimum of 40% marks individually both in CIE and SEE to pass. CIE: The CIE has three components – CIE - theory component, assignment and group activity. Students have to score a minimum of 40% Marks in the total of CIE - theory, assignment and group activity components put together to take SEE. SEE: Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration) and reduced to 50 Marks.			
CONTINUOUS INTERNAL EVALUATION (CIE)		Max. Marks	Minimum Marks to be scored in CIE, to qualify to take SEE (40% individually)
Theory	Weightage of CIE-1 and CIE-2 Tests or CIE-3	50	20
TOTAL		50	20

QUESTION PAPER PATTERN (SEE)										
Q. No.	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
UNIT	1		2		3		4		5	
1. Two full questions (each of 20 Marks) are to be set from each unit.										
2. Student shall answer five full questions selecting one full question from each unit.										

Course Outcomes: After the completion of the course, the student will be able to:	
CO1	Analyze satellite orbits, orbital parameters, launching methods, and frequency allocation using the principles of satellite motion and Kepler's laws.
CO2	Analyze and determine geostationary orbit parameters, antenna look angles, visibility limits, eclipse conditions, and satellite launching orbits.
CO3	Analyze and evaluate satellite space-segment subsystems, attitude control, station keeping, thermal control, TT&C, and satellite link-budget parameters.
CO4	Analyze and evaluate earth-station configurations, satellite access mechanisms, and interference between satellite communication systems.
CO5	Evaluate direct broadcast satellite services, transponder capacity, digital TV

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Mapping of CO's, PO's with PSO's														
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	3	3	1	1	1	0	1	1	3	1	1
CO2	3	3	3	3	3	1	1	1	0	1	1	3	1	1
CO3	3	3	3	3	3	1	1	1	1	1	1	3	1	2
CO4	3	3	3	3	3	1	1	2	2	2	1	3	1	2
CO5	3	3	3	3	3	2	2	2	2	3	2	2	1	3

Mapping of CO's with Knowledge and Attitude Profile (WK)										
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0										
CO/SDG's	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	
CO1	3	3	3	3	2	3	1	2	2	
CO2	3	3	3	3	3	3	1	2	3	
CO3	3	3	3	3	3	3	2	3	3	
CO4	2	3	3	3	3	3	2	3	3	
CO5	2	3	3	3	3	3	3	3	3	

Mapping of CO's with Sustainable Development Goals (SDG)																	
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0																	
CO	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1	0	0	0	3	0	0	0	2	3	0	2	0	2	1	0	0	0
CO2	0	0	0	3	0	0	0	2	3	0	2	0	2	1	0	0	0
CO3	0	0	1	3	0	0	0	2	3	0	3	0	2	1	0	0	0
CO4	0	0	1	3	0	0	0	2	3	0	3	0	2	2	0	0	0
CO5	0	0	2	3	0	0	0	3	3	0	3	0	3	3	0	0	0

Semester: VI

Course Title	CRYPTOGRAPHY						
Course Code	ECT603B						
Course Category	PEC (Professional Elective Course)						
Teaching - Learning Scheme & Credit	L	T	P	S	Total	Total Teaching Hours	Credit
	3	0	0	0	3	39+0+0+0=39	3
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hrs	

Course Learning Objectives:	
CLO1	Understand the fundamental concepts of cryptography, information security, number theory, and finite field arithmetic used in secure communication systems.
CLO2	Explain the principles and working of classical, symmetric-key, and asymmetric-key cryptographic algorithms.
CLO3	Apply mathematical concepts and cryptographic techniques to perform encryption, decryption, and secure key exchange.
CLO4	Analyze and evaluate cryptographic mechanisms and stream cipher designs for ensuring confidentiality and secure data transmission.
CLO5	Implement cryptographic algorithms and pseudo-random sequence generators using programming languages such as C++, Python, or Scilab

SYLLABUS	No. of Hours	BTLs
UNIT 1	8	L1-L2
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)		
UNIT 2	7	L1-L3
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)		
UNIT 3	8	L1-L4
Block Ciphers: Traditional Block Cipher structure, Data encryption standard (DES) (Text 1: Chapter 2: Section 1, 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)		
UNIT 4	8	L1-L4
ASYMMETRIC CIPHERS: Principles of Public-Key Cryptosystems, The RSA algorithm, Diffie – Hellman Key Exchange, Elliptic Curve Arithmetic, Basics of Elliptic Curve Cryptography (Text 1: Chapter 8, Chapter 9: Section 1, 3, 4)		

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Course Outcomes: After the completion of the course, the student will be able to:	
CO1	Explain traditional cryptographic algorithms of encryption and decryption process.
CO2	Use symmetric and asymmetric cryptography algorithms to encrypt and decrypt the data.
CO3	Apply concepts of modern algebra in cryptography algorithms.
CO4	Design cryptographic algorithms and finite field operations using suitable programming languages for secure communication applications.
CO5	Implement pseudo random sequence generation algorithms for stream cipher systems.

Mapping of CO's, PO's with PSO's														
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	0	1	0	0	0	1	0	1	1	0	2
CO2	3	3	2	1	3	1	0	0	1	0	2	1	0	2
CO3	3	3	1	1	2	0	0	0	1	0	2	1	0	3
CO4	3	3	3	2	3	0	0	1	1	1	2	2	0	3
CO5	3	3	2	2	3	0	0	1	1	0	2	2	0	3

Mapping of CO's with Knowledge and Attitude Profile (WK)										
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0										
CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	
CO1	3	3	1	1	0	0	0	1	0	
CO2	3	2	2	3	0	2	0	1	0	
CO3	3	3	2	3	0	1	0	1	0	
CO4	3	3	3	3	0	3	0	2	0	
CO5	3	3	3	3	0	3	0	2	0	

Mapping of CO's with Sustainable Development Goals (SDG)																	
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0																	
CO/SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1	0	0	0	1	0	0	0	0	3	0	0	0	0	0	0	2	0
CO2	0	0	0	1	0	0	0	1	3	0	0	0	0	0	0	2	0
CO3	0	0	0	1	0	0	0	1	3	0	0	0	0	0	0	2	0
CO4	0	0	0	1	0	0	0	1	3	0	0	0	0	0	0	3	0
CO5	0	0	0	1	0	0	0	1	3	0	0	0	0	0	0	3	0

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Course Title	MACHINE LEARNING						
Course Code	ECT603C						
Course Category	PEC (Professional Elective Course)						
Teaching - Learning Scheme & Credit	L	T	P	S	Total	Total Teaching Hours	Credit
	3	0	0	0	3	39+0+0+0=39	3
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hrs	

Course Learning Objectives:	
CLO1	Acquire some concepts and techniques that are core to Machine Learning.
CLO2	Understand learning and decision trees.
CLO3	Acquire knowledge of neural networks, Bayesian techniques and instant based learning.
CLO4	Understand analytical learning and reinforced learning.

SYLLABUS	No. of Hours	BTLs
UNIT 1	08	L1-L3
Introduction: Need of Machine Learning ,Examples of Machine Learning Applications, Supervised Learning: Learning a Class from Examples, Learning Multiple Classes, Regression, Model Selection and Generalization, Bayesian Decision Theory: Introduction, Classification, Losses and Risks, Discriminant Functions, Association Rules.		
UNIT 2	08	L1-L4
Parametric Methods & Clustering: Introduction, Maximum Likelihood Estimation, Evaluating an Estimator: Bias and Variance, The Bayes' Estimator, Parametric Classification, Regression, Model Selection Procedures. Clustering: k-Means Clustering, Spectral Clustering, Hierarchical Clustering, Choosing the Number of Clusters Nonparametric Methods: Nonparametric Density Estimation, Condensed Nearest Neighbor, Distance -Based classification, Outlier Detection.		
UNIT 3	08	L1-L4
Decision Trees & Linear Discrimination: Introduction, Univariate Trees, Pruning, Rule Extraction from Trees, Learning Rules from Data, Multivariate Trees. Linear Discrimination: Introduction, Generalizing the Linear Model, Geometry of the Linear Discriminant, Gradient Descent, Discrimination by Regression.		

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Course Outcomes: After the completion of the course, the student will be able to:	
CO1	Explain the fundamental concepts, terminology, learning paradigms, and workflow of Machine Learning for solving computational problems.
CO2	Apply mathematical, statistical, and computational foundations to formulate and analyze Machine Learning models.
CO3	Analyze and compare supervised and unsupervised learning algorithms based on their principles, assumptions, performance, and suitability for different applications.
CO4	Develop and evaluate appropriate Machine Learning models for real-world problems using suitable data preprocessing, feature engineering, model selection, and performance evaluation techniques.
CO5	Assess the applicability, limitations, ethical implications, and societal and sustainability impacts of Machine Learning in real-time applications.

Mapping of CO's, PO's with PSO's														
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	0	0	1	0	0	0	1	0	2	2	2	1
CO2	3	3	1	2	2	0	0	0	1	0	2	2	2	1
CO3	3	3	2	2	2	0	1	0	1	0	2	2	2	1
CO4	3	3	3	3	3	2	1	1	1	1	2	2	2	1
CO5	2	2	2	1	2	3	3	1	2	2	3	2	2	1

Mapping of CO's with Knowledge and Attitude Profile (WK)										
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0										
CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	
CO1	1	3	2	3	0	2	0	1	0	
CO2	1	3	2	3	0	2	0	2	0	
CO3	1	3	2	3	0	3	0	3	0	
CO4	1	3	2	3	2	3	1	3	1	
CO5	1	2	1	2	3	2	3	3	3	

Mapping of CO's with Sustainable Development Goals (SDG)																	
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0																	
CO/SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1	0	0	0	3	0	0	0	1	2	0	1	0	0	0	0	0	0
CO2	0	0	0	3	0	0	0	2	3	0	1	0	0	0	0	0	0
CO3	0	0	0	3	0	0	0	2	3	1	1	0	0	0	0	1	0
CO4	0	0	0	2	0	0	0	3	3	2	3	2	2	0	0	1	0
CO5	0	0	0	2	0	0	0	2	3	3	3	3	3	0	0	3	0

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Course Title	DIGITAL IMAGE PROCESSING						
Course Code	ECT603D						
Course Category	PCC (Professional Core Course)						
Teaching - Learning Scheme & Credit	L	T	P	S	Total	Total Teaching Hours	Credit
	3	0	0	0	3	39+0+0+0=39	3
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hrs	

Course Learning Objectives:	
CLO1	Understand the fundamental concepts of Digital Image Processing, image representation, visual perception, image acquisition, sampling, quantization, and pixel relationships.
CLO2	Understand and analyze two-dimensional image transformation techniques such as DFT, DCT, and Haar Transform and their properties.
CLO3	Apply intensity transformations, histogram processing, and spatial-domain filtering techniques for image enhancement.
CLO4	Apply frequency-domain filtering techniques for smoothing and sharpening of digital images.
CLO5	Understand and apply color fundamentals, color models, and pseudo-color image processing techniques for various image-processing applications.

SYLLABUS	No. of Hours	BTLs
UNIT 1	8	L1-L4
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]		
UNIT 2	8	L1-L4
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]		
UNIT 3	9	L1-L4
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]		
UNIT 4	8	L1-L4
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]		

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UNIT 5		7	L1-L4
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]			
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 BOOKS:	
1	Digital Image Processing- S Jayaraman, S Esakkirajan, T Veerakumar, Tata McGraw Hill, 2014.
E-LEARNING RESOURCES:	
1	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,

Assessment Details both (CIE and SEE)			
The weightage of Continuous Internal Evaluation (CIE) and Semester End Exam (SEE) is 50% each. The students have to obtain a minimum of 40% marks individually both in CIE and SEE to pass. CIE: The CIE has three components – CIE - theory component, assignment and group activity. Students have to score a minimum of 40% Marks in the total of CIE - theory, assignment and group activity components put together to take SEE. SEE: Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration) and reduced to 50 Marks. **Self-Study Component should be not included for SEE & CIE.			
CONTINUOUS INTERNAL EVALUATION (CIE)		Max. Marks	Minimum Marks to be scored in CIE, to qualify to take SEE (40% individually)
Theory	Weightage of CIE1 and CIE2 Tests or CIE3	50	20
TOTAL		50	20

QUESTION PAPER PATTERN (SEE)										
Q. No.	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
UNIT	1		2		3		4		5	
1. Two full questions (each of 20 Marks) are to be set from each unit.										
2. Student shall answer five full questions selecting one full question from each unit.										

Course Outcomes: After the completion of the course, the student will be able to:	
CO1	Explain the fundamentals of digital images, acquisition, sampling and quantization.
CO2	Apply two-dimensional transforms for image representation and analysis.
CO3	Apply spatial-domain techniques for image enhancement.
CO4	Apply frequency-domain filtering techniques for image enhancement.
CO5	Apply color image processing techniques using color models and pseudo-color processing.

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Mapping of CO's, PO's with PSO's														
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0														
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PSO 1	PSO 2	PSO 3
CO 1	3	2	0	2	1	0	0	0	0	0	2	3	1	1
CO 2	3	3	2	3	2	0	0	0	0	0	2	3	2	1
CO 3	3	3	3	2	3	0	0	0	0	0	2	3	3	2
CO 4	3	3	3	3	3	0	0	0	0	0	2	3	3	2
CO 5	3	2	2	2	3	1	0	0	0	0	2	3	3	2

Mapping of CO's with Knowledge and Attitude Profile (WK)										
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0										
CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	
CO1	2	2	3	3	0	1	0	0	0	
CO2	0	3	3	3	1	2	0	2	0	
CO3	0	2	3	3	2	3	0	1	0	
CO4	0	3	3	3	2	3	0	2	0	
CO5	2	2	3	3	2	3	0	2	0	

Mapping of CO's with Sustainable Development Goals (SDG)																	
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0																	
CO/SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1	0	0	1	2	0	0	0	0	2	0	0	0	1	0	0	0	0
CO2	0	0	1	2	0	0	0	0	3	0	1	1	2	0	0	0	0
CO3	0	0	2	2	0	0	0	0	3	0	2	2	2	0	0	0	0
CO4	0	0	2	2	0	0	0	0	3	0	2	2	3	0	0	0	0
CO5	0	0	3	2	0	0	0	0	3	0	2	2	2	0	0	0	0

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Semester: VI

Course Title	ROBOTICS MECHANICS AND CONTROL						
Course Code	ECT603E						
Course Category	PEC (Professional Elective Course)						
Teaching - Learning Scheme & Credit	L	T	P	S	Total	Total Teaching Hours	Credit
	3	0	0	0	3	39+0+0+0=39	3
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hrs	

Course Learning Objectives:	
CLO1	Understand various elements of robotic system and how they integrate.
CLO2	Analyze various operations of robot end effectors.
CLO3	Understand applications various sensors in robotics
CLO4	Introduce robot mechanics and artificial intelligence.
CLO5	Understand the fundamentals of machine vision

SYLLABUS	No. of Hours	BTLs
UNIT 1	08	L1-L3
FUNDAMENTALS OF ROBOTICS: Automation and Robotics, Robotics in science Fiction, A brief history of robotics, Robot Anatomy, Work volume, Robot drive systems, Control systems and Dynamic performance, Precision of movement, End effectors, Robotic sensors, Robot applications <i>TEXT 1.</i>		
UNIT 2	08	L1-L3
ROBOT END EFFECTORS: Introduction, Types of end effectors, Mechanical gripper, Other types of grippers, Tools as end effectors, The Robot/End effectors interface, Considerations in gripper selection and design. SENSORS IN ROBOTICS: Transducers and sensors, sensors in robotics, tactile sensors, proximity and range sensors, miscellaneous sensors and sensor-based system. Use of sensors in Robotics. <i>TEXT 1.</i>		
UNIT 3	08	L1-L3
ROBOT MECHANICS: Introduction to manipulator kinematics, homogeneous transformation and robot kinematics, manipulator path control, robot dynamics, configuration of a robot controller. MACHINE VISION FUNDAMENTALS: Introduction to machine vision, the sensing and digitizing function in machine vision, Image processing and Analysis. <i>TEXT 1.</i>		
UNIT 4	08	L1-L4
ROBOT PROGRAMMING: Methods of robot programming, leadthrough programming methods, a robot program as a path in space, motion interpolation, WAIT, SIGNAL and DELAY commands, branching. ARTIFICIAL INTELLIGENCE: Introduction, goals of AI research, AI techniques, LISP programming, AI and Robotics. <i>TEXT 1.</i>		

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UNIT 5	07	L1-L4
ROBOT APPLICATIONS IN MANUFACTURING: Material transfer and machine loading/unloading. Processing operations. <i>TEXT 1.</i>		

TEXT BOOKS:	
1	M.P. Groover, M. Weiss, R.N. Nagel, N.G. Odrey, “Industrial Robotics-Technology, Programming and Applications”, Tata McGraw-Hill Education Pvt Ltd., 2008

REFERENCE BOOKS:	
1	R.K.Mittal, I.J.Nagrath, Robotics and controls, Tata McGraw Hill Education Pvt.
2	Sathya Ranjan Deb, “Robotics Technology and flexible Automation”, 6th Edition, TMH, 2003.

Assessment Details both (CIE and SEE)			
The weightage of Continuous Internal Evaluation (CIE) and Semester End Exam (SEE) is 50% each. The students have to obtain a minimum of 40% marks individually both in CIE and SEE to pass. CIE: The CIE has three components – CIE - theory component, assignment and group activity. Students have to score a minimum of 40% Marks in the total of CIE - theory, assignment and group activity components put together to take SEE. SEE: Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration) and reduced to 50 Marks.			
CONTINUOUS INTERNAL EVALUATION (CIE)		Max. Marks	Minimum Marks to be scored in CIE, to qualify to take SEE (40% individually)
Theory	Weightage of CIE1 and CIE2 Tests or CIE3	50	20
TOTAL		50	20

QUESTION PAPER PATTERN (SEE)										
Q. No.	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
UNIT	1		2		3		4		5	
1. Two full questions (each of 20 Marks) are to be set from each unit.										
2. Student shall answer five full questions selecting one full question from each unit.										

Course Outcomes: After the completion of the course, the student will be able to:	
CO1	Explain the fundamental concepts, anatomy, work volume, drive systems, control systems, performance characteristics, end effectors, sensors, and applications of industrial robots.
CO2	Analyze and select suitable robot end effectors and sensors based on application requirements, operating conditions, precision, and payload considerations.
CO3	Apply kinematic, homogeneous transformation, path-control, and dynamic concepts to analyze robotic manipulators and configure robot controllers.
CO4	Develop and evaluate robot programs using leadthrough programming, motion interpolation, control commands, branching, machine vision, and AI techniques for robotic tasks.

