



# Dr. AMBEDKAR INSTITUTE OF TECHNOLOGY

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BDA Outer Ring Road, Mallathalli, Bengaluru 56

Board Of Studies 2024-25



## Approved UG Scheme and Syllabus For Academic Year 2024-25

Submitted by  
Department of Electronics and Communication  
Engineering

To  
DEAN (Academic)

Dr. Ambedkar Institute of Technology, Bengaluru-560056  
Scheme of Teaching and Examination for I/II Semester B.E. CBCS 2022, Academic Year 2024-25  
2022 Scheme for EC/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	ESG1	ESX104x	Engineering Science Course I	Respective Engg dept	3	0	0	0	3	03	50	50	100	03	
5	ETG1	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	Placement cell	2	0	0	0	2	-	50	---	---	NP/PP	
Total									25		450	400	800	20	

<p>D/PSB- Teaching Department / Paper Setting Board,SSSelf Study,ASGApplied Science Course,ESG Engineering Science Course,ETC Emerging Technology Course,AEG Ability Enhancement Course,HSSHumanity and Social Science Course,CE-Continuous Internal Evaluation,SEE Semester End Examination, IC – Integrated Course (Theory Course Integrated with Practical Course)</p>	
<p>Credit Definition:  1-hour Lecture (L) per week=1Credit  2-hoursTutorial (T) per week=1Credit  2-hours Practical / Drawing (P) per week=1Credit</p>	<p>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 125 hours of Teaching Learning sessions</p>
<p><b>Student's Induction Program:</b> 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 skills of his/her study, students' character needs to be nurtured as an essential quality by which he/she would understand and fulfill the responsibility as an engineer. The following activities are to be covered in 21 days. Physical Activity, Creative Arts, Universal Human Values, Literary, Proficiency Modules Lectures by Eminent People, Visits to Local areas, Familiarization with Department/Branch and Innovation, etc. For details refer the ANNEXURE I of Induction Programs notification of the University published at the beginning of the 1<sup>st</sup> semester.</p>	
<p>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.</p>	
<p>MAU101D Shall have the 03 hours of theory examination(SEE), however, practical sessions question shall be included in the theory type papers #-  CHU102B SEE shall have the 03 hours of theory examination ), however, practical sessions question shall be included in the theory type 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 they shall be designed as an Integrated course (L:T:P:S= 2:0:2:0 ).  All 01 Credit - courses shall have the SEE of 02 hours duration and the pattern of the question paper shall be MCQ</p>	

(ESGI) Engineering Science Courses-I					(ETC-I ) Emerging Technology Courses -I				
Code ESX104x	Title	L	T	P	Code ETT105x	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 PLU105x	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.

I/II Semester

<b>BASIC ELECTRONICS</b>			
<b>Course Code:</b>	ECT103/ECT203	<b>CIE Marks:</b>	50
<b>Teaching Hours/Week (L:T:P:S):</b>	3:0:0:0	<b>SEE Marks:</b>	50
<b>Total Hours of Pedagogy:</b>	40	<b>Total Marks:</b>	100
<b>Credits:</b>	03	<b>Exam Hours:</b>	03
<b>Course objectives:</b>			
1. Operation of Semiconductor diode, Zener diode and Special purpose diodes and their applications. 2. Biasing circuits for transistor (BJT) as an amplifier. 3. Study of linear Op-amps and its applications. 4. Logic circuits and their optimization. 5. Principle of basic communication system.			
<b>Module-1</b>			<b>08 Hrs</b>
<b>Semiconductor Diodes:</b> Introduction, PN Junction diode, Characteristics and Parameters- Forward and Reverse Characteristics, Diode Parameters, Diode Approximations-Ideal Diodes and Practical Diodes, Piecewise Linear Characteristics, DC Equivalent Circuits. (Text 1) <b>Diode Applications:</b> Introduction, Half-Wave Rectifier, Full-Wave Rectifier, Bridge Rectifier. Rectifier circuit with RC Filters. (Text 1) (Simple Numerical Examples excluding Derivations) <b>Zener Diodes:</b> Zener diode Characteristics and Parameters, Equivalent Circuit, Zener Diode Voltage Regulators, Regulator Circuit with No Load, Loaded Regulator, Regulator Performance (Text 1) (Simple Numerical Examples excluding Derivations)			
<b>Teaching Learning Method:</b>	Chalk and Talk, power point presentation, animations, videos		
<b>RBT Level:</b>	L1, L2		
<b>Module-2</b>			<b>08 Hrs</b>
<b>Bipolar Junction Transistors:</b> Introduction, BJT Operation- PNP and NPN Transistors and Operation, Bipolar Devices, BJT Voltages and Currents, Terminal Voltages, Transistor Currents. BJT Amplification-Current Amplification, Voltage Amplification. Common Base, Common-Emitter and Common Collector Characteristics- Circuit, Input and output characteristics, Current Gain Characteristics. (Text 1) <b>Field Effect Transistor:</b> Junction Field Effect Transistor - n-channel and p-channel FET, JFET Characteristics-Depletion regions