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CO5	Analyze and recommend suitable robotic systems for manufacturing applications such as material handling, machine loading/unloading, and processing operations, considering productivity, safety, resource efficiency, and sustainability.
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Mapping of CO's, PO's with PSO's														
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	2	1	1	1	0	1	2	2	2	1
CO2	3	3	2	2	3	2	1	1	1	1	2	2	2	1
CO3	3	3	3	2	3	1	1	1	1	1	2	2	2	1
CO4	2	3	3	3	3	1	1	1	2	2	3	2	2	1
CO5	3	3	3	2	3	3	3	2	2	2	3	2	2	1

Mapping of CO's with Knowledge and Attitude Profile (WK)										
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0										
CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	
CO1	1	1	3	3	1	2	1	1	1	
CO2	1	2	3	3	3	3	2	1	2	
CO3	1	3	3	3	3	3	2	2	2	
CO4	1	2	2	3	3	3	2	3	3	
CO5	1	2	3	3	3	3	3	2	3	

Mapping of CO's with Sustainable Development Goals (SDG)																	
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0																	
CO/SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1	0	0	0	3	0	0	0	2	3	0	1	1	1	0	0	0	0
CO2	0	0	0	2	0	0	0	2	3	0	1	2	1	0	0	0	0
CO3	0	0	0	2	0	0	0	2	3	0	1	2	1	0	0	0	0
CO4	0	0	0	3	0	0	0	3	3	0	1	2	2	0	0	0	0
CO5	0	0	0	2	0	0	0	3	3	0	2	3	3	0	0	0	0

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Course Title	ADAPTIVE SIGNAL PROCESSING						
Course Code	ECT603F						
Course Category	PEC (Professional Elective Course)						
Teaching - Learning Scheme & Credit	L	T	P	S	Total	Total Teaching Hours	Credit
	3	0	0	0	3	39+0+0+0=39	3
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hrs	

Course Learning Objectives:	
CLO1	To understand the basic concept of adaptive filter and adaptive system.
CLO2	To be able to identify the geometrical significance of Eigenvectors and values
CLO3	To analyze the Simple, Newton's and Steepest descent Gradient search method to search performance surface
CLO4	To study estimation of gradient component using Newton's, Steepest-descent methods and LMS algorithm
CLO5	To be familiar with design of adaptive communication system, adaptive noise canceller and adaptive modelling in FIR digital filter synthesis

SYLLABUS	No. of Hours	BTLs
UNIT 1	08	L1-L3
ADAPTIVE FILTERS: The Filtering Problem, Linear Optimum Filters, Adaptive Filters, Linear filter structures, Approaches to the development of linear adaptive filters. ADAPTIVE SYSTEMS: Definition and characteristics, Areas of application, General properties, Open-and closed-loop adaptation, Applications of closed-loop adaptation, Example of an adaptive system. (TEXT 1&TEXT2)		
UNIT 2	08	L1-L3
THE ADAPTIVE LINEAR COMBINER: General description, Input signal and weight vectors, Desired response and error, the performance function, gradient and minimum mean-square error, Example of a performance surface, Alternative expression of the gradient, Decorrelation of error and input components. PROPERTIES OF THE QUADRATIC PERFORMANCE SURFACE: Normal of the input correlation matrix, Eigen values and Eigen vectors of the input correlation matrix, an example with two weights, geometrical significance of eigenvectors and Eigen values. (TEXT2)		
UNIT 3	08	L1-L3
SEARCHING THE PERFORMANCE SURFACE: Methods of searching the performance surface, Basic ideal of gradient search methods, a simple gradient search algorithm and its solution, Stability and rate of convergence, The learning curve, and Gradient search by Newton's method in multidimensional space, Gradient search by the method of steepest descent, Comparison of learning curves. (TEXT2)		

UNIT 4	08	L1-L4
GRADIENT ESTIMATION AND ITS EFFECTS ON ADAPTATION: Gradient component estimation by derivative measurement, the performance penalty, Derivative measurement and performance penalties with multiple weights, variance of the gradient estimate, effects on the weight-over solution. THE LMS ALGORITHM: Derivation of the LMS algorithm, convergence of the weight vector, an example of convergence, learning curve, noise in the weight-vector solution, mis adjustment, performance. (TEXT2)		
UNIT 5	07	L1-L4
ADAPTIVE MODELING AND SYSTEM IDENTIFICATION: General description, Adaptive modeling of multipath communication channel, adaptive modeling in geophysical exploration, Adaptive modeling in FIR digital filter synthesis. ADAPTIVE INTERFACING CANCELING: The concept of adaptive noise canceling, stationary noise-canceling solutions, effects of signal components in the reference input, The adaptive interference canceller as a notch filter, The adaptive interface canceller as a high-pass filter. TEXT2		

TEXT BOOKS:	
1	Simon Haykin: “Adaptive filter Theory”, , Pearson Education Asia,4th edition- 2008.
2	Bernard Widrow and Samuel D. Stearns: “Adaptive Signal Processing”, Pearson Education Asia, 2009.

REFERENCE BOOKS:	
1	T. Adali and Simon Haykin, “Adaptive Signal Processing: Next Generation Solutions,”Wiley India, 2012.
2	Jophn R. Treichler C. Richard Johnson, Jr. and Michael G. Larimore, “Theory and Design of Adaptive Filters”, Pearson Education / PHI 2002.

1

Assessment Details both (CIE and SEE)			
The weightage of Continuous Internal Evaluation (CIE) and Semester End Exam (SEE) is 50% each. The students have to obtain a minimum of 40% marks individually both in CIE and SEE to pass. CIE: The CIE has three components – CIE - theory component, assignment and group activity. Students have to score a minimum of 40% Marks in the total of CIE - theory, assignment and group activity components put together to take SEE. SEE: Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration) and reduced to 50 Marks. **Self-Study Component should be not included for SEE & CIE.			
CONTINUOUS INTERNAL EVALUATION (CIE)		Max. Marks	Minimum Marks to be scored in CIE, to qualify to take SEE (40% individually)
Theory	Weightage of CIE1 and CIE2 Tests or CIE3	50	20
TOTAL		50	20

QUESTION PAPER PATTERN (SEE)										
Q. No.	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
UNIT	1		2		3		4		5	
1. Two full questions (each of 20 Marks) are to be set from each unit.										
2. Student shall answer five full questions selecting one full question from each unit.										

Course Outcomes: After the completion of the course, the student will be able to:	
CO1	Explain the fundamental concepts, characteristics, and applications of adaptive filters and adaptive systems
CO2	Analyze the design and operation of an adaptive linear combiner and explain the geometrical significance of eigenvectors and eigenvalues.
CO3	Analyze and compare simple, Newton's, and steepest-descent gradient search methods for optimizing the performance surface of adaptive systems.
CO4	Determine gradient components using Newton's method, steepest-descent method, and LMS algorithm for adaptive filter optimization.
CO5	Design adaptive communication systems, adaptive noise cancellers, and adaptive modeling systems using FIR digital filters.

Mapping of CO's, PO's with PSO's														
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	0	0	0	0	1	2	2	2	1
CO2	3	3	2	2	2	0	0	0	1	1	2	2	2	1
CO3	3	3	2	3	2	0	0	0	1	1	2	2	2	1
CO4	3	3	2	3	3	0	0	0	1	1	2	2	2	1
CO5	3	3	3	2	3	1	2	1	2	2	3	2	2	1

Mapping of CO's with Knowledge and Attitude Profile (WK)										
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0										
CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	
CO1	1	2	3	3	1	1	1	1	1	
CO2	1	3	3	3	2	2	1	2	1	
CO3	1	3	3	3	2	3	2	2	2	
CO4	1	3	3	3	2	3	2	2	3	
CO5	1	2	3	3	3	3	3	2	3	

Mapping of CO's with Sustainable Development Goals (SDG)																	
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0																	
CO/SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1	0	0	0	3	0	0	0	1	3	0	1	1	0	0	0	0	0
CO2	0	0	0	2	0	0	0	1	3	0	1	1	0	0	0	0	0
CO3	0	0	0	2	0	0	0	2	3	0	1	1	1	0	0	0	0
CO4	0	0	0	2	0	0	0	2	3	0	1	2	1	0	0	0	0
CO5	0	0	0	3	0	0	0	3	3	0	2	3	2	0	0	0	0

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Semester: VI

Course Title	MECHATRONICS						
Course Code	ECT604A						
Course Category	OEC (Open Elective Course)						
Teaching - Learning Scheme & Credit	L	T	P	S	Total	Total Teaching Hours	Credit
	3	0	0	0	3	39+0+0+0=39	3
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hrs	

Course Learning Objectives:	
CLO1	Explaining the various building blocks of mechatronic systems with components of Mechatronic systems.
CLO2	Study of the sensors and transducers.
CLO3	Explaining signal conditioning techniques and actuation systems.
CLO4	Controlling the mechatronic systems using digital logics, also explaining the inverts concepts.
CLO5	Procedure for designing mechatronic system with few case studies.

SYLLABUS	No. of Hours	BTLs
UNIT 1	08	L1-L3
Introduction to Mechatronics, Measurement systems, and control systems. Introduction to mechatronics and Measurement systems, Control Systems – Introduction, elements of control system, classification of control systems, transfer function, Open loop and closed loop control system, time response of control system, stability, frequency response, System Models – Mechanical systems, electrical systems, fluid systems, Thermal systems, time response, Control Modes – two step mode, P, D, I, PD, PI, and PID controllers, digital controllers. Text Book1: 1.1, 1.2:1.2.1-1.2.10, 1.2.16-1.2.18, 5.1, 5.3		
UNIT 2	08	L1-L3
Sensors and Transducers Sensors and transducers, performance terminology, potentiometer sensor, strain gauged element, capacitive element, Differential transformers, Eddy current proximity sensors, Optical encoders, Pneumatic proximity sensor, Hall effect sensors, incremental encoder, Piezoelectric sensors, tactile sensor, RTDs, thermistors, light sensors, Selection of sensors, inputting data by switches – Denouncing, Keypads. Text Book2: 2.1, 2.2, 2.3.1, 2.3.2, 2.3., 2.3.4, 2.3.5, 2.3.7, 2.3.9, 2.3.10, 2.4.1, 2.6.1, 2.6.2, 2.9.2, 2.9.3, 2.10, 2.11, 2.12.		
UNIT 3	08	L1-L3
Signal Conditioning Signal conditioning process, Operational Amplifier, Protection, Filtering, Digital Signals, Multiplexers, Data acquisition. Electrical Actuation systems Electrical systems, Mechanical switches, Solid state switches, DC Motors, AC Motors, Stepper motors, Text Book2: 3.1-3.8, 7.1-7.7		

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UNIT 4	08	L1-L4
Digital Logic Combinational logic, Digital comparator, code converters, Sequential logic-flip-flops, Microprocessor, Microcontrollers, Programmable logic controllers, Inverters Introduction, Single-Phase Voltage Source Inverters, Current Source Inverters. Textbook2: 14.6.2, 14.6, 14.7. Textbook1: 7.2.1-7.2.4, 7.4, 7.5		
UNIT 5	07	L1-L4
Design of Mechatronic Systems Mechatronic design Elements, Traditional and mechatronic designs, Embedded Systems, MEMS, Procedure for designing a mechatronic system, Engine Management system, Automatic camera, Automatic washing machine, Simple weighing machine, and Manual room temperature controller. Text Book1: 8.1-8.6		

TEXT BOOKS:	
1	R K Rajput, "A Textbook of Mechatronics", First edition, S. Chand and company Ltd., 2007.
2	W. Bolton, "Mechatronics" by W. Bolton, 3 rd Edition, PEI, 2003.

Assessment Details both (CIE and SEE)			
The weightage of Continuous Internal Evaluation (CIE) and Semester End Exam (SEE) is 50% each. The students have to obtain a minimum of 40% marks individually both in CIE and SEE to pass. CIE: The CIE has three components – CIE - theory component, assignment and group activity. Students have to score a minimum of 40% Marks in the total of CIE - theory, assignment and group activity components put together to take SEE. SEE: Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration) and reduced to 50 Marks. **Self-Study Component should be not included for SEE & CIE.			
CONTINUOUS INTERNAL EVALUATION (CIE)		Max. Marks	Minimum Marks to be scored in CIE, to qualify to take SEE (40% individually)
Theory	Weightage of CIE1 and CIE2 Tests or CIE3	50	20
TOTAL		50	20

QUESTION PAPER PATTERN (SEE)										
Q. No.	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
UNIT	1		2		3		4		5	
1. Two full questions (each of 20 Marks) are to be set from each unit.										
2. Student shall answer five full questions selecting one full question from each unit.										

Course Outcomes: After the completion of the course, the student will be able to:
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CO1	Explain the basic building blocks of mechatronic systems and the importance of mechatronics in engineering applications.
CO2	Describe the working principles and characteristics of sensors and transducers used in mechatronic systems.
CO3	Illustrate signal conditioning methods and actuators used in mechatronic systems.
CO4	Explain digital logic principles and applications of inverters in mechatronic systems.
CO5	Illustrate the design procedure and analyze case studies of real-time mechatronic systems.

Mapping of CO's, PO's with PSO's														
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	0	1	0	0	0	0	1	2	2	2	1
CO2	3	2	1	1	2	0	0	0	0	1	2	2	2	1
CO3	3	2	2	1	3	0	1	0	1	1	2	2	2	1
CO4	3	2	1	1	2	0	0	0	0	1	2	2	2	1
CO5	3	3	3	2	3	2	2	1	2	2	3	2	2	1

Mapping of CO's with Knowledge and Attitude Profile (WK)										
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0										
CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	
CO1	1	1	3	3	1	1	1	0	1	
CO2	1	1	3	3	1	2	1	1	1	
CO3	1	2	3	3	2	3	1	1	2	
CO4	1	2	3	3	1	2	1	1	1	
CO5	1	2	3	3	3	3	2	2	3	

Mapping of CO's with Sustainable Development Goals (SDG)																	
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0																	
CO/SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1	0	0	0	3	0	0	0	1	3	0	1	1	0	0	0	0	0
CO2	0	0	0	2	0	0	0	1	3	0	1	1	0	0	0	0	0
CO3	0	0	0	2	0	0	0	2	3	0	1	2	1	0	0	0	0
CO4	0	0	0	2	0	0	0	1	3	0	1	1	0	0	0	0	0
CO5	0	0	0	3	0	0	0	3	3	0	2	3	2	0	0	0	0

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Course Title	MICRO ELECTRO MECHANICAL SYSTEMS						
Course Code	ECT604B						
Course Category	OEC (Open Elective Course)						
Teaching - Learning Scheme & Credit	L	T	P	S	Total	Total Teaching Hours	Credit
	3	0	0	0	3	39+0+0+0=39	3
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hrs	

Course Learning Objectives:	
CLO1	Prepare students with fundamental knowledge/ overview in the field of Micro Electro Mechanical Systems.
CLO2	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.
CLO3	Inculcate in students an ethical and professional attitude by providing an academic environment inclusive of effective communication, teamwork.
CLO4	Ability to relate engineering issues to a broader social context, and life-long learning needed for a successful professional career.

SYLLABUS	No. of Hours	BTLs
UNIT 1	08	L1-L3
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		
UNIT 2	08	L1-L3
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		
UNIT 3	08	L1-L3
Engineering Mechanics for Microsystems Design: Introduction, Static Bending of Thin Plates, Mechanical Vibration, Thermomechanics, 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		
UNIT 4	08	L1-L4
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		

QUESTION PAPER PATTERN (SEE)										
Q. No.	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
UNIT	1		2		3		4		5	
1. Two full questions (each of 20 Marks) are to be set from each unit.										
2. Student shall answer five full questions selecting one full question from each unit.										

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Course Outcomes: After the completion of the course, the student will be able to:	
CO1	Explain and analyze the working principles of microsensors, microactuators, microaccelerometers, and microfluidic microsystems.
CO2	Apply principles of atomic structure, plasma physics, electrochemistry, and intermolecular forces to microsystem design and fabrication.
CO3	Analyze and evaluate mechanical behavior of microsystems, including bending, vibration, thermomechanics, fracture, thin-film mechanics, and stress using analytical and numerical methods.
CO4	Analyze and apply scaling laws governing mechanical, electrical, electromagnetic, fluidic, and thermal behavior of miniaturized systems.
CO5	Analyze and evaluate bulk and surface micromachining, LIGA-based micromanufacturing, and microsystem packaging techniques for MEMS applications.

Mapping of CO's, PO's with PSO's														
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	1	1	1	1	1	1	2	2	1
CO2	3	3	3	3	3	1	2	1	1	1	1	2	2	1
CO3	3	3	3	3	3	1	2	1	1	1	2	2	2	1
CO4	3	3	3	3	3	2	3	1	1	1	2	2	2	1
CO5	3	3	3	3	3	1	2	1	2	2	3	2	2	1

Mapping of CO's with Knowledge and Attitude Profile (WK)										
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0										
CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	
CO1	3	3	3	3	3	3	1	2	3	
CO2	3	3	3	3	3	3	2	2	3	
CO3	3	3	3	3	3	3	2	3	3	
CO4	3	3	3	3	3	3	3	3	3	
CO5	3	3	3	3	3	3	2	3	3	

Mapping of CO's with Sustainable Development Goals (SDG)																	
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0																	
CO/SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1	0	0	3	3	0	0	2	2	3	0	2	2	1	0	0	0	0
CO2	0	0	2	3	0	0	2	2	3	0	1	2	1	0	0	0	0
CO3	0	0	3	3	0	0	3	3	3	0	2	2	2	0	0	0	0
CO4	0	0	2	3	0	0	3	3	3	0	3	3	3	0	0	0	0
CO5	0	0	3	3	0	0	2	2	3	0	3	3	3	0	0	0	0

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Course Title	RTOS						
Course Code	ECT604C						
Course Category	PCC (Professional Core Course)						
Teaching - Learning Scheme & Credit	L	T	P	S	Total	Total Teaching Hours	Credit
	3	0	0	0	3	39+0+0+0=39	3
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hrs	

Course Learning Objectives:	
CLO1	Impart the fundamental concepts of the OS and real time systems.
CLO2	Expose to the concepts such as scheduling techniques, dynamic priority policies.
CLO3	Describe the concepts such as blocking, deadlock, live lock & soft real-time services.
CLO4	Impart the firmware components, debugging and reliability system design.
CLO5	Expose to different available RTOS's through their analysis.

SYLLABUS	No. of Hours	BTLs
UNIT 1	8	L1-L4
Real-Time Systems and Resources: Real Time Systems, Real-Time Embedded Systems, Resource Analysis, Real-Time Service Utility, scheduling classes, Scheduler concepts, OS basics, Types of OS, OS in an embedded device, State transition diagram.		
UNIT 2	8	L1-L4
Processing with Real Time Scheduling: Introduction, Pre-emptive Fixed Priority Scheduling Policies with timing diagrams, Problems and issues, Feasibility, Rate Monotonic least upper bound (No derivation), Necessary and Sufficient feasibility, Deadline Monotonic Policy, Dynamic priority policies.		
UNIT 3	8	L1-L4
I/O Resources: Worst case execution time, Execution efficiency, I/O Architecture. Memory: Physical hierarchy, Shared Memory, ECC Memory. Multi-resource Services: Blocking, Deadlock and livelock, Priority inversion. Soft real-time services: Missed deadline, QoS.		
UNIT 4	8	L1-L4
Firmware Components: Boot Code, Device Drivers, Operating System Services, Communicating and Synchronized Services. Single-Step Debugging: Task/process-level debugging, System/kernel-level debugging, Processor-level debugging. High Availability and Reliability Design: Reliability and Availability Similarities and Differences, Reliability, Reliable Software, Available Software, Design Trade-Offs, Hierarchical Approaches for Fail-Safe Design.		
UNIT 5	7	L1-L4
FreeRTOS Alternative to Proprietary RTOS, Future Directions for RTOS, RTOS Examples-LynxOS, OSE, QNX, VxWorks, Windows Embedded Compact, Embedded Linux, Embedded System Design with VxWorks, Comparison of available RTOS, Selection criteria of RTOS for an application.		

TEXT BOOKS:	
1	Real-time Embedded Components and Systems”, Sam Siewert, Cengage Learning.

REFERENCE BOOKS:	
1	“Real-time embedded components and systems with Linux and RTOS”, Pratt, Siewert, Mercury Learning and Information, 2016
2	Shibu K V, “Introduction to Embedded Systems”, Tata McGraw Hill Education Private Limited, 2017
e-LEARNING RESOURCES:	
1	https://nptel.ac.in/courses
2	https://nptel.ac.in/courses

Assessment Details both (CIE and SEE)			
The weightage of Continuous Internal Evaluation (CIE) and Semester End Exam (SEE) is 50% each. The students have to obtain a minimum of 40% marks individually both in CIE and SEE to pass. CIE: The CIE has three components – CIE - theory component, assignment and group activity. Students have to score a minimum of 40% Marks in the total of CIE - theory, assignment and group activity components put together to take SEE. SEE: Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration) and reduced to 50 Marks. **Self-Study Component should be not included for SEE & CIE.			
CONTINUOUS INTERNAL EVALUATION (CIE)		Max. Marks	Minimum Marks to be scored in CIE, to qualify to take SEE (40% individually)
Theory	Weightage of CIE1 and CIE2 Tests or CIE3	50	20
TOTAL		50	20

QUESTION PAPER PATTERN (SEE)										
Q. No.	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
UNIT	1	2	3	4	5	6	7	8	9	10
1. Two full questions (each of 20 Marks) are to be set from each unit.										
2. Student shall answer five full questions selecting one full question from each unit.										

Course Outcomes: After the completion of the course, the student will be able to:	
CO1	Discuss the fundamentals of various real time services, real time service utilities.
CO2	Apply static and dynamic scheduling techniques for the given real time system constraints.
CO3	Analyze deadlock, priority inversion, missed deadlines and QoS of real time embedded systems.
CO4	Analyse firmware components, debugging and high availability/reliability design concepts.
CO5	Choose the appropriate available OS to improve the real time embedded system performance.

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Mapping of CO's, PO's with PSO's														
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	0	0	0	0	0	0	0	0	0	1	3	2
CO2	3	3	2	2	2	0	0	0	0	0	0	1	3	3
CO3	2	3	0	1	0	2	0	0	0	0	0	1	3	2
CO4	2	2	2	2	3	1	0	0	0	0	0	1	3	3
CO5	2	2	2	1	2	2	0	0	0	0	0	1	3	3

Mapping of CO's with Knowledge and Attitude Profile (WK)										
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0										
CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	
CO1	3	2	1	0	0	0	0	0	1	
CO2	3	3	2	2	1	0	0	0	1	
CO3	3	3	2	2	1	0	0	0	1	
CO4	3	2	3	2	2	1	0	0	1	
CO5	3	3	2	2	2	1	1	0	1	

Mapping of CO's with Sustainable Development Goals (SDG)																	
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0																	
CO/SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1	0	0	0	2	0	0	1	0	3	0	1	1	0	0	0	0	0
CO2	0	0	0	2	0	0	2	0	3	0	1	2	1	0	0	0	0
CO3	0	0	0	1	0	0	2	0	3	0	2	2	1	0	0	0	0
CO4	0	0	0	2	0	0	1	0	3	0	1	1	0	0	0	0	0
CO5	0	0	0	2	0	0	2	0	3	0	2	2	1	0	0	0	0

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Semester: VI

Course Title	ROBOTICS MECHANICS AND CONTROL						
Course Code	ECT604D						
Course Category	OEC (Open Elective Course)						
Teaching - Learning Scheme & Credit	L	T	P	S	Total	Total Teaching Hours	Credit
	3	0	0	0	3	39+0+0+0=39	3
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hrs	

Course Learning Objectives:	
CLO1	Terminologies and mathematical fundamentals of robotics mechanics and design.
CLO2	Obtaining Kinematics and inverse kinematics of manipulators.
CLO3	Study of manipulator dynamics and static forces.
CLO4	Manipulator design and trajectory generation.
CLO5	Incorporating control systems to improve the performance of manipulator.

SYLLABUS	No. of Hours	BTLs
UNIT 1	08	L1-L3
Introduction Background, Terminologies, Descriptions, mapping, operators, summary of interpretations, transformation arithmetic, Transform equations, more on representation of orientation. Text Book1		
UNIT 2	08	L1-L3
Manipulator Kinematics Link Description, Link Connection description, DH Parameters, Convention for affixing frames to links, Manipulator kinematics. Inverse Manipulator Kinematics Solvability, Algebraic and Geometric Solutions Examples: Unimation PUMA 560, Yasukawa Motoman L-3. Text Book1: 2.6, 2.7, 3.1 to 3.4, 3.6, 3.7		
UNIT 3	08	L1-L3
Jacobians: Velocities and static forces Notion for time varying position and orientation, Linear and rotational velocity of rigid bodies, motion of the links of a robot, velocity propagation from link to link, Jacobians, Singularities, Static force in manipulators. Manipulator dynamics Acceleration of a rigid body, Mass distribution, Newton's equation, Euler's equation, iterative newton-Euler dynamic formulation, iterative vs. closed form. Text Book2: 5.1 to 5.3, 5.7, 5.8		
UNIT 4	08	L1-L4
Trajectory Generation General considerations in path description and generation, Joint-space schemes, Cartesian-space schemes. Manipulator Mechanism Design Basing the design on task requirements, Kinematic configuration, quantitative measures of workspace attributes, redundant and closed chain structures, Actuation schemes, stiffness and deflections, position sensing and force sensing. Text Book1: 7.1 to 7.3		

UNIT 5	07	L1-L4
Linear control of Manipulators Feedback and closed loop control, second order linear systems, control of second order systems, control law partitioning, and trajectory following control, disturbance rejection, modelling and control of a single joint, Architecture of industrial robot controller. Text Book3: 8.1, 8.2, 8.4, 8.6		

TEXTBOOKS:	
1	J. J. Craig, "Introduction to robotics Mechanics and control, PEI, 3 rd Edition, 2009

Assessment Details both (CIE and SEE)			
The weightage of Continuous Internal Evaluation (CIE) and Semester End Exam (SEE) is 50% each. The students have to obtain a minimum of 40% marks individually both in CIE and SEE to pass. CIE: The CIE has three components – CIE - theory component, assignment and group activity. Students have to score a minimum of 40% Marks in the total of CIE - theory, assignment and group activity components put together to take SEE. SEE: Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration) and reduced to 50 Marks. **Self-Study Component should be not included for SEE & CIE.			
CONTINUOUS INTERNAL EVALUATION (CIE)		Max. Marks	Minimum Marks to be scored in CIE, to qualify to take SEE (40% individually)
Theory	Weightage of CIE1 and CIE2 Tests or CIE3	50	20
TOTAL		50	20

QUESTION PAPER PATTERN (SEE)										
Q. No.	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
UNIT	1	2	3	4	5	6	7	8	9	10
1. Two full questions (each of 20 Marks) are to be set from each unit.										
2. Student shall answer five full questions selecting one full question from each unit.										

Course Outcomes: After the completion of the course, the student will be able to:	
CO1	Explain the fundamental concepts of robot transformations, coordinate frames, orientation representations, and transformation operators used in robotic systems.
CO2	Analyze and formulate forward and inverse kinematic models of robotic manipulators using link parameters, Denavit–Hartenberg conventions, and appropriate solution techniques.
CO3	Analyze manipulator Jacobians, velocity relationships, singularities, static forces, and dynamic behavior using Newton–Euler formulations.
CO4	Design and evaluate joint-space and Cartesian-space trajectories and select suitable manipulator mechanisms, actuation, sensing, and structural configurations for given task requirements.

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CO5	Develop and evaluate linear feedback-control strategies for robotic manipulators, including trajectory tracking, disturbance rejection, and single-joint control, considering performance and practical implementation requirements.
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Mapping of CO's, PO's with PSO's														
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	0	2	0	0	0	0	1	0	2	2	1
CO2	3	3	3	2	3	0	0	0	1	1	0	2	2	1
CO3	3	3	2	3	3	0	1	0	1	1	0	2	2	1
CO4	3	3	3	2	3	2	3	1	2	2	0	2	2	1
CO5	3	3	3	2	3	2	2	2	2	2	0	2	2	1

Mapping of CO's with Knowledge and Attitude Profile (WK)										
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0										
CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	
CO1	2	3	3	3	0	1	0	0	0	
CO2	2	3	3	3	3	2	0	1	0	
CO3	3	3	3	3	2	3	0	2	0	
CO4	2	3	3	3	3	3	2	2	2	
CO5	2	3	3	3	3	3	2	2	3	

Mapping of CO's with Sustainable Development Goals (SDG)																	
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0																	
CO/SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1	0	0	0	3	0	0	0	1	2	0	0	0	0	0	0	0	0
CO2	0	0	0	2	0	0	0	2	3	0	1	1	0	0	0	0	0
CO3	0	0	0	2	0	0	0	2	3	0	1	2	0	0	0	0	0
CO4	0	0	0	2	0	0	0	3	3	0	2	3	0	0	0	0	0
CO5	0	0	0	2	0	0	0	3	3	0	2	3	0	0	0	0	0

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Semester: VI

Course Title	VLSI LABORATORY						
Course Code	ECL606						
Course Category	PCCL (Professional Core Course Laboratory)						
Teaching - Learning Scheme & Credit	L	T	P	TW+SL	Total	Total Teaching Hours	Credit
	0	0	2	0	2	0 + 0 + 2 + 0 = 26	2
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hrs	

Course Learning Objectives:	
CLO1	Design, model, simulate and verify CMOS digital circuits
CLO2	Design layouts CMOS digital circuits
CLO3	Perform physical verification of CMOS digital circuits
CLO4	Perform RTL- flow and understand the stages in ASIC design.
CLO5	To analysis the power and delay model.

Syllabus	
PART: A - CONVENTIONAL EXPERIMENTS	
1	DC, Transient analysis of CMOS logic-Universal gates schematic
2	DC, Transient analysis of CMOS full adder schematic
3	DC, Transient analysis of Pass transistor and transmission gates schematic
4	DC, Transient analysis of Sequential circuits schematic 1. Clocked D Latch 2. Master-Slave Edge Triggered Register
5	DRC and LVS analysis of CMOS Inverter layout
6	DRC and LVS analysis of Common Source Amplifier Layout
7	DRC and LVS analysis of Common Drain Amplifier Layout
8	DRC and LVS analysis of Differential Amplifier Layout
9	Synthesis and Simulation of Inverter using Verilog code
10	Synthesis and Simulation of Buffer Verilog code
11	Synthesis and Simulation of Basic/Universal Gate using Verilog code
12	Synthesis and Simulation of JK, MSJK flip-flops using Verilog code

Teaching & Learning Process (Innovative Delivery Methods):	
1	Active Learning Techniques
2	Problem-Based Learning (PBL)
3	Team-Based Learning (TBL)
4	Hands-On Experiments and Simulations

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School of Electrical, Electronics Sciences & Engineering
Program: Electronics and communication Engineering

Semester: VI

TEXT BOOKS:	
1	Basic VLSI Design”, Douglas A Pucknell, Kamran Eshraghian, 3rd Edition, Prentice Hall of India publication, 2005
2	R. Jacob Baker, “CMOS Circuit Design, Layout and Simulation”, edition, John Wiley India Pvt. Ltd, year

REFERENCE BOOKS:	
1	CMOS VLSI Design- A Circuits and Systems Perspective”, Neil H E Weste, and David Money Harris 4th Edition, Pearson Education. 2015
2	CMOS Digital Integrated Circuits: Analysis and Design”, Sung Mo Kang & Yosuf Leblebici, Third Edition, Tata McGraw-Hill, 2019.
e-LEARNING RESOURCES:	
1	https://www.nptel.ac.in/courses/117101058
2	https://onlinecourses.nptel.ac.in/noc26_ee85/preview

Assessment Details both (CIE and SEE)			
The weightage of Continuous Internal Evaluation (CIE) and Semester End Exam (SEE) is 50% each. The students have to obtain a minimum of 40% marks individually both in CIE and SEE to pass. CIE: The CIE has two components – CIE - theory component and CIE – laboratory component. Students have to score a minimum of 40% Marks in the total of CIE - theory and CIE – laboratory components put together, provided students have to score a minimum of 40% marks in CIE laboratory component alone to qualify to take SEE. Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration) and reduced to 50 Marks. **Self-Study Component should be not included for SEE & CIE.			
CONTINUOUS INTERNAL EVALUATION (CIE)		Max. Marks	Minimum Marks to be scored in CIE, to qualify to take SEE (40% individually)
Laboratory components	Rubrics for each experiment are added, then taken average	30	20
	Lab CIE	20	
TOTAL		50	20

Course Outcomes: After the completion of the course, the student will be able to:	
CO1	Design and simulate basic CMOS circuits like different logic structures
CO2	Design and analyze Power Amplifiers.
CO3	Design and simulate basic CMOS circuits like inverter, common source amplifier and Differential Amplifier
CO4	Perform ASIC design flow and understand the process of synthesis, synthesis constraints and evaluating the synthesis reports to obtain optimum gate level net list.
CO5	Design and simulate combinational and sequential digital circuits using cadence digital

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Semester: VI

Mapping of CO's, PO's with PSO's														
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	1	3	0	0	0	2	2	0	3	2	1
CO2	3	3	3	3	3	0	1	0	1	0	0	3	2	2
CO3	3	3	3	2	3	0	0	0	1	0	0	3	1	1
CO4	3	3	3	3	3	0	0	0	1	1	2	3	1	1
CO5	3	3	3	2	3	0	0	0	1	1	0	3	1	1

Mapping of CO's with Knowledge and Attitude Profile (WK)										
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0										
CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	
CO1	1	1	2	2	2	3	0	1	1	
CO2	1	1	2	3	3	3	0	1	1	
CO3	1	1	2	3	3	3	0	1	1	
CO4	1	1	2	3	2	3	0	1	1	
CO5	1	1	2	3	3	3	0	2	1	

Mapping of CO's with Sustainable Development Goals (SDG)																	
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0																	
CO/SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1	0	0	0	3	0	0	0	0	2	0	0	0	0	0	0	0	0
CO2	0	0	0	3	0	0	1	0	2	0	0	0	0	0	0	0	0
CO3	0	0	0	3	0	0	2	0	3	0	0	0	0	0	0	0	0
CO4	0	0	0	3	0	0	0	0	2	0	0	0	0	0	0	0	0
CO5	0	0	0	3	0	0	1	0	2	0	0	0	0	0	0	0	0

Semester: VI

Course Title	INTRODUCTION TO E-VEHICLES						
Course Code	ECT607B						
Course Category	Ability Enhancement Course						
Teaching - Learning Scheme & Credit	L	T	P	S	Total	Total Teaching Hours	Credit
	1	0	0	0	1	16+0+0+0=16	1
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 02 Hrs	

Course Learning Objectives:	
CLO1	To impart the knowledge of EV battery chargers.
CLO2	To introduce advanced linear and state space methods for the control of electrified vehicles.
CLO3	To provide a fundamental understanding of the various mechanical systems of a typical electric vehicle.
CLO4	To provide a fundamental understanding of the Chassis and Steering System
CLO5	To provide a fundamental understanding of the Controls for steering, braking, and suspension.

SYLLABUS	No. of Hours	BTLs
UNIT 1	4	L1-L2
Environmental Impact: Air Pollution- Nitrogen Oxides, Carbon Monoxide, Unburned Hydrocarbons and Other Pollutants. Global Warming, Petroleum Resources, Induced Costs		
UNIT 2	3	L1-L2
History of Modern Transportation: Importance of Different Transportation Development Strategies to Future Oil Supply, History of Electric Vehicles, History of Hybrid Electric Vehicles, History of Fuel Cell Vehicles.		
UNIT 3	3	L1-L3
Electric Vehicles: Configurations of Electric Vehicles, Performance of Electric Vehicles- Traction Motor Characteristics, Tractive Effort and Transmission Requirement., Vehicle Performance. Tractive Effort in Normal Driving, Energy Consumption.		
UNIT 4	3	L1-L3
Hybrid Electric Vehicles: Concept of Hybrid Electric Drive Trains, Architectures of Hybrid Electric Drive Trains, Series Hybrid Electric Drive Trains, Parallel Hybrid Electric Drive Trains		
UNIT 5	3	L1-L2
Energy Storages: Electrochemical Batteries, Electrochemical Reactions, Thermodynamic Voltage, Specific Energy, Specific Power, Energy Efficiency, Battery Technologies.		

TEXT BOOKS:	
1	Ehsani, Mehrdad, et al. Modern electric, hybrid electric, and fuel cell vehicles. CRC press 2018
REFERENCE BOOKS:	
1	Jazar, Reza N. Vehicle dynamics: theory and application. Springer 2017

Semester: VI

2	Rajesh Rajamani, Vehicle Dynamics and Control, Springer 2012
3	Husain, Iqbal. Electric and hybrid vehicles: design fundamentals. CRC press 2010
4	Katsuhiko Ogata, Modern Control Engineering, PHI, Twelfth Edition 2014
5	Iqbal Husain, "Electric and Hybrid Vehicles: Design Fundamentals", CRC Press 202

Assessment Details both (CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) and Semester End Exam (SEE) is 50% each. The students have to obtain a minimum of 40% marks individually both in CIE and SEE to pass.
CIE: The CIE has three components – CIE - theory component, assignment and group activity. Students have to score a minimum of 40% Marks in the total of CIE - theory, assignment and group activity components put together to take SEE.
SEE: Theory Semester End Exam (SEE) is conducted for 50 marks (2 Hours duration). ****Self-Study Component should be not included for SEE & CIE.**

CONTINUOUS INTERNAL EVALUATION (CIE)		Max. Marks	Minimum Marks to be scored in CIE, to qualify to take SEE (40% individually)
Theory	Weightage of CIE1 and CIE2 Tests or CIE3	50	20
TOTAL		50	20

QUESTION PAPER PATTERN (SEE)

Q. No.	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
UNIT	1	2	3	4	5					

1. Two full questions (each of 20 Marks) are to be set from each unit.

2. Student shall answer five full questions selecting one full question from each unit.

Course Outcomes: After the completion of the course, the student will be able to:

CO1	Explain Environmental Impact
CO2	Discuss the Modern Transportation
CO3	Analyze the systems of a typical electric vehicle.
CO4	Illustrate the concepts of Hybrid Electric Vehicles
CO5	Describe Energy Storages

Mapping of CO's, PO's with PSO's

Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	0	0	0	3	0	0	0	0	1	1	0	3
CO2	3	2	2	0	2	3	0	0	1	1	3	2	2	3
CO3	3	3	2	1	3	2	0	0	1	0	2	3	3	1
CO4	3	3	3	1	3	2	0	0	1	1	3	3	3	1
CO5	3	3	2	1	3	2	0	0	1	1	3	3	2	2

Semester: VI

Mapping of CO's with Knowledge and Attitude Profile (WK)									
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0									
CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
CO1	2	0	0	0	3	1	3	0	0
CO2	1	1	3	3	3	3	3	2	0
CO3	0	3	3	3	2	3	1	2	0
CO4	0	3	3	3	3	3	2	2	0
CO5	0	3	3	3	3	3	2	3	0

Mapping of CO's with Sustainable Development Goals (SDG)																	
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0																	
CO/SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1	0	0	3	0	0	0	2	0	0	0	3	3	3	0	0	0	0
CO2	0	0	2	0	0	0	3	0	3	0	3	2	3	0	0	0	0
CO3	0	0	2	0	0	0	3	0	3	0	3	1	3	0	0	0	0
CO4	0	0	0	0	0	0	3	0	3	0	3	1	3	0	0	0	0
CO5	0	0	0	0	0	0	3	0	3	0	2	3	3	0	0	0	0

Dr.Ambedkar Institute of Technology, Bengaluru-560056
Outcome Based Education(OBE) and Choice Based Credit System
B.E. Name of the programme: Electronics and Communication Engineering
Tentative Scheme of Teaching and Examination effective from the Academic Year 2023-24
(Applicable to 2023 batch)

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 hours	CIE Marks	SEE Marks	Total Marks	
1	IPCC	22ECU701	Digital communication and coding		3	0	2		03	50	50	100	4
2	IPCC	22ECU702	Computer Networks and Protocols		3	0	2		03	50	50	100	4
3	PCC	22ECT703	Wireless Communication Systems		3	2	0		03	50	50	100	4
4	PEC	22ECT704x	Professional Elective Course		3	0	0		03	50	50	100	3
5	OEC	22ECT705x	Open Elective Course		3	0	0		01	50	50	100	3
6	PROJ	22ECP706	Major Project Phase-II		0	0	12		03	100	100	200	6
										400	300	700	24

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=** Self-Study, **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

Professional Elective Course 22ECT704x

22ECT704A	ASIC	22ECT704D	Analog and Mixed mode VLSI
22ECT704B	Intelligent Systems and Machine Learning Algorithms	22ECT704E	Cyber Security
22ECT704C	Operation Research	22 ECT704F	RF IC Design

Open Elective Course 22ECT705x

22ECT705A	E-waste Management	22ECT705D	Embedded Systems Applications
22ECT705B	Automotive Electronics	22ECT705E	Cryptography
22ECT705C	Basic VLSI Design		

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. To install responsibilities to oneself and others.
- (vii) 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.

Dr. Ambedkar Institute of Technology, Bengaluru-560056
Outcome Based Education(OBE) and Choice Based Credit System
B.E. Name of the programme: Electronics and Communication Engineering
Tentative Scheme of Teaching and Examination effective from the Academic Year 2023-24
(Applicable to 2023 batch)

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	22ECT801x	Professional Elective (Online Courses)		3	0	0		-	-	-	-	3
2	OEC	22ECT802x	Open Elective (Online Courses)		3	0	0		-	-	-	-	3
3	INT	22ECI803	Internship (Industry/Research) (14 - 20 Weeks)		0	0	12		03	100	100	200	10
										200	200	400	16

L: Lecture, **T:** Tutorial, **P:** Practical **S=** Self-Study, **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.

Professional Elective Course (Online courses) 22ECT801x

22ECT801A		22ECT801C	
22ECT801B		22ECT801D	

Open Elective Courses (Online Courses) 22ECT802x

22ECT802A		22ECT802C	
22ECT802B		22ECT802D	

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 home town (**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/Institute shall not bear any cost involved in carrying out the internship by students. However, students can receive any financial assistance extended by the organization

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School of Electrical, Electronics Sciences and Engineering
Program: Electronics & Communication Engineering

Semester: VII

Course Title	DIGITAL COMMUNICATION AND CODING						
Course Code	22ECU701						
Course Category	IPCC (Integrated Professional Core Course)						
Teaching - Learning Scheme & Credit	L	T	P	S	Total	Total Teaching Hours	Credit
	3	0	2	0	5	39+0+26+0=65	4
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hrs	

Course Learning Objectives:	
CLO1	A brief overview of the digital communication system and the techniques detection and estimation.
CLO2	To Understand information on discrete PAM signals, ISI for data transmission
CLO3	To Understand and analyse different waveform coding techniques and applications and spread spectrum modulation
CLO4	To impart the basic concepts of information theory
CLO5	To be able to understand the concepts of source coding.

SYLLABUS	No. of Hours	BTLs
UNIT 1	8	L1-L4
DETECTION AND ESTIMATION: Introduction to communication system(Block Diagram), Gram-Schmidt Orthogonalization Procedure, geometric interpretation of signals, response of bank of correlators to noisy input, Detection of known signals in noise, probability of error, correlation receiver, matched filter receiver. WAVEFORM CODING TECHNIQUES: Pulse Code Modulation, channel noise and error probability, Quantization noise and Signal to Noise Ratio, robust quantization, DPCM, DM TEXT 1		
UNIT 2	8	L1-L4
BASE-BAND SHAPING FOR DATA TRANSMISSION: Discrete PAM signals, power spectra of discrete PAM signals, Inter Symbol Interference, Nyquist's criterion for distortion less base-band binary transmission, eye pattern. SPREAD SPECTRUM MODULATION: Principle of Direct Sequence Spread Spectrum (DSSS), frequency hop spread spectrum. TEXT 1.		
UNIT 3	8	L1-L4
DIGITAL MODULATION TECHNIQUES: Digital Modulation formats. Coherent binary modulation techniques: Binary ASK, PSK, and FSK. Coherent Quadrature modulation techniques: Quadriphase-shift keying (QPSK). Non-coherent binary modulation techniques, Differential phase shift keying (DPSK). TEXT 1 and TEXT 2		
UNIT 4	8	L1-L4
INFORMATION THEORY: Introduction, Measure of information, Average information content of symbols in long independent sequences, Average information content of symbols in long dependent sequences. Markoff statistical model for information source, Entropy and information rate of mark-off source. SOURCE CODING: Encoding of the source output, Shannon's encoding algorithm, Source coding theorem, Huffman coding, Single error correction Hamming code.(Only binary codes) TEXT 2 and TEXT 3		

UNIT 5		7	L1-L4
INTRODUCTION TO ERROR CONTROL CODING: Introduction, Types of errors, examples, Types of codes, Linear Block Codes: Matrix description, Error detection and correction, Convolution Encoder. TEXT 2 and TEXT 3			
PRACTICAL COMPONENTS OF IPCC Using suitable simulation software, demonstrate the operation of the following circuits			
Experiments			
Sl.No.	Hardware Experiments		
1	Generation and demodulation of the Amplitude Shift Keying signal.		
2	Generation and demodulation of the Phase Shift Keying signal.		
3	Generation and demodulation of the Frequency Shift Keying signal.		
4	Generation of DPSK signal and detection of data using DPSK transmitter and receiver.		
5	Generation and demodulation of the Quadrature Frequency Shift Keying signal.		
Simulation Experiments (Using MATLAB software)			
6	Gram-Schmidt Orthogonalization: To find orthogonal basis vectors for the given set of vectors and plot the orthonormal vectors.		
7	Simulation of binary baseband signals using a rectangular pulse and estimate the BER for AWGN channel using matched filter receiver.		
8	Perform the DM, DPCM Modulation and demodulation.		
9	Encoding and Decoding of binary data using a Hamming code.		
10	Encoding and Decoding of Huffman code.		
11	Encoding and Decoding of Linear Block Codes.		
12	Encoding and Decoding of Convolution code		

TEXT BOOKS:	
1	Simon Haykins , “Digital Communications”, 4th Edition, John Wiley, 2008(reprint).
2	K.Sam Shanmugam , “Digital and analog communication systems”, 4th Edition, John Wiley, 1996.
3	Simon Haykins , “Communication systems”, 4 th Edition edition, John Wiley India Pvt. Ltd, 2008
4	Dr. K. N. Hari Bhat & Dr. D. Ganesh Rao , ”Digital communications”, 2nd Edition, Sanguine Technical publications, 2008. (Reprint).
5	5. Bernard Sklar ,” Digital communications”, 3rd Edition, Pearson education, 2007

REFERENCE BOOKS:	
1	John Proakis, Masoud Salehi ,” Digital communications”, 5th Edition, Mac Graw Hill, 2008.
2	Glover and Grant , “Digital Communications”, 2nd , Pearson Ed, 2008
3	P.S Satyanarayana , “Information Theory and Coding”, edition, Dyanaram Publications, Reprint 2001

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School of Electrical, Electronics Sciences and Engineering
Program: Electronics & Communication Engineering

Semester: VII

Assessment Details both (CIE and SEE)				
The weightage of Continuous Internal Evaluation (CIE) and Semester End Exam (SEE) is 50% each. The students have to obtain a minimum of 40% marks individually both in CIE and SEE to pass. CIE: The CIE has two components – CIE - theory component and CIE – laboratory component. Students have to score a minimum of 40% Marks in the total of CIE - theory and CIE – laboratory components put together, provided students have to score a minimum of 40% marks in CIE laboratory component alone to qualify to take SEE. Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration) and reduced to 50 Marks. **Self-Study Component should be not included for SEE & CIE.				
CONTINUOUS INTERNAL EVALUATION (CIE)		Max. Marks		Minimum Marks to be scored in CIE, to qualify to take SEE (40% individually)
Theory	Weightage of CIE1 and CIE2 Tests or CIE3	30		12
Laboratory components	Rubrics for experiment are added, then taken average	10	20	08
	Lab CIE	10		
TOTAL		50		20

QUESTION PAPER PATTERN (SEE)										
Q. No.	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
UNIT	1	2	3	4	5	6	7	8	9	10
1. Two full questions (each of 20 Marks) are to be set from each unit.										
2. Student shall answer five full questions selecting one full question from each unit.										

Course Outcomes: After the completion of the course, the student will be able to:	
CO1	Explain the principles of detection and estimation of signals in noise and analyze the performance of correlator and matched-filter receivers.
CO2	Analyze discrete PAM signals, inter-symbol interference, Nyquist criterion and eye patterns, and evaluate the performance of baseband data transmission techniques.
CO3	Analyze different digital modulation techniques such as ASK, PSK, FSK, QPSK and DPSK, and compare their performance for digital communication systems.
CO4	Apply the principles of information theory and source coding to determine entropy, information rate and construct Shannon and Huffman codes for efficient information representation.
CO5	Apply error-control coding techniques to analyze and Design linear block and convolutional codes for error detection and correction in digital communication systems

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School of Electrical, Electronics Sciences and Engineering
Program: Electronics & Communication Engineering

Semester: VII

Mapping of CO's, PO's with PSO's														
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	3	1	0	0	0	0	0	0	3	3	0
CO2	3	3	3	3	2	0	0	0	0	0	0	3	3	0
CO3	3	3	3	3	2	0	0	0	0	1	0	3	3	0
CO4	3	3	3	3	2	0	0	0	0	0	0	3	3	0
CO5	3	3	3	3	2	1	0	0	0	1	0	3	3	0

Mapping of CO's with Knowledge and Attitude Profile (WK)										
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0										
CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	
CO1	3	3	3	2	2	0	0	0	0	
CO2	3	3	3	3	3	2	0	0	0	
CO3	3	3	3	3	3	2	0	0	0	
CO4	3	3	3	3	3	2	0	0	0	
CO5	3	3	3	3	3	2	2	0	0	

Mapping of CO's with Sustainable Development Goals (SDG)																	
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0																	
CO/SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1	0	0	0	1	0	0	0	1	2	0	1	0	0	0	0	0	1
CO2	0	0	0	1	0	0	0	1	3	0	2	1	1	0	0	0	2
CO3	0	0	0	1	0	0	0	1	3	0	2	1	1	0	0	0	2
CO4	0	0	0	2	0	0	0	1	3	0	2	1	0	0	0	0	2
CO5	0	0	0	2	0	0	0	2	3	0	2	1	1	0	0	0	2

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Semester: VII

Course Title	COMPUTER NETWORKS AND PROTOCOLS						
Course Code	22ECU702						
Course Category	IPCC (Integrated Professional Core Course)						
Teaching - Learning Scheme & Credits	L	T	P	S	Total	Total Teaching Hours	Credits
	3	0	2	0	5	39+0+26+0=65	4
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hrs	

Course Learning Objectives:	
CLO1	To introduce the fundamental concepts of data communication and network models, including components, types of networks, and layered architectures like TCP/IP and OSI
CLO2	Understand the functioning of data link control mechanisms, media access control protocols, and the structure and behaviour of wired and wireless LANs.
CLO3	To explore the services of the network layer, including routing, packet forwarding, IP addressing (IPv4 and IPv6), and network protocols.
CLO4	To analyse the functionalities of transport layer protocols, with a focus on reliable data transfer, error control, and congestion management in TCP and UDP.
CLO5	To understand the working of application layer protocols such as HTTP, FTP, DNS, and email, and their role in delivering services to end-users.

SYLLABUS	No. of Hours	BTLs
UNIT 1	8	L1-L4
Introduction: Data communication: Components, Data representation, Data flow, Networks: Network criteria, Physical Structures, Network types: LAN, WAN, Switching, The Internet. 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. Data-Link Layer: Introduction: Nodes and Links, Services, Two Categories' of link, Sublayers, Link Layer addressing: Types of addresses, ARP. Text 1 (1.1, 1.2, 1.3.1 to 1.3.4, 2.2, 2.3 ,9.1, 9.2.1, 9.2.2)		
UNIT 2	8	L1-L4
Data Link Control (DLC) services: Framing, Flow and Error Control. Media Access Control: Random Access: ALOHA, CSMA, CSMA/CD, CSMA/CA. Connecting Devices: Hubs, Switches, Virtual LANs: Membership, Configuration, Communication between Switches, Advantages,Wired and Wireless LANs: Ethernet Protocol, Standard Ethernet. Introduction to wireless LAN: Architectural Comparison, Characteristics, Access Control. Text 1 (11.1,12.1,13.1, 13.2.1 to 13.2.5,15.1,17.1,17.2)		
UNIT 3	8	L1-L4
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. Network Layer Protocols: Internet Protocol (IP): Datagram Format, Fragmentation, Options, Security of IPv4 Datagrams. IPv6		

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addressing and Protocol. Unicast Routing: Introduction, Routing Algorithms: Distance Vector Routing, Link State Routing, Path vector routing. Text 1 (18.1(excluding 18.1.3), 18.2, 18.4,19.1,20.1, 20.2,22.1 and 22.2)		
UNIT 4	8	L1-L4
Transport Layer: Introduction: Transport Layer Services, Connectionless and Connection oriented Protocols, Transport Layer Protocols: Simple protocol, Stop and wait protocol, GoBackN Protocol, Selective repeat protocol, Piggybacking.Transport-Layer Protocols in the Internet: User Datagram Protocol: User Datagram, UDP Services, UDP Applications, Transmission Control Protocol: TCP Services, TCP Features, Segment, Connection, State Transition diagram, Windows in TCP, Error control, TCP congestion control. Text1 (23.1, 23.2.1, 23.2.2, 23.2.3, 23.2.4, 23.2.5,24.2, 24.3.1, 24.3.2, 24.3.3, 24.3.4, 24.3.6, 24.3.8, 24.3.9)		
UNIT 5	7	L1-L4
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. Quality of Service Text1 (25.1, 26.1.2, 26.2, 26.3, 26.6, 30.1, 30.2.)		
PRACTICAL COMPONENTS OF IPCC		
Using suitable simulation software, demonstrate the operation of the following circuits		
Experiments		
Simulation experiments using NS2/ NS3/ OPNET/ NCTUNS/NetSim/ QualNet or any other equivalent tool		
1.Implement a point to point network with four nodes and duplex links between them. Analyze the network performance by setting the queue size and varying the bandwidth.		
2.Implement a four node point to point network with links n0-n2, n1-n2 and n2-n3. Apply TCP agent between n0-n3 and UDP between n1-n3. Apply relevant applications over TCP and UDP agents changing the parameter and determine the number of packets sent by TCP/UDP.		
3.Implement Ethernet LAN using n (6-10) nodes. Compare the throughput by changing the error rate and data rate.		
4.Implement Ethernet LAN using n nodes and assign multiple traffic to the nodes and obtain congestion window for different sources/ destinations.		
5.Implement ESS with transmission nodes in Wireless LAN and obtain the performance parameters.		
6.Implementation of Link state routing algorithm.		
Implement the following using programming languages C/C++ etc.,		
7. Write a program for a HDLC frame to perform the following. i) Bit stuffing ii) Character stuffing.		
8. Write a program for distance vector algorithm to find suitable path for transmission.		
9.Implement Dijkstra's algorithm to compute the shortest routing path.		
10..For the given data, use CRC-CCITT polynomial to obtain CRC code. Verify the program for the cases : i)with out error ii)with error.		
11. Implementation of Stop and Wait Protocol and Sliding Window Protocol.		
12. Write a program for congestion control using leaky bucket algorithm.		

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TEXT BOOKS:	
1	Data Communications and Networking, Forouzan, 5th Edition, McGraw Hill, 2016 ISBN: 1-25-906475-
REFERENCE BOOKS:	
1	A.S Tanenbaum - Computer Networks, 4th Edition, PHI, 2003
2	Computer Networks, James J Kurose, Keith W Ross, Pearson Education, 2013, ISBN: 0-273-76896-4
3	Introduction to Data Communication and Networking, Wayarles Tomasi, Pearson Education, 2007, ISBN:0130138282

Assessment Details both (CIE and SEE)			
The weightage of Continuous Internal Evaluation (CIE) and Semester End Exam (SEE) is 50% each. The students have to obtain a minimum of 40% marks individually both in CIE and SEE to pass. CIE: The CIE has three components – CIE - theory component, assignment and group activity. Students have to score a minimum of 40% Marks in the total of CIE - theory, assignment and group activity components put together to take SEE. SEE: Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration) and reduced to 50 Marks.			
CONTINUOUS INTERNAL EVALUATION (CIE)		Max. Marks	Minimum Marks to be scored in CIE, to qualify to take SEE (40% individually)
Theory	Weightage of CIE-1 and CIE-2 Tests or CIE-3	50	20
TOTAL		50	20

QUESTION PAPER PATTERN (SEE)										
Q. No.	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
UNIT	1		2		3		4		5	
1. Two full questions (each of 20 Marks) are to be set from each unit.										
2. Student shall answer five full questions selecting one full question from each unit.										

Course Outcomes: After the completion of the course, the student will be able to:	
CO1	Understand the fundamentals of computer networks, communication models, protocol architectures, and networking devices.
CO2	Apply data link layer concepts to implement error detection and correction techniques, Ethernet technologies, and media access control protocols.
CO3	Analyze Internet Protocol addressing schemes, routing algorithms, and network layer protocols.
CO4	Analyze the operation of transport layer protocols, including TCP and UDP, for reliable end-to-end data communication.
CO5	Develop an understanding of application layer services and protocols including HTTP, FTP, DNS, Email, Peer-to-Peer applications, security of DNS, Quality of Service.

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Mapping of CO's, PO's with PSO's														
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	0	2	0	0	0	0	0	2	2	0	1
CO2	3	3	2	2	3	0	0	1	0	0	2	3	0	1
CO3	3	3	2	3	2	0	1	0	0	0	2	3	1	2
CO4	3	3	2	2	3	0	1	0	0	0	3	3	1	2
CO5	3	3	2	2	3	1	3	1	1	0	3	2	1	3

Mapping of CO's with Knowledge and Attitude Profile (WK)										
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0										
CO/SDG's	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	
CO1	2	2	3	3	0	3	0	1	0	
CO2	1	3	3	3	0	3	0	1	1	
CO3	1	3	3	3	0	3	0	2	1	
CO4	1	3	3	3	0	3	0	2	1	
CO5	2	2	2	3	1	3	2	2	3	

Mapping of CO's with Sustainable Development Goals (SDG)																	
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0																	
CO	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1	0	0	0	3	0	0	0	1	3	0	2	0	0	0	0	1	0
CO2	0	0	0	2	0	0	0	2	3	0	2	1	1	0	0	1	0
CO3	0	0	0	2	0	0	0	2	3	0	3	1	1	0	0	2	0
CO4	0	0	0	2	0	0	0	3	3	0	2	1	1	0	0	2	0
CO5	0	0	0	3	0	0	0	2	3	0	3	1	1	0	0	3	0

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Course Title	WIRELESS COMMUNICATION SYSTEMS						
Course Code	22ECT703						
Course Category	PCC (Professional Core Course)						
Teaching - Learning Scheme & Credit	L	T	P	S	Total	Total Teaching Hours	Credit
	4	0	0	0	4	53+0+0+0=40	4
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hrs	

Course Learning Objectives:	
CLO1	Explain the fundamentals of wireless communication systems and the concepts of signal propagation over wireless channels
CLO2	Describe the system architecture and layers of LTE based on the use of OFDMA and SCFDMA principles.
CLO3	Analyze the multiple access and MIMO techniques used in cellular communications standards.

SYLLABUS	No. of Hours	BTLs
UNIT 1	10	L1-L4
Principles of Wireless Communications: The Wireless Communication Environment, Modelling of wireless systems, System model for narrowband Signals, Rayleigh fading Wireless Channel. The Wireless Channel: Basics of Wireless Channel Modelling, Average Delay Spread in Outdoor Cellular Channels, Coherence bandwidth, Relation between ISI and Coherence Bandwidth, Doppler fading, Doppler Impact on a wireless Channel, Coherence Time. [Text1: 3.1 to 3.4, 4.1 to 4.7]		
UNIT 2	10	L1-L4
Evolution of Cellular Technologies: First Generation Cellular Systems, 2G Digital cellular systems – GSM and its Evolution, 3G Broadband Wireless Systems, Key Enabling Technologies and features of LTE, LTE Network Architecture. Frequency Domain Multiple Accesses: Multiple Access for OFDM Systems, Orthogonal Frequency Division Multiple Access, Single Carrier Frequency Division Multiple Access. [Text2: 1.2.1, 1.2.1.1, 1.2.2, 1.2.2.1, 1.2.3 (Only the mentioned sections and subsections), 1.4, 1.5, 4.1, 4.2, 4.3]		
UNIT 3	10	L1-L4
Code Division for Multiple Access (CDMA): Basic CDMA Mechanism, Fundamentals of CDMA codes, Spreading Codes based on PN sequences, Correlation Properties of Random CDMA Spreading Sequences, Advantages of CDMA. Orthogonal Frequency Division Multiplexing (OFDM): Introduction, Motivation and Multicarrier basics, OFDM basics, OFDM Example, MIMO OFDM, OFDM Peak to Average Power ratio, SC-FDMA. [Text1: 5.1 to 5.5, 5.7, 7.1, 7.2, 7.3, 7.5, 7.7, 7.8]		

UNIT 4		11	L1-L4
Multiple Input Multiple Output Wireless Communications: Introduction to MIMO Communications, MIMO system Model, MIMO Zero Forcing Receiver, MIMO MMSE Receiver, Singular Value decomposition of MIMO Channel, SVD and MIMO capacity, Alamouti and Space-Time Codes, Nonlinear MIMO receiver: V-Blast, MIMO Beamforming. [Text1:6.1,6.2, 6.3, 6.4, 6.5, 6.6, 6.8, 6.9, 6.10]			
UNIT 5		11	L1-L4
Overview and Channel Structure of LTE: Radio Interface Architecture, LTE Design principles, Network Architecture, Radio Interface Protocols, Hierarchical Structure of LTE: Logical Channels, transport Channels and Physical Channels, Channel mapping, Downlink OFDMA Radio resources, Physical Resource Blocks for OFDMA, Uplink SC-FDMA Radio resources. [Text2: 6.1 to 6.4]			

TEXTBOOKS:	
1	Aditya K Jagannatham, “Principles of Modern Wireless Communication systems, Theory and Practice”, Mc Graw Hill Education (India) Private Limited, 2017, ISBN 978-81- 265-4231-4.
2	Arunabha Ghosh, Jun Zhang, Jeffrey G. Andrews, Rias Muhamed, “Fundamentals of LTE”, Pearson India Education Services Private Limited, 2018, ISBN: 978-93-530-6239-2.

REFERENCE BOOKS:	
1	T L Singal, “Wireless Communications”, Mc Graw Hill Education (India) Private Limited, 2016, ISBN:978-0-07-068178-1
2	Theodore Rappaport, Wireless Communications: Principles and Practice, 2nd Edition, Prentice Hall Communications Engineering and Emerging Technologies Series, 2002, ISBN 0-13-042232-0.

Assessment Details both (CIE and SEE)			
The weightage of Continuous Internal Evaluation (CIE) and Semester End Exam (SEE) is 50% each. The students have to obtain a minimum of 40% marks individually both in CIE and SEE to pass. CIE: The CIE has three components – CIE - theory component, assignment and group activity. Students have to score a minimum of 40% Marks in the total of CIE - theory, assignment and group activity components put together to take SEE. SEE: Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration) and reduced to 50 Marks.			
CONTINUOUS INTERNAL EVALUATION (CIE)		Max. Marks	Minimum Marks to be scored in CIE, to qualify to take SEE (40% individually)
Theory	Weightage of CIE1 and CIE2 Tests or CIE3	50	20
TOTAL		50	20

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QUESTION PAPER PATTERN (SEE)										
Q. No.	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
UNIT	1		2		3		4		5	
1. Two full questions (each of 20 Marks) are to be set from each unit.										
2. Student shall answer five full questions selecting one full question from each unit.										

Course Outcomes: After the completion of the course, the student will be able to:	
CO1	Interpret the concepts of wireless communication to appropriately model the wireless channels and evaluate their characteristics such as ISI and coherence bandwidth, delay spread and Doppler phenomena.
CO2	Understand the evolution and operation of modern wireless communication systems and apply the cellular communication and multiple-access techniques to achieve better spectral efficiency
CO3	Analyze and distinguish between the CDMA, OFDM and SC-FDMA techniques with respect to spreading, orthogonality, spectral efficiency and peak-to-average power ratio.
CO4	Apply MIMO transmission, receiver and space-time coding techniques to improve the capacity and reliability of wireless communication systems.
CO5	Analyze the LTE radio interface, protocol architecture, channel structure including downlink OFDMA and uplink SC-FDMA and adopt better radio resource allocation techniques.

Mapping of CO's, PO's with PSO's														
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	0	2	2	0	0	1	1	0	2	3	3	1
CO2	3	2	1	0	2	0	0	1	1	0	3	1	3	1
CO3	3	3	1	2	3	0	0	1	1	0	2	3	3	1
CO4	3	3	2	2	3	0	0	1	1	0	2	3	3	1
CO5	3	3	1	2	3	0	1	1	1	0	3	2	3	1

Mapping of CO's with Knowledge and Attitude Profile (WK)									
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0									
CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
CO1	1	3	3	2	0	2	0	0	0
CO2	0	2	2	3	0	3	0	2	0
CO3	0	3	3	3	0	3	0	2	0
CO4	0	3	3	3	0	3	0	2	0
CO5	0	2	2	3	0	3	0	3	0

Mapping of CO's with Sustainable Development Goals (SDG)																	
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0																	
CO/SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1	0	0	0	0	0	0	0	0	3	0	1	0	0	0	0	0	0
CO2	0	0	0	0	0	0	0	2	3	0	2	0	0	0	0	0	0
CO3	0	0	0	0	0	0	0	1	3	0	2	0	0	0	0	0	0
CO4	0	0	0	0	0	0	0	2	3	0	2	0	0	0	0	0	0
CO5	0	0	0	0	0	0	0	2	3	0	3	0	0	0	0	0	0

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Course Title	ASIC DESIGN						
Course Code	22ECT704A						
Course Category	PEC (Professional Elective Course)						
Teaching - Learning Scheme & Credit	L	T	P	S	Total	Total Teaching Hours	Credit
	3	0	0	0	3	39+0+0+0=39	3
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hrs	

Course Learning Objectives:	
CLO1	Analysis of ASIC design flow.
CLO2	Describe the concepts of ASIC design methodology, data path elements, logical effort
CLO3	Analyze back-end physical design flow, including partitioning
CLO4	Analyze back-end physical design flow, including floor planning and placement,
CLO5	Analyze back-end physical design flow, includes routing.

SYLLABUS	No. of Hours	BTLs
UNIT 1	08	L1-L3
Introduction To ASICs: Types of ASICs, Full-Custom ASICs, Standard cell based ASICs, Gate array based ASICs, Channelled gate array, channel-less gate array, structured gate array, Programmable logic devices (PLD), Field– programmable gate arrays (FPGA), ASIC Design flow, ASIC Cell Libraries (Text 1)		
UNIT 2	08	L1-L3
CMOS Logic: Datapath Logic Cells: Datapath Elements, Adders: Carry Skip, Carry Bypass, Carry Save, Carry Select, Conditional Sum. Multiplier (Booth Encoding), Data Path Operators, I/O Cells. [TEXT1] ASIC Library Design: Logical Effort: Predicting Delay, Logical Area and Logical Efficiency, Logical Paths, Multi Stage Cells, Optimum Delay and Number of Stages. (Text 1)		
UNIT 3	08	L1-L3
Low-Level Design Entry: Schematic Entry: Hierarchical Design, Netlist Screener. ASIC Construction: Physical Design, CAD Tools. Partitioning: Goals and Objectives, Constructive Partitioning, Iterative Partitioning Improvement. KL Algorithms. (TEXT1)		
UNIT 4	08	L1-L3
Floor Planning and Placement: Goals and Objectives, Floor Planning Tools, Channel Definition, I/O And Power Planning and Clock Planning. Placement: Goals and Objectives, Min-Cut Placement Algorithm, Iterative Placement Improvement, Physical Design Flow. (TEXT1)		

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UNIT 5	07	L1-L3
Routing: Global Routing: Goals and Objectives, Global Routing Methods, Back-Annotation. Detailed Routing: Goals and Objectives, Measurement of Channel Density, Left-Edge and Area-Routing Algorithms. Special Routing, Circuit Extraction and DRC. (TEXT1)		

TEXT BOOKS:	
1	Michael John Sebastian Smith, "Application - Specific Integrated Circuits" Addison Wesley Professional; 2005.
2	Neil H.E. Weste, David Harris, and Ayan Banerjee, "CMOS VLSI Design: A Circuits and Systems Perspective", Addison Wesley/ Pearson education 3rd edition, 2011

REFERENCE BOOKS:	
1	Vikram Arkalgud Chandrasetty, "VLSI Design: A Practical Guide for FPGA and ASIC Implementations" Springer, ISBN: 978-1-4614-1119-2. 2011

Assessment Details both (CIE and SEE)			
The weightage of Continuous Internal Evaluation (CIE) and Semester End Exam (SEE) is 50% each. The students have to obtain a minimum of 40% marks individually both in CIE and SEE to pass. CIE: The CIE has three components – CIE - theory component, assignment and group activity. Students have to score a minimum of 40% Marks in the total of CIE - theory, assignment and group activity components put together to take SEE. SEE: Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration) and reduced to 50 Marks. **Self-Study Component should be not included for SEE & CIE.			
CONTINUOUS INTERNAL EVALUATION (CIE)		Max. Marks	Minimum Marks to be scored in CIE, to qualify to take SEE (40% individually)
Theory	Weightage of CIE1 and CIE2 Tests or CIE3	50	20
TOTAL		50	20

QUESTION PAPER PATTERN (SEE)										
Q. No.	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
UNIT	1	2	3	4	5	6	7	8	9	10
1. Two full questions (each of 20 Marks) are to be set from each unit.										
2. Student shall answer five full questions selecting one full question from each unit.										

Course Outcomes: After the completion of the course, the student will be able to:	
CO1	Analyze the various stages of the ASIC design flow and evaluate the role of each stage in realizing an optimized integrated circuit.
CO2	Explain and apply ASIC design methodologies, datapath elements, and logical effort concepts for efficient digital circuit design.

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CO3	Analyze the back-end physical design process with emphasis on partitioning and evaluate its impact on design performance and implementation.
CO4	Analyze and evaluate floorplanning and placement techniques in the back-end physical design flow considering area, timing, power, and routability constraints.
CO5	Analyze routing techniques in the back-end physical design flow and evaluate interconnect implementation with respect to timing, congestion, power, and design-rule constraints.

Mapping of CO's, PO's with PSO's														
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	1	3	0	1	0	1	1	1	2	2	1
CO2	3	3	3	1	3	0	2	0	1	1	1	2	2	1
CO3	3	3	3	2	3	0	1	0	1	1	2	2	2	1
CO4	3	3	3	2	3	1	2	1	1	1	2	2	2	1
CO5	3	3	3	2	3	1	2	1	1	1	2	2	2	1

Mapping of CO's with Knowledge and Attitude Profile (WK)										
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0										
CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	
CO1	1	2	3	3	2	3	1	1	2	
CO2	1	3	3	3	2	2	1	1	2	
CO3	0	2	3	3	3	3	1	2	2	
CO4	0	2	3	3	3	3	2	2	3	
CO5	0	2	3	3	3	3	2	2	3	

Mapping of CO's with Sustainable Development Goals (SDG)																	
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0																	
CO/SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1	0	0	0	2	0	0	1	1	3	0	0	1	0	0	0	0	0
CO2	0	0	0	2	0	0	2	1	3	0	0	2	0	0	0	0	0
CO3	0	0	0	1	0	0	1	1	3	0	0	2	0	0	0	0	0
CO4	0	0	0	1	0	0	2	1	3	0	0	3	0	0	0	0	0
CO5	0	0	0	1	0	0	1	1	3	0	0	3	0	0	0	0	0

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Program: Electronics and Communication Engineering

Semester: VII

Course Title	INTELLIGENT SYSTEMS AND MACHINE LEARNING ALGORITHMS						
Course Code	22ECT704B						
Course Category	PEC (Professional Elective Course)						
Teaching - Learning Scheme & Credit	L	T	P	S	Total	Total Teaching Hours	Credit
	3	0	0	0	3	39+0+0+0=39	3
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hrs	

Course Learning Objectives:	
CLO1	Gain a historical perspective of AI and its foundations.
CLO2	Become familiar with basic principles of AI toward Problem-Solving
CLO3	Get to know approaches of inference, perception, knowledge representation, and learning
CLO4	Define Machine Learning and understand the basic theory underlying machine learning.
CLO5	Differentiate supervised, unsupervised, and reinforcement learning

SYLLABUS	No. of Hours	BTLs
UNIT 1	08	L1-L3
Introduction: Acting humanly: The Turing Test approach, Thinking humanly: The cognitive modeling approach, Thinking rationally: The "laws of thought" approach, Acting rationally: The rational agent approach, Foundations and History of AI. Intelligent Agents: Agents and environment, Concept of Rationality, The nature of environment, The structure of agents. Text book 1: Chapter 1- 1.1, 1.2, 1.3 Chapter 2- 2.1, 2.2, 2.3, 2.4		
UNIT 2	08	L1-L3
Problem-solving: Problem-solving agents, Example problems, Searching for Solutions Uninformed Search Strategies: Breadth First search, Depth First Search, Iterative deepening depth first search; Text book 1: Chapter 3- 3.1, 3.2, 3.3, 3.4		
UNIT 3	08	L1-L3
Informed Search Strategies: Heuristic functions, Greedy best first search, A*search. Heuristic Functions Logical Agents: Knowledge-based agents, The Wumpus world, Logic, Propositional logic, Reasoning patterns in Propositional Logic Text book 1: Chapter 4- 4.1, Chapter 7		
UNIT 4	08	L1-L3
Introduction: Machine learning Landscape: About ML, Types of ML, main challenges of ML Concept learning and Learning Problems – Designing Learning systems, Perspectives and Issues – Concept Learning – Find S-Version Spaces and Candidate Elimination Algorithm – Remarks on VS- Inductive bias. Text book 3: Chapter 1, Textbook 4: Chapter 1 and 2		

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UNIT 5	07	L1-L3
End-to-end Machine learning Project: Working with real data, Look at the big picture, Get the data, Discover and visualize the data, Prepare the data, select and train the model, Fine tune your model. Classification: MNIST, training a Binary classifier, performance measure, multiclass classification, error analysis, multi-label classification, multi-output classification Textbook 4: Chapter 2, Chapter 3		

TEXT BOOKS:	
1	Stuart J. Russell and Peter Norvig , Artificial Intelligence, 3rd Edition, Pearson,2015
2	Elaine Rich, Kevin Knight, Artificial Intelligence, 3rd Edition,Tata McGraw Hill,2013.
3	Tom M. Mitchell, Machine Learning, McGraw-Hill Education, 2013
4	Aurelien Geron, Hands-on Machine Learning with Scikit-Learn &Tensor Flow , O'Reilly, Shroff Publishers and Distributors Pvt. Ltd 2019.

REFERENCE BOOKS:	
1	George F Lugar, Artificial Intelligence Structure and strategies for complex, Pearson Education, 5th Edition, 2011
2	Nils J. Nilsson, Principles of Artificial Intelligence, Elsevier, 1980
3	Saroj Kaushik, Artificial Intelligence, Cengage learning, 2014.
4	Ethem Alpaydin, Introduction to Machine Learning, PHI Learning Pvt. Ltd, 2nd Ed., 2013
5	T. Hastie, R. Tibshirani, J. H. Friedman, The Elements of Statistical Learning, Springer, 1st edition, 2001
6	Machine Learning using Python, Manaranjan Pradhan, U Dinesh Kumar, Wiley, 2019
7	Machine Learning, Saikat Dutt, Subramanian Chandramouli, Amit Kumar Das, Pearson,2020

Assessment Details both (CIE and SEE)			
The weightage of Continuous Internal Evaluation (CIE) and Semester End Exam (SEE) is 50% each. The students have to obtain a minimum of 40% marks individually both in CIE and SEE to pass. CIE: The CIE has three components – CIE - theory component, assignment and group activity. Students have to score a minimum of 40% Marks in the total of CIE - theory, assignment and group activity components put together to take SEE. SEE: Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration) and reduced to 50 Marks. **Self-Study Component should be not included for SEE & CIE.			
CONTINUOUS INTERNAL EVALUATION (CIE)		Max. Marks	Minimum Marks to be scored in CIE, to qualify to take SEE (40% individually)
Theory	Weightage of CIE1 and CIE2 Tests or CIE3	50	20
TOTAL		50	20

QUESTION PAPER PATTERN (SEE)										
Q. No.	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
UNIT	1		2		3		4		5	
1. Two full questions (each of 20 Marks) are to be set from each unit.										
2. Student shall answer five full questions selecting one full question from each unit.										

Course Outcomes: After the completion of the course, the student will be able to:	
CO1	Apply intelligent agent architectures, search strategies, and reasoning techniques to solve problems in diverse application domains.
CO2	Analyze and compare various search and inference techniques based on their performance, efficiency, and suitability for different problem domains.
CO3	Develop knowledge representations using propositional logic and first-order logic for representing and reasoning about real-world problems.
CO4	Analyze the fundamental concepts of Machine Learning and Concept Learning and select appropriate learning approaches for given applications.
CO5	Design, implement, and evaluate an ML-based solution using appropriate classification techniques for a real-world problem.

Mapping of CO's, PO's with PSO's														
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	2	3	1	1	1	1	1	0	2	2	1
CO2	3	3	2	3	2	0	0	1	1	1	0	2	2	1
CO3	3	3	2	2	2	1	0	1	1	1	0	2	2	1
CO4	3	3	2	2	3	1	1	2	1	1	0	2	2	1
CO5	3	3	3	3	3	2	2	2	3	3	2	2	2	1

Mapping of CO's with Knowledge and Attitude Profile (WK)										
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0										
CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	
CO1	1	3	3	3	2	2	1	1	2	
CO2	1	3	3	3	2	2	1	3	2	
CO3	1	3	3	3	2	2	1	2	2	
CO4	1	3	3	3	2	2	1	3	2	
CO5	1	3	3	3	3	3	2	3	3	

Mapping of CO's with Sustainable Development Goals (SDG)																	
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0																	
CO/SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1	0	0	0	2	0	0	0	1	3	1	0	1	0	0	0	0	0
CO2	0	0	0	2	0	0	0	1	3	1	0	1	0	0	0	0	0
CO3	0	0	0	2	0	0	0	1	3	1	0	1	0	0	0	0	0
CO4	0	0	0	3	0	0	0	2	3	2	0	1	0	0	0	0	0
CO5	0	0	0	2	0	0	0	3	3	2	0	3	0	0	0	0	0

Semester: VII

Course Title	OPERATIONS RESEARCH						
Course Code	22ECT704C						
Course Category	Professional Elective Course (PEC)						
Teaching - Learning Scheme & Credit	L	T	P	S	Total	Total Teaching Hours	Credit
	3	0	0	0	3	39+0+0+0=40	3
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hrs	

Course Learning Objectives:	
CLO1	Understand the Scope of Operations Research and TP Formulation.
CLO2	Understand the Assignment Problem.
CLO3	Understand the Network Construction.
CLO4	Understand the competitive real-world phenomena using concepts from game theory.
CLO5	Formulate Queuing models for service and manufacturing systems, and apply operations research techniques and algorithms to solve these Queuing problems.

SYLLABUS	No. of Hours	BTLs
UNIT 1	8	L1-L2
Introduction to Operations Research: Basics definition, Scope, Objectives, Phases, Models and Limitations of Operations Research. Transportation Problem: Formulation, Solution, Unbalanced Transportation problem. Finding basic feasible solutions – Northwest corner rule, least cost method and Vogel’s approximation method. Optimality test.		
UNIT 2	8	L1-L3
Assignment model: Formulation. Hungarian method for optimal solution. Solving unbalanced problem. Traveling salesman problem and assignment problem.		
UNIT 3	8	L1-L4
PERT-CPM Techniques: Network construction, determining critical path, floats, scheduling by network, project duration, variance under probabilistic models, prediction of date of completion, crashing of simple networks.		
UNIT 4	8	L1-L4
Game Theory: Formulation of games, two person-Zero sum game, games with and without saddle point, Graphical solution (2x n, m x 2 game).		
UNIT 5	7	L1-L4
Queuing Theory: Queuing system and their characteristics. The M/M/1 Queuing system, Steady state performance analyzing of M/M/ 1 and M/M/C queuing model.		

TEXT BOOKS:	
1	P. Sankara Iyer, “ Operations Research ”, First Edition, Tata McGraw-Hill, 2008

Semester: VII

REFERENCE BOOKS:	
1	A.M. Natarajan, P. Balasubramani, A. Tamilarasi, “ Operations Research ”, First Edition, Pearson Education, 2005
2	P. K. Gupta and D. S. Hira, “ Operations Research ”, Second Edition, S. Chand & co, 2007
3	S D Sharma, “ Operations Research, Problems and Solutions ”, Paperback 1, kedar Nath Publisher, India Ltd, 2012

Assessment Details both (CIE and SEE)			
The weightage of Continuous Internal Evaluation (CIE) and Semester End Exam (SEE) is 50% each. The students have to obtain a minimum of 40% marks individually both in CIE and SEE to pass. CIE: The CIE has three components – CIE - theory component, assignment and group activity. Students have to score a minimum of 40% Marks in the total of CIE - theory, assignment and group activity components put together to take SEE. SEE: Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration) and reduced to 50 Marks. **Self-Study Component should be not included for SEE & CIE.			
CONTINUOUS INTERNAL EVALUATION (CIE)		Max. Marks	Minimum Marks to be scored in CIE, to qualify to take SEE (40% individually)
Theory	Weightage of CIE1 and CIE2 Tests or CIE3	50	20
TOTAL		50	20

QUESTION PAPER PATTERN (SEE)										
Q. No.	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
UNIT	1		2		3		4		5	
1. Two full questions (each of 20 Marks) are to be set from each unit.										
2. Student shall answer five full questions selecting one full question from each unit.										

Course Outcomes: After the completion of the course, the student will be able to:	
CO1	Determine the optimal solution for Transportation problems.
CO2	Ability to interpret and explain the Assignment Problem.
CO3	Formulate and solve problems as networks and graphs.
CO4	Determine the best strategy and value of the given game model.
CO5	Design the Queuing system, Game Theory and their characteristics.

Mapping of CO's, PO's with PSO's														
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0														
CO	P O1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PSO 1	PSO 2	PSO 3
CO1	3	3	2	1	3	1	0	0	1	2	2	3	1	2
CO2	3	3	2	1	3	1	0	0	1	2	2	3	1	2
CO3	3	3	3	2	3	1	0	1	1	2	3	3	2	2
CO4	3	3	2	1	3	1	0	1	1	3	2	3	1	3
CO5	3	3	3	2	3	1	0	1	2	3	3	3	1	3

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Mapping of CO's with Knowledge and Attitude Profile (WK)									
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0									
CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
CO1	1	3	3	2	2	3	1	1	0
CO2	1	3	3	2	2	3	1	1	0
CO3	1	3	3	3	1	3	1	2	0
CO4	1	3	3	3	1	3	1	2	0
CO5	1	3	3	3	2	3	1	2	0

Mapping of CO's with Sustainable Development Goals (SDG)																	
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0																	
CO/SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1	0	0	0	0	0	0	0	3	3	0	3	3	0	0	0	0	0
CO2	0	0	0	0	0	0	0	3	3	0	2	3	0	0	0	0	0
CO3	0	0	0	0	0	0	0	3	3	0	3	2	0	0	0	0	0
CO4	0	0	0	0	0	0	0	3	3	0	1	2	0	0	0	0	0
CO5	0	0	0	0	0	0	0	3	3	0	3	2	0	0	0	0	0

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Semester: VII

Course Title	ANALOG AND MIXED MODE VLSI CIRCUITS						
Course Code	22ECT704D						
Course Category	PEC (Professional Elective Course)						
Teaching - Learning Scheme & Credit	L	T	P	S	Total	Total Teaching Hours	Credit
	3	0	0	0	3	39+0+0+0=39	3
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hrs	

Course Learning Objectives:	
CLO1	Understand the concept of Analog Design
CLO2	Analysis of Single stage amplifiers in VLSI perspective
CLO3	Analysis of Single stage amplifiers in common gate amplifier
CLO4	Analysis of Current sources and sinks in VLSI perspective.
CLO5	Design and Mismatch Error Analysis of DAC and ADC Architectures.

SYLLABUS	No. of Hours	BTLs
UNIT 1	08	L1-L3
Basic MOS Device Physics: General considerations: MOSFET as a Switch, MOSFET Structure, MOS symbols, MOS I/V Characteristics: Threshold Voltage, Derivation of I/V Characteristics, Second Order Effects, MOS Device Models: MOS Device Layout, capacitances, MOS Small-signal Model (Text 1)		
UNIT 2	08	L1-L3
Single Stage Amplifiers: Basic Concepts, Common source stage, Common Source stage with resistive load, Common Source stage with Diode connected load, Common Source Stage with Current Source load, Common Source stage with Triode load, Common Source stage with source degeneration. (Text 1)		
UNIT 3	08	L1-L3
Single stage Amplifier: Common-gate stage, Cascode Stage, choice of device models.		
UNIT 4	08	L1-L3
Current Sources and Sinks: The current mirror, The Cascade Connection, Sensitivity Analysis, Transient response, other current sources & sinks. (Text 1, 2)		
UNIT 5	07	L1-L3
Data Converter Architectures: DAC architecture, Digital input code, Resistors string, R-2R ladder networks, Charge scaling DACs, Cyclic DAC, and Pipeline DAC. ADC Architecture: Flash, 2-step flash ADC, Pipeline ADC, Integrating ADC, Successive Approximation ADC. (Text 2).		

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TEXTBOOKS:	
1	Behzad Razavi, "Design of Analog CMOS Integrated Circuits", Twenty Fifth Reprint, TATA McGraw Hill, 2013.
2	Adel Sedra and K C Smith, "Microelectronics Circuits", Fifth edition, Oxford University Press, 2009.

REFERENCE BOOKS:	
1	Philip E Allen and Douglas R Holberg, "CMOS Analog Circuit Design", Second edition, Oxford University Press, 2004
e-LEARNING RESOURCES:	
1	http://nptel.ac.in

Assessment Details both (CIE and SEE)			
The weightage of Continuous Internal Evaluation (CIE) and Semester End Exam (SEE) is 50% each. The students have to obtain a minimum of 40% marks individually both in CIE and SEE to pass. CIE: The CIE has three components – CIE - theory component, assignment and group activity. Students have to score a minimum of 40% Marks in the total of CIE - theory, assignment and group activity components put together to take SEE. SEE: Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration) and reduced to 50 Marks. **Self-Study Component should be not included for SEE & CIE.			
CONTINUOUS INTERNAL EVALUATION (CIE)		Max. Marks	Minimum Marks to be scored in CIE, to qualify to take SEE (40% individually)
Theory	Weightage of CIE1 and CIE2 Tests or CIE3	50	20
TOTAL		50	20

QUESTION PAPER PATTERN (SEE)										
Q. No.	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
UNIT	1	2	3	4	5	6	7	8	9	10
1. Two full questions (each of 20 Marks) are to be set from each unit.										
2. Student shall answer five full questions selecting one full question from each unit.										

Course Outcomes: After the completion of the course, the student will be able to:	
CO1	Draw the basic gates using the stick and layout diagrams with the knowledge of physical design aspects
CO2	Analyze and Design of Single Stage Amplifiers of common source amplifier
CO3	Analyze and Design of Single Stage Amplifiers of common gate amplifier
CO4	Analyze and Design of Current sources and sinks
CO5	Analysis of ADC, DAC Architectures and Mismatch errors.

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Mapping of CO's, PO's with PSO's														
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	2	3	0	0	0	1	0	0	3	2	1
CO2	3	3	3	2	3	0	0	0	1	0	0	3	2	1
CO3	3	3	3	2	3	0	0	0	1	0	0	3	2	1
CO4	3	3	3	2	3	0	0	0	1	0	0	3	2	1
CO5	3	3	3	3	3	0	0	0	1	1	0	3	2	1

Mapping of CO's with Knowledge and Attitude Profile (WK)										
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0										
CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	
CO1	2	2	3	3	1	1	0	0	2	
CO2	2	2	3	3	2	1	0	0	2	
CO3	2	1	3	3	1	1	0	0	2	
CO4	1	2	2	3	3	2	1	1	1	
CO5	1	1	2	3	3	2	1	1	1	

Mapping of CO's with Sustainable Development Goals (SDG)																	
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0																	
CO/SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1	0	0	0	3	0	0	1	0	2	0	0	0	0	0	0	0	0
CO2	0	0	0	3	0	0	1	1	2	0	0	0	0	0	0	0	0
CO3	0	0	0	3	0	0	2	0	2	0	0	0	0	0	0	0	0
CO4	0	0	0	3	0	0	2	0	3	0	0	1	0	0	0	0	0
CO5	0	0	0	3	0	0	2	1	3	0	0	1	0	0	0	0	0

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Semester: VII

Course Title	CYBER SECURITY						
Course Code	22ECT704E						
Course Category	PCC (Professional Core Course)						
Teaching - Learning Scheme & Credits	L	T	P	S	Total	Total Teaching Hours	Credits
	3	0	0	0	3	39+0+0+0=39	3
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hrs	

Course Learning Objectives:	
CLO1	Familiarize various types of cyber-attacks and cyber-crimes
CLO2	Give an overview of the cyber laws
CLO3	Study the defensive techniques against these attacks
CLO4	Study cyber security challenges and implications.

SYLLABUS	No. of Hours	BTLs
UNIT 1	8	L1-L4
Introduction to Cyber Security: Basic Cyber Security Concepts, layers of security, Vulnerability, threat, Harmful acts, Internet Governance – Challenges and Constraints, Computer Criminals, CIA Triad, Assets and Threat, motive of attackers, active attacks, passive attacks, Software attacks, hardware attacks, Spectrum of attacks, Taxonomy of various attacks, IP spoofing, Methods of defence, Security Models, risk management, Cyber Threats- Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage, etc., Comprehensive Cyber Security Policy.		
UNIT 2	8	L1-L4
Cyberspace and the Law & Cyber Forensics: Introduction, Cyber Security Regulations, Roles of International Law. The INDIAN Cyberspace, National Cyber Security Policy. Introduction, Historical background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber Forensics and Digital evidence, Forensics Analysis of Email, Digital Forensics Lifecycle, Forensics Investigation, Challenges in Computer Forensics, Special Techniques for Forensics Auditing.		
UNIT 3	8	L1-L4
Cybercrime: Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.		
UNIT 4	8	L1-L5
Cyber Security: Organizational Implications: Introduction, cost of cybercrimes and IPR issues, web threats for organizations, security and privacy implications, social media marketing: security risks and perils for organizations, social computing and the associated challenges for organizations. Cybercrime and Cyber terrorism: Introduction, intellectual property in the cyberspace, the ethical dimension of cybercrimes the psychology, mindset and skills of hackers and other cybercriminals.		

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Course Outcomes: After the completion of the course, the student will be able to:	
CO1	Understand the fundamental concepts of cybersecurity, including vulnerabilities, threats, assets, attacks, CIA Triad, security models, risk management, and methods of defense.
CO2	Identify and classify different types of cyber attacks, cybercrimes, cyber threats, software and hardware attacks, active and passive attacks, and attack techniques such as IP spoofing.
CO3	Understand cybersecurity laws, regulations, Internet governance, the Indian cyberspace framework, and the role of national and international laws in protecting digital environments.
CO4	Apply basic principles of cyber forensics, digital evidence collection, forensic analysis, email forensics, and the digital forensics lifecycle in cybercrime investigations.
CO5	Analyse security challenges associated with mobile and wireless devices, laptops, authentication services, organizational networks, social media, and cloud/digital environments.

Mapping of CO's, PO's with PSO's														
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	2	2	1	0	2	1	1	0	2	1	2
CO2	3	3	2	3	3	1	0	2	1	1	0	3	2	2
CO3	3	3	3	3	3	1	0	2	1	1	1	3	2	2
CO4	3	3	3	3	3	2	1	3	2	2	1	3	3	3
CO5	2	2	1	2	1	3	1	3	2	2	1	1	1	3

Mapping of CO's with Knowledge and Attitude Profile (WK)										
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0										
CO/SDG's	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	
CO1	1	2	1	3	0	2	2	1	2	
CO2	0	2	1	3	0	3	2	2	2	
CO3	0	2	1	3	0	3	2	2	2	
CO4	0	2	1	3	0	3	3	3	3	
CO5	1	1	0	2	0	2	3	2	3	

Mapping of CO's with Sustainable Development Goals (SDG)																	
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0																	
CO	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1	0	0	0	2	0	0	0	1	2	0	0	0	0	0	0	3	1
CO2	0	0	0	2	0	0	0	2	3	1	0	0	0	0	0	3	1
CO3	0	0	0	2	0	0	0	2	3	1	1	0	0	0	0	3	2
CO4	0	0	0	2	0	0	0	3	3	2	2	0	0	0	0	3	2
CO5	0	0	0	2	0	0	0	2	2	2	1	0	0	0	0	3	2

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Semester: VII

Course Title	RF IC DESIGN						
Course Code	22ECT704F						
Course Category	PEC (Professional Elective Course)						
Teaching - Learning Scheme & Credit	L	T	P	S	Total	Total Teaching Hours	Credit
	3	0	0	0	3	39+0+0+0=39	3
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hrs	

Course Learning Objectives:	
CLO1	Understand passive components at RF frequencies and required circuit theory
CLO2	Design high frequency amplifiers and low noise amplifiers
CLO3	Carryout comparison different types of mixers
CLO4	Perform analysis of oscillators and synthesizers at RF frequencies

SYLLABUS	No. of Hours	BTLs
UNIT 1	08	L1-L3
Characteristics of passive IC components at RF frequencies: Interconnects, resistors, capacitors, inductors and transformers – Transmission lines Classical two-port noise theory, noise models for active and passive components, Noise figure, Nonlinearity, cascaded stages, Sensitivity and dynamic range		
UNIT 2	08	L1-L3
High frequency amplifier design – zeros as bandwidth enhancers, shunt-series amplifier, f_T doublers, Low noise amplifier design – LNA topologies, impedance matching, power constrained noise optimization, linearity and large signal performance		
UNIT 3	08	L1-L3
Mixers – fundamentals of mixers, multiplier-based mixers, sub sampling mixers, diode-ring mixers.		
UNIT 4	08	L1-L3
Oscillators – Feedback View of Oscillators, Colpitts oscillator, Hartley oscillator, describing functions, tuned oscillators, negative resistance oscillators.		
UNIT 5	07	L1-L3
Synthesizers: Basic Integer-N Synthesizer, synthesis with static moduli, combination synthesizers, phases noise considerations.		

TEXT BOOKS:	
1	Thomas H. Lee, Cambridge, The Design of CMOS Radio-Frequency Integrated Circuits, UK: Cambridge University Press, 2004
2	Phillip E. Allen and Douglas R. Holberg- CMOS Analog Circuit Design Oxford University Press -3rd Ed., -20

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REFERENCE BOOKS:	
1	Behzad Razavi, RF Microelectronics, Prentice Hall, 1998.
2	Ludwig, RF Circuit Design, 2nd Ed., Pearson

Assessment Details both (CIE and SEE)			
The weightage of Continuous Internal Evaluation (CIE) and Semester End Exam (SEE) is 50% each. The students have to obtain a minimum of 40% marks individually both in CIE and SEE to pass. CIE: The CIE has three components – CIE - theory component, assignment and group activity. Students have to score a minimum of 40% Marks in the total of CIE - theory, assignment and group activity components put together to take SEE. SEE: Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration) and reduced to 50 Marks. **Self-Study Component should be not included for SEE & CIE.			
CONTINUOUS INTERNAL EVALUATION (CIE)		Max. Marks	Minimum Marks to be scored in CIE, to qualify to take SEE (40% individually)
Theory	Weightage of CIE1 and CIE2 Tests or CIE3	50	20
TOTAL		50	20

QUESTION PAPER PATTERN (SEE)										
Q. No.	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
UNIT	1	2	3	4	5	6	7	8	9	10
1. Two full questions (each of 20 Marks) are to be set from each unit.										
2. Student shall answer five full questions selecting one full question from each unit.										

Course Outcomes: After the completion of the course, the student will be able to:	
CO1	Analyze the high-frequency characteristics of passive IC components, transmission lines, noise, nonlinearity, sensitivity, and dynamic range in RF circuits.
CO2	Design and evaluate high-frequency amplifiers and low-noise amplifiers considering bandwidth, impedance matching, noise, linearity, and large-signal performance.
CO3	Analyze and compare different mixer architectures and evaluate their performance for RF frequency-conversion applications.
CO4	Analyze and design RF oscillators using feedback, tuned-circuit, and negative-resistance techniques for specified frequency and performance requirements.
CO5	Analyze and evaluate frequency synthesizer architectures with emphasis on frequency generation, phase-noise performance, and implementation constraints.

Mapping of CO's, PO's with PSO's														
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	3	3	0	1	1	0	1	0	2	2	1
CO2	3	3	3	3	3	1	1	1	1	1	1	2	2	1
CO3	3	3	3	2	3	1	1	1	1	1	1	2	2	1
CO4	3	3	3	3	3	1	1	1	1	1	1	2	2	1
CO5	3	3	3	3	3	1	2	1	1	1	2	2	2	1

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Mapping of CO's with Knowledge and Attitude Profile (WK)									
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0									
CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
CO1	2	3	3	3	2	3	1	2	2
CO2	2	3	3	3	3	3	1	3	2
CO3	2	3	3	3	3	3	1	2	2
CO4	2	3	3	3	3	3	1	3	2
CO5	2	3	3	3	3	3	2	3	3

Mapping of CO's with Sustainable Development Goals (SDG)																	
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0																	
CO/SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1	0	0	0	2	0	0	1	1	3	0	0	1	0	0	0	0	0
CO2	0	0	0	2	0	0	2	2	3	0	0	2	0	0	0	0	0
CO3	0	0	0	2	0	0	2	2	3	0	0	1	0	0	0	0	0
CO4	0	0	0	2	0	0	2	2	3	0	0	1	0	0	0	0	0
CO5	0	0	0	2	0	0	2	2	3	0	0	2	0	0	0	0	0

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Semester: VII

Course Title	E-WASTE MANAGEMENT						
Course Code	22ECT705A						
Course Category	OEC (Open Elective Course)						
Teaching - Learning Scheme & Credit	L	T	P	S	Total	Total Teaching Hours	Credit
	3	0	0	0	3	39+0+0+0=39	3
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hrs	

Course Learning Objectives:	
CLO1	Understanding e-waste: To learn about e-waste, its different types, and how it's generated
CLO2	E-waste rules and directives: To understand the rules and directives for e-waste in different countries
CLO3	E-waste management: To learn how to manage e-waste throughout its life cycle
CLO4	Environmental and health impacts: To understand the environmental and health impacts of e-waste

SYLLABUS	No. of Hours	BTLs
UNIT 1	08	L1-L3
Introduction: Preamble, What is e-waste, E-waste Sources and generation, Growth of Electrical and Electronics Industry in India, Global Context of e-waste Management, Indian Scenario on e-waste Management, E-WASTE: E-waste Definition, Classification of e-waste, Characterization of e-waste Text 1: Chapter 1 & 2		
UNIT 2	08	L1-L3
Regulatory Framework: Global e-waste Regulations, Waste Electronics and Electrical Equipment (WEEE Directive 82), International norms – Basel Convention, Evolution of e-waste regulations in India, E-waste Management Rules 2016 (amendments to 2011 Rules), Regulatory Compliance Mechanisms, E-waste Management Guidelines (Text 1: 3.1 to 3.7)		
UNIT 3	08	L1-L3
Extended Producer Responsibility (EPR): E-waste – A post Consumer Waste, E-waste value Chain, E-waste Collection Systems, Extended Producer Responsibility (EPR), Collective Responsibility, Producer Responsible Organization (PRO) (Text 2: 4.1 to 4.6)		
UNIT 4	08	L1-L3
E-Waste Handling: Characterization & Classification, Packaging and Labelling, Transportation, Storage, Safety in Handling – Precautionary Principles: Text 1- Chapter 5		
UNIT 5	07	L1-L3
Restrictions on Use of Hazardous Substances (ROHS): Hazardous substances in e-waste, Global ROHS compliances (ROHS Directive 84), ROHS compliance requirements in India: Text 1: Chapter 6		

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Semester: VII

E-Waste Recycling: E-waste Recycling Operations, Dismantling & Segregation, Recycling & Recovery, Recycling Technologies – Text 1: Chapter 7 (7.1 to 7.4)

TEXT BOOKS:

1	Lakshmi Raghupathy, Introduction to E-Waste Management, TERI Press, New Delhi.
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REFERENCE BOOKS:

1	Johri R., E-waste: implications, regulations, and management in India and current global best practices, TERI Press, New Delhi
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Assessment Details both (CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) and Semester End Exam (SEE) is 50% each. The students have to obtain a minimum of 40% marks individually both in CIE and SEE to pass.

CIE: The CIE has three components – CIE - theory component, assignment and group activity. Students have to score a minimum of 40% Marks in the total of CIE - theory, assignment and group activity components put together to take SEE.

SEE: Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration) and reduced to 50 Marks.

****Self-Study Component should be not included for SEE & CIE.**

CONTINUOUS INTERNAL EVALUATION (CIE)		Max. Marks	Minimum Marks to be scored in CIE, to qualify to take SEE (40% individually)
Theory	Weightage of CIE1 and CIE2 Tests or CIE3	50	20
TOTAL		50	20

QUESTION PAPER PATTERN (SEE)

Q. No.	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
UNIT	1	2	3	4	5	6	7	8	9	10

1. Two full questions (each of 20 Marks) are to be set from each unit.

2. Student shall answer five full questions selecting one full question from each unit.

Course Outcomes: After the completion of the course, the student will be able to:

CO1	Explain and analyze the sources, classification, characteristics, generation trends, and environmental impacts of e-waste in Indian and global contexts.
CO2	Analyze and interpret national and international regulatory frameworks, including WEEE, Basel Convention, E-Waste Management Rules, and regulatory compliance mechanisms.
CO3	Analyze and evaluate e-waste value chains, collection systems, Extended Producer Responsibility (EPR), collective responsibility, and Producer Responsibility Organizations (PROs).
CO4	Apply and evaluate appropriate e-waste handling practices, including characterization, packaging, labelling, transportation, storage, and safety precautions.

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CO5	Analyze and evaluate RoHS requirements and e-waste recycling processes, including dismantling, segregation, recovery, and recycling technologies, for sustainable resource management.
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Mapping of CO's, PO's with PSO's														
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	3	1	3	3	2	1	2	1	2	2	1
CO2	2	3	2	3	1	3	3	3	1	3	3	2	2	1
CO3	3	3	3	3	2	3	3	3	2	3	3	2	2	1
CO4	3	3	3	3	3	3	3	3	2	3	2	2	2	1
CO5	3	3	3	3	3	3	3	3	2	2	3	2	2	1

Mapping of CO's with Knowledge and Attitude Profile (WK)									
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0									
CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
CO1	3	1	2	3	1	2	3	3	2
CO2	2	1	2	3	1	3	3	3	3
CO3	2	1	3	3	3	3	3	3	3
CO4	3	1	3	3	3	3	3	3	3
CO5	3	1	3	3	3	3	3	3	3

Mapping of CO's with Sustainable Development Goals (SDG)																	
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0																	
CO/SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1	0	0	3	0	0	3	0	2	0	0	3	3	3	0	0	0	0
CO2	0	0	2	0	0	2	0	3	0	0	3	3	2	0	0	0	0
CO3	0	0	2	0	0	2	0	3	0	0	3	3	3	0	0	0	0
CO4	0	0	3	0	0	3	0	3	0	0	3	3	2	0	0	0	0
CO5	0	0	2	0	0	3	0	3	0	0	3	3	3	0	0	0	0

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Semester: VII

Course Title	AUTOMOTIVE ELECTRONICS						
Course Code	22ECT705B						
Course Category	OEC (Open Elective Course)						
Teaching - Learning Scheme & Credit	L	T	P	S	Total	Total Teaching Hours	Credit
	3	0	0	0	3	39+0+0+0=39	3
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hrs	

Course Learning Objectives:	
CLO1	Understand the basics of automobile dynamics and design electronics to complement those features
CLO2	Design and implement the electronics that attribute the reliability, safety, and smartness to automobile, providing add – on comforts

SYLLABUS	No. of Hours	BTLs
UNIT 1	08	L1-L3
Automotive Fundamentals Overview – Evolution of Automotive Electronics, Automobile Physical Configuration, Survey of Major Automotive systems, The Engine- Engine Block, Cylinder Head, four stroke Cycle, Engine Control, Ignition System- Spark plug, High voltage circuit and distribution, spark pulse generation, ignition timing, diesel engine, Drive Train – Transmission, drive shaft, differential, suspension, brakes, steering system, starter battery operating principle. (Text1: Chapter1, Text 2: Pg. 407-410) The Basics of Electronic Engine Control - Motivation for Electronic Engine, control – exhaust emissions, fuel economy, concept of an electronic engine, control system, definition of general terms, definition of engine performance terms, engine mapping, effect of air/fuel ration, spark timing and EGR on performance, control strategy, electronic fuel control system, analysis of intake manifold pressure, electronic ignition. (Text1: Chapter 5)		
UNIT 2	08	L1-L3
Automotive Sensors – Automotive control system applications of sensors and Actuators – Variables to be measured, airflow rate sensor, strain gauge MAP sensor, Hall Effect position sensor, Magnetic Reluctance Crankshaft position sensor, Throttle angle sensor, Engine coolant Temperature (ECT) Sensor, Exhaust Gas Oxygen (O₂ /EGO) Lambda sensors, piezoelectric Knock sensor (Text 1: Chapter 6) Automotive Engine Control Actuators – Solenoid, Fuel Injector, EGR actuator, Ignition system (Text 1: Chapter 6)		
UNIT 3	08	L1-L3
Digital Engine Control System- Digital Engine control features, Control modes for fuel control (Seven Modes), EGR Control, Electronic Ignition control- closed loop ignition timing, spark advance correction scheme, Integrated engine control system- secondary air management, Evaporative Emissions, Canister Purge, automatic system adjustment, system diagnostics (Text 1: Chapter 7)		

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Control Units – Operating conditions, Design, Data Processing, Programming, Digital modules in the Control Unit, Control Unit Software (Text 2: Pg. 196-207)		
UNIT 4	08	L1-L3
Automotive Networking – Bus Stem- classification, Applications in the Vehicle, Coupling of networks, Examples of Networked Vehicles (Text 2: Pg. 85-91), Buses – CAN Bus, LIN Bus, MOST Bus, Bluetooth, Flex Ray, Diagnostic Interfaces (Text 2: Pg. 92-151) Vehicle Motion Control – Typical Cruise control system, Digital Cruise Control System, Digital Speed Sensor, Throttle Actuator, Cruise Control Configuration		
UNIT 5	07	L1-L3
Automotive Diagnostics – Timing Light, Engine Analyzer, On-Board diagnostics, Off-Board diagnostics, Expert Systems, Occupant Protection Systems – Accelerometer based Air Bag Systems (Text1: Chapter10) Future Automotive Electronic Systems – Alternative Fuel Engines, Electric and Hybrid Vehicles, Fuel Cell Power Cars, Collision Avoidance Radar Warning Systems, Low tire pressure warning systems, Head Up Display, Speech Synthesis, Navigation- Navigation Sensors – Radio Navigation, Signpost Navigation, Dead reckoning navigation, Voice Recognition Cell phone Dialing, Advanced Cruise Control, Stability Augmentation, Automatic Driving Control (Text 1: Chapter 11)		

TEXT BOOKS:

1	William B Ribbens, “Understanding Automotive Electronics”, 6th Edition, Elsevier Publishing.
2	Robert Bosch GmbH (Ed.), “Bosch Automotive Electrics and Automotive Electronics Systems and

Assessment Details both (CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) and Semester End Exam (SEE) is 50% each. The students have to obtain a minimum of 40% marks individually both in CIE and SEE to pass. CIE: The CIE has three components – CIE - theory component, assignment and group activity. Students have to score a minimum of 40% Marks in the total of CIE - theory, assignment and group activity components put together to take SEE. SEE: Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration) and reduced to 50 Marks. **Self-Study Component should be not included for SEE & CIE.			
CONTINUOUS INTERNAL EVALUATION (CIE)		Max. Marks	Minimum Marks to be scored in CIE, to qualify to take SEE (40% individually)
Theory	Weightage of CIE1 and CIE2 Tests or CIE3	50	20
TOTAL		50	20

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QUESTION PAPER PATTERN (SEE)										
Q. No.	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
UNIT	1		2		3		4		5	
1. Two full questions (each of 20 Marks) are to be set from each unit.										
2. Student shall answer five full questions selecting one full question from each unit.										

Course Outcomes: After the completion of the course, the student will be able to:	
CO1	Explain and analyze the fundamentals of automobile configuration, major automotive systems, engine operation, ignition, drivetrain, and electronic engine control.
CO2	Analyze and select appropriate automotive sensors and actuators for measuring and controlling critical vehicle operating parameters.
CO3	Analyze and evaluate digital engine control systems, control strategies, electronic control units, software, and vehicle emission-control mechanisms.
CO4	Analyze and evaluate automotive communication networks, in-vehicle buses, diagnostic interfaces, and vehicle motion-control systems.
CO5	Evaluate and apply automotive diagnostic techniques and emerging electronic technologies for electric/hybrid vehicles, safety, navigation, driver assistance, and autonomous driving applications.

Mapping of CO's, PO's with PSO's														
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	2	3	2	2	1	1	1	1	2	2	1
CO2	3	3	3	3	3	2	2	1	1	1	1	2	2	1
CO3	3	3	3	3	3	2	2	2	1	2	2	2	2	1
CO4	3	3	3	3	3	2	2	2	2	2	2	2	2	1
CO5	3	3	3	3	3	3	3	2	2	3	2	2	2	1

Mapping of CO's with Knowledge and Attitude Profile (WK)										
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0										
CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	
CO1	3	2	3	3	2	3	2	1	2	
CO2	3	3	3	3	3	3	2	2	3	
CO3	2	3	3	3	3	3	2	3	3	
CO4	2	3	3	3	3	3	2	3	3	
CO5	3	3	3	3	3	3	3	3	3	

Mapping of CO's with Sustainable Development Goals (SDG)																	
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0																	
CO/SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1	0	0	2	0	0	0	2	2	3	0	2	2	2	0	0	0	0
CO2	0	0	3	0	0	0	2	2	3	0	2	2	2	0	0	0	0
CO3	0	0	3	0	0	0	3	2	3	0	3	3	3	0	0	0	0
CO4	0	0	3	0	0	0	2	2	3	0	3	2	2	0	0	0	0
CO5	0	0	3	0	0	0	3	3	3	0	3	3	3	0	0	0	0

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Course Title	BASIC VLSI DESIGN						
Course Code	22ECT705C						
Course Category	OEC (Open Elective Course)						
Teaching - Learning Scheme & Credit	L	T	P	S	Total	Total Teaching Hours	Credit
	3	0	0	0	3	39+0+0+0=39	3
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hrs	

Course Learning Objectives:	
CLO1	Impart knowledge of MOS transistor theory and CMOS technologies
CLO2	Learn the operation principles and analysis of inverter circuits, Understand basic circuit concepts and scaling of MOS circuits.
CLO3	Representation of different forms of diagrams like layout & stick diagram.
CLO4	Different CMOS logic structures
CLO5	Analyze adder & multiplier circuits, Design Combinational

SYLLABUS	No. of Hours	BTLs
UNIT 1	08	L1-L3
MOS Transistor: Enhancement and Depletion mode MOS transistors, Basic DC equations, second order effects: Threshold Voltage-Body Effect, Subthreshold region, channel length modulation, Mobility variation, Fowler Northeim Tunnelling, Drain Punch Through, Impact Ionization. DC Transfer Characteristics: Static CMOS Inverter DC Characteristics, Beta Ratio Effect. Noise margin.		
UNIT 2	08	L1-L3
Basic Circuit Concepts: Sheet resistance, Area capacitances, Capacitance calculations, The delay unit, Inverter delays. Scaling of MOS Circuits: Scaling models and scaling factors, Scaling factors for device parameters, Limitations of scaling. TEXT 1		
UNIT 3	08	L1-L3
CMOS Logic Structures: CMOS Complementary Logic, Pseudo-nMOS Logic, Dynamic CMOS Logic, Clocked CMOS Logic, Pass Transistor Logic, CMOS Domino Logic, BiCMOS logic, Cascaded Voltage Switch Logic (CVSL).		
UNIT 4	08	L1-L3
Data Path Subsystems I: Introduction, addition/subtraction, single bit addition, carry propagate addition, carry ripple adder, carry generation & propagation, Manchester carry chain adder, carry skip Adder, carry look ahead adder, carry select, conditional sum adders, adder variants.		
UNIT 5	07	L1-L3
Data Path Subsystems II: Multiplication, unsigned array multiplication, 2's complement array multiplication, Booth encoding, Wallace tree multiplication		

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TEXT BOOKS:	
1	Douglas A. Pucknell& Kamran Eshraghian, “Basic VLSI Design”, Third Edition, PHI, 2005
2	Neil H. E. Weste, K. Eshragian, “Principles of CMOS VLSI Design - A Systems Perspective”, Second edition, Pearson Education (Asia) Pvt. Ltd, year.
3	Neil H.E Weste, David Harris, Ayan Banerjee, “CMOS VLSI design- A circuits and systems perspective”, Third edition Pearson Education (Asia) Pvt. Ltd, 2006.

REFERENCE BOOKS:	
1	R. Jacob Baker, “CMOS Circuit Design, Layout and Simulation”, edition, John Wiley India Pvt. Ltd,
2	2 Sung- Mo Kang & Yusuf Leblebici, “CMOS Digital Integrated Circuits: Analysis and Design”, Third edition, Tata McGraw-Hill Publishing Company Ltd, 2007

Assessment Details both (CIE and SEE)			
The weightage of Continuous Internal Evaluation (CIE) and Semester End Exam (SEE) is 50% each. The students have to obtain a minimum of 40% marks individually both in CIE and SEE to pass. CIE: The CIE has three components – CIE - theory component, assignment and group activity. Students have to score a minimum of 40% Marks in the total of CIE - theory, assignment and group activity components put together to take SEE. SEE: Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration) and reduced to 50 Marks. **Self-Study Component should be not included for SEE & CIE.			
CONTINUOUS INTERNAL EVALUATION (CIE)		Max. Marks	Minimum Marks to be scored in CIE, to qualify to take SEE (40% individually)
Theory	Weightage of CIE1 and CIE2 Tests or CIE3	50	20
TOTAL		50	20

QUESTION PAPER PATTERN (SEE)										
Q. No.	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
UNIT	1	2	3	4	5					
1. Two full questions (each of 20 Marks) are to be set from each unit.										
2. Student shall answer five full questions selecting one full question from each unit.										

Course Outcomes: After the completion of the course, the student will be able to:	
CO1	Explain and analyze the fundamentals of VLSI technology, fabrication processes, and CMOS device structures.
CO2	Analyze the VLSI circuit design process and MOS transistor characteristics for CMOS circuit implementation.

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CO3	Analyze and evaluate the electrical and performance parameters of MOS-based VLSI components and circuits.
CO4	Analyze and compare different CMOS logic structures based on speed, power, area, and implementation requirements.
CO5	Design and evaluate arithmetic circuits using MOS transistors and CMOS logic structures considering area, power, and performance constraints.

Mapping of CO's, PO's with PSO's														
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	2	2	1	1	1	0	1	1	2	2	1
CO2	3	3	2	3	3	1	1	1	0	1	1	2	2	1
CO3	3	3	3	3	3	1	1	1	1	1	1	2	2	1
CO4	3	3	3	3	3	1	1	1	1	1	1	2	2	1
CO5	3	3	3	3	3	1	1	1	1	2	3	2	2	1

Mapping of CO's with Knowledge and Attitude Profile (WK)										
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0										
CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	
CO1	2	2	3	3	1	2	1	1	2	
CO2	2	3	3	3	2	3	1	2	3	
CO3	2	3	3	3	3	3	1	3	3	
CO4	1	3	3	3	3	3	1	2	3	
CO5	1	3	3	3	3	3	1	3	3	

Mapping of CO's with Sustainable Development Goals (SDG)																	
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0																	
CO/SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1	0	0	0	3	0	0	1	2	3	0	0	1	1	0	0	0	0
CO2	0	0	0	3	0	0	2	3	3	0	0	2	1	0	0	0	0
CO3	0	0	0	3	0	0	3	3	3	0	0	3	2	0	0	0	0
CO4	0	0	0	3	0	0	3	3	3	0	0	3	2	0	0	0	0
CO5	0	0	0	3	0	0	3	3	3	0	0	3	3	0	0	0	0

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Semester: VII

Course Title	EMBEDDED SYSTEMS APPLICATIONS						
Course Code	22ECT705D						
Course Category	PCC (Professional Core Course)						
Teaching - Learning Scheme & Credit	L	T	P	S	Total	Total Teaching Hours	Credit
	3	0	0	0	3	39+0+0+0=39	3
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hrs	

Course Learning Objectives:	
CLO1	Understand the fundamental concepts, characteristics, and applications of embedded systems across various domains.
CLO2	Analyse the hardware components of embedded systems, including microcontrollers, memory, and low-power design techniques.
CLO3	E Explore the role of sensors, ADCs, and actuators in embedded systems, and their interfacing with digital systems.
CLO4	Apply embedded systems design principles in real-world applications such as mobile phones, automotive electronics, RFID, and biomedical systems.
CLO5	Understand the embedded systems design and development process.

SYLLABUS	No. of Hours	BTLs
UNIT 1	8	L1-L2
Introduction to embedded systems: Application domain of embedded systems, desirable features and general characteristics of embedded systems, model of an embedded system, microprocessor Vs microcontroller, example of a simple embedded system, figure of merit for an embedded system, classification of MCUs: 4/8/16/32 bits, current trends.		
UNIT 2	8	L1-L4
Embedded systems-The hardware point of view: Microcontroller unit (MCU), The Processor, The Harvard Architecture, A popular 8-bit MCU: General Purpose I/O (GPIO), Clock; Memory for embedded systems: Random Access Memory (RAM), Static RAM (SRAM), Dynamic RAM (DRAM). ROM (Read Only Memory) types, Caches.		
UNIT 3	8	L1-L4
Sensors, ADCs and Actuators Sensors: Temperature Sensor, Light Sensor, Proximity/range Sensor; Analog to digital converters: ADC Interfacing, Control Interface, Data Interface; Actuators: Displays, Light Emitting Diodes (LED), Seven Segment LED; Motors: Stepper Motors, DC Motors.		
UNIT 4	8	L1-L4
Examples of embedded systems: Mobile phone: Block Diagram, Automotive electronics: Anti-lock Braking System (ABS), Airbag Deployment, Automotive Navigation Systems, Radio Frequency Identification (RFID), Wireless Sensor Networks (WISENET), Robotics, Biomedical applications, Brain machine interface: Block Diagram.		

QUESTION PAPER PATTERN (SEE)										
Q. No.	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
UNIT	1		2		3		4		5	
1. Two full questions (each of 20 Marks) are to be set from each unit.										
2. Student shall answer five full questions selecting one full question from each unit.										

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Course Outcomes: After the completion of the course, the student will be able to:	
CO1	Understand the fundamental concepts and characteristics of embedded systems, including their classification and modern trends
CO2	Analyse the architecture and hardware components of MCUs and their role in embedded systems.
CO3	Apply knowledge of sensors, ADCs, and actuators for interfacing and control in embedded systems.
CO4	Evaluate real-world embedded system applications such as mobile phones, automotive electronics, RFID, and robotics.
CO5	Understanding of the embedded design process, from concept to bulk manufacturing, including testing and product design.

Mapping of CO's, PO's with PSO's														
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0														
CO	P O1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PSO 1	PSO 2	PSO 3
CO1	3	2	0	0	0	0	0	0	0	0	0	1	3	2
CO2	3	3	2	0	2	0	0	0	0	0	0	1	3	3
CO3	2	2	3	1	3	0	0	0	0	0	0	1	3	3
CO4	2	3	2	2	2	1	0	0	0	0	0	1	3	2
CO5	2	2	3	2	2	1	0	0	0	0	0	2	3	3

Mapping of CO's with Knowledge and Attitude Profile (WK)										
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0										
CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	
CO1	0	0	3	3	0	0	0	0	0	
CO2	0	0	3	3	2	1	0	0	0	
CO3	0	0	2	3	3	2	0	0	1	
CO4	0	0	2	3	2	2	1	1	2	
CO5	0	0	2	2	3	2	1	1	2	

Mapping of CO's with Sustainable Development Goals (SDG)																	
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0																	
CO/SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1	0	0	0	3	0	0	0	0	2	0	0	0	0	0	0	0	0
CO2	0	0	0	2	0	0	1	2	3	0	0	0	0	0	0	0	0
CO3	0	0	1	1	0	0	2	2	3	0	1	0	0	0	0	0	0
CO4	0	0	2	1	0	0	0	2	3	0	2	0	0	0	0	0	0
CO5	0	0	0	2	0	0	1	2	3	0	0	2	1	0	0	0	1

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Semester: VII

Course Title	CRYPTOGRAPHY						
Course Code	22ECT705E						
Course Category	OEC (Open Elective Course)						
Teaching - Learning Scheme & Credit	L	T	P	S	Total	Total Teaching Hours	Credit
	3	0	0	0	3	39+0+0+0=39	3
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hrs	

Course Learning Objectives:	
CLO1	To impart the basic concepts of network security and classical encryption, number theory, stream ciphers, block ciphers and authentication.
CLO2	To interpret the cryptographic algorithms like stream ciphers and block ciphers using classical encryption techniques.
CLO3	To apply the concept of classical encryption techniques to stream ciphers and block ciphers.
CLO4	To analyse the stream ciphers, block ciphers and authentication functions.
CLO5	To design the stream ciphers, block ciphers and authentication functions.

SYLLABUS	No. of Hours	BTLs
UNIT 1	8	L1-L2
Introduction: Services, mechanisms and attacks, OSI security architecture, Model for network security. Symmetric ciphers: Symmetric Cipher Model, Substitution Techniques: Caesar Cipher, Mono Alphabetic Cipher, Playfair Cipher, Hill Cipher, polyalphabetic Cipher and One-Time Pad (OTP). Transposition Techniques, Rotor Machines, Steganography. TEXT 1		
UNIT 2	7	L1-L3
Finite Fields: Groups, Rings, Fields. Modular Arithmetic: Divisors, properties of modulo operator, modular arithmetic operations and properties. Euclid's Algorithm, Greatest Common Divisor (GCD), finding GCD. Finite Fields of the form GF (p): Finite fields of order p, polynomial arithmetic. TEXT 1		
UNIT 3	8	L1-L4
Private Key Encryption: Simplified DES, Block Cipher Principles, Data encryption standard (DES), Strength of DES, Block Cipher Design Principles and Block Cipher Modes of Operation, Evaluation Criteria for Advanced Encryption Standard, The AES Cipher. TEXT 1		
UNIT 4	8	L1-L4
Public Key Encryption: Principles of Public-Key Cryptosystems, The RSA algorithm. Key Management, Diffie - Hellman Key Exchange. TEXT 1		

TEXT BOOKS:	
1	William Stallings , “Cryptography and Network Security Principles and Practice”, Pearson Education Inc., 6th Edition, 2014, ISBN: 978-93-325-1877-3
REFERENCE BOOKS:	
1	Behrouz Forouzan, “Cryptography and Network Security”, edition, TMH, 2007
2.	Alfred J. Menezes, Paul C. Van Oorschot and Scott A. Vanstone, “Handbook of Applied Cryptography”, edition, CRC Press, Reprint 2001
3.	Bruce Schneier, “Applied cryptography: protocols, algorithms, and source code in C”, 2nd edition, Wiley India, 2008
4.	Atul Kahate, “Cryptography and Network Security”, 2nd edition, TMH, 2006
	Weblink: https://nptel.ac.in/courses/106105031

Assessment Details both (CIE and SEE)			
The weightage of Continuous Internal Evaluation (CIE) and Semester End Exam (SEE) is 50% each. The students have to obtain a minimum of 40% marks individually both in CIE and SEE to pass. CIE: The CIE has three components – CIE - theory component, assignment and group activity. Students have to score a minimum of 40% Marks in the total of CIE - theory, assignment and group activity components put together to take SEE. SEE: Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration) and reduced to 50 Marks. **Self-Study Component should be not included for SEE & CIE.			
CONTINUOUS INTERNAL EVALUATION (CIE)		Max. Marks	Minimum Marks to be scored in CIE, to qualify to take SEE (40% individually)
Theory	Weightage of CIE1 and CIE2 Tests or CIE3	50	20
TOTAL		50	20

QUESTION PAPER PATTERN (SEE)										
Q. No.	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
UNIT	1		2		3		4		5	
1. Two full questions (each of 20 Marks) are to be set from each unit.										
2. Student shall answer five full questions selecting one full question from each unit.										

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Course Outcomes: After the completion of the course, the student will be able to:	
CO1	Define the basic concepts of network security, classical encryption, number theory, Private key, public key, authentication.
CO2	Understand the structure of cryptographic algorithms and their applications.
CO3	Apply the concept of classical encryption techniques to existing standard algorithms.
CO4	Illustrate the significance of cryptographic algorithms and their applications.
CO5	Design the private key and public key, authentication functions for applications.

Mapping of CO's, PO's with PSO's														
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	0	1	0	0	0	1	0	1	1	0	2
CO2	3	3	2	1	3	1	0	0	1	0	2	1	0	2
CO3	3	3	1	1	2	0	0	0	1	0	2	1	0	3
CO4	3	3	3	2	3	0	0	1	1	1	2	2	0	3
CO5	3	3	2	2	3	0	0	1	1	0	2	2	0	3

Mapping of CO's with Knowledge and Attitude Profile (WK)										
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0										
CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	
CO1	3	3	1	1	0	0	0	1	0	
CO2	3	2	2	3	0	2	0	1	0	
CO3	3	3	2	3	0	1	0	1	0	
CO4	3	3	3	3	0	3	0	2	0	
CO5	3	3	3	3	0	3	0	2	0	

Mapping of CO's with Sustainable Development Goals (SDG)																	
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0																	
CO/SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1	0	0	0	1	0	0	0	0	3	0	0	0	0	0	0	2	0
CO2	0	0	0	1	0	0	0	1	3	0	0	0	0	0	0	2	0
CO3	0	0	0	1	0	0	0	1	3	0	0	0	0	0	0	2	0
CO4	0	0	0	1	0	0	0	1	3	0	0	0	0	0	0	3	0
CO5	0	0	0	1	0	0	0	1	3	0	0	0	0	0	0	3	0

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Semester: VII

Course Title	MAJOR PROJECT						
Course Code	22ECP706						
Course Category	Project						
Teaching - Learning Scheme & Credits	L	T	P	S	Total	Total Teaching Hours	Credits
	0	0	6	0	6	0+0+6+0=6	6
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hrs	

Course Learning Objectives:

The Major Project is a practical, applied-learning course that builds students' technical knowledge and responsibility. It focuses on real issues such as climate change, pollution, biodiversity, resource use, soil erosion, and thermal comfort, using field surveys, case studies, data collection, audits, and analysis to develop feasible and sustainable solutions. Students may work individually or in groups of up to four, including interdisciplinary topics, and assessment is based on the prescribed rubrics.

Course outcome (Course Skill Set):

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

1. **C01 (L2 – Analyze): Identify** a real-world engineering problem through literature survey and define appropriate project objectives and requirements.
2. **C02 (L3 – Create): Design** a hardware/software-based solution using appropriate engineering principles, components, and modern tools.
3. **C03 (L4 – Apply): Develop** and test a functional prototype by applying engineering knowledge and modern engineering tools..
4. **C04 (L4 – Evaluate): Evaluate** the performance of the developed prototype through experimentation, analysis, and validation of results.
5. **C05 (L5 – Apply): Communicate** the project outcomes effectively through technical reports, presentations, and teamwork while demonstrating professional ethics.

Restrictions and professional conduct:

Major Projects should be academic, socially responsible, technically focused, and politically neutral. Students and faculty must maintain professionalism, ethical conduct, and respect while working with communities and stakeholders, and avoid any political, ideological, commercial, or disruptive activities. Projects should also consider practical constraints such as cost, resources, safety, environmental impact, and stakeholder cooperation.

Major Project Guidelines:

The project topic, title and synopsis have to be finalized and submitted to their respective internal guide(s) before the beginning of the 8th semester. The detailed Synopsis (approved by the department Project Review Committee) has to be submitted during the 1st week after the commencement of 8th semester.

Formation of Groups:

Students are free to choose their project partners from within the programme or any other programme. The project work is to be carried out by a team of two to four students. Each student in the team must contribute towards the successful completion of the project.

The project may be carried out In-house / Industry / R & D Institution.

Selection of Project Topic:

The topics of the project work must be in the field of respective program. The projects as far as possible should have societal relevance with focus on sustainability.

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Assessment structure:

A. Continuous Internal Evaluation (CIE) – 50 marks

- Students, in batches of 3–4, shall undertake at least one project (or a combination of two related activities) aiming, as far as possible, at a logical implemented or implementable outcome.
- CIE will be conducted by a departmental committee (HoD/nominee, guide and one senior faculty) using the following rubrics totalling 50 marks:

The following are the weightings given for the various stages of the project.

- | | |
|---|-----|
| 1. Identification of Problem and Introduction | 20% |
| 2. Literature Survey and Identifying Research Gap | 20% |
| 3. Methodology, H/W & S/W Specifications | 20% |
| 4. Design requirements and Specifications | 20% |
| 5. Presentation and Viva voce | 20% |

CIE pass requirement:

- A student shall secure a minimum of 20 marks out of 50 in CIE to become eligible to appear for SEE.
- Students who fail to earn the required CIE marks may be given additional opportunities before closure of the semester; no re-doing of CIE is permitted after the end of the semester.

B. Semester End Examination (SEE) – 100 marks (scaled to 50)

- Examination duration: 2 hours.
- Maximum examination marks: 100 (entered as 100 in the VTU portal; the ITI-SMU module automatically scales 100 → 50 for result processing).
- The SEE shall be conducted batch-wise by a committee of three faculty: project guide, one faculty from the same department and one from a different department.

The following are the weightages given during Viva Examination.

- | | |
|--|-----|
| 1. Written presentation of synopsis | 10% |
| 2. Presentation/Demonstration of the project | 30% |
| 3. Methodology and Experimental Results & Discussion | 30% |
| 4. Report | 10% |
| 5. Viva Voce | 20% |

SEE pass requirement and overall passing rule:

- For a pass in SEE, a student shall secure minimum 35 marks out of 100.
- For declaration of a pass grade, the sum of CIE marks (out of 50) and scaled SEE marks (out of 50) shall be ≥ 40 ; otherwise, the student is awarded grade F (Fail).

Mapping of CO's, PO's with PSO's

Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	3	0	2	0	0	0	0	0	0	3	2	2	1
CO2	3	2	3	1	3	2	0	0	0	2	1	3	3	1
CO3	3	2	3	3	3	1	0	2	0	1	1	3	3	1
CO4	2	3	2	3	3	2	0	0	0	1	2	3	3	1
CO5	0	0	0	0	0	2	3	3	3	2	2	1	1	3

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Mapping of CO's with Knowledge and Attitude Profile (WK) Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0									
CO/SDG's	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
C01	2	2	3	2	1	1	1	3	0
C02	1	2	3	3	2	3	1	2	1
C03	1	3	3	3	2	3	1	2	1
C04	1	3	2	3	2	3	1	3	1
C05	0	1	0	1	1	1	3	2	3

Mapping of CO's with Sustainable Development Goals (SDG) Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0																	
CO	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
C01	0	0	1	2	0	1	1	1	3	1	2	1	1	0	0	1	2
C02	0	0	1	1	0	1	3	1	3	1	2	2	1	0	0	0	1
C03	0	1	1	1	0	1	3	1	3	1	3	2	1	0	0	0	1
C04	0	0	1	1	0	0	2	1	3	1	3	2	2	0	0	0	1
C05	1	0	1	3	2	0	0	2	2	2	2	1	1	0	0	2	3

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Semester: VII

Course Title	Internship (Industry/Research)						
Course Code	22ECI803						
Course Category	Internship						
Teaching - Learning Scheme & Credits	L	T	P	S	Total	Total Teaching Hours	Credits
					10		10
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hrs	

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 home town (**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/Institute shall not bear any cost involved in carrying out the internship by students.** However, students can receive any financial assistance extended by the organization

Course outcome (Course Skill Set):

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

CO1: Analyze engineering practices, workflows, and technologies adopted in the industry to understand professional engineering environments.

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CO2: Apply engineering knowledge, modern tools, and technical skills to perform assigned tasks and solve engineering problems encountered during the internship.

CO3: Evaluate engineering solutions by interpreting technical data, experimental results, and industrial practices to improve system performance.

CO4: Demonstrate professional ethics, effective communication, teamwork, leadership, and project management skills in an industrial environment.

CO5: Prepare comprehensive technical reports and present internship outcomes by integrating practical experience with engineering concepts for lifelong learning.

Mapping of CO's, PO's with PSO's

Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	3	3	3	2	2	3	3	3	2	2	1
CO2	3	3	3	3	3	2	2	2	2	2	3	3	3	1
CO3	3	3	3	3	3	2	2	2	2	2	3	3	3	1
CO4	2	3	3	2	3	3	2	3	3	3	3	3	3	1
CO5	3	2	2	3	3	3	2	3	3	3	3	1	1	3

Mapping of CO's with Knowledge and Attitude Profile (WK)

Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0

CO/SDG's	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
CO1	2	2	3	3	2	3	3	2	3
CO2	2	3	3	3	3	3	2	2	3
CO3	2	3	3	3	3	3	2	3	3
CO4	1	1	2	3	2	3	3	2	3
CO5	2	2	3	3	3	3	3	3	3

Mapping of CO's with Sustainable Development Goals (SDG)

Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0

CO	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1	0	0	0	3	0	0	0	3	3	0	0	2	1	0	0	0	0
CO2	0	0	0	3	0	0	0	3	3	0	0	2	2	0	0	0	0
CO3	0	0	0	3	0	0	0	3	3	0	0	3	2	0	0	0	0
CO4	0	0	0	3	0	0	0	3	3	0	0	2	2	0	0	0	0
CO5	0	0	0	3	2	0	0	3	3	0	0	2	2	0	0	0	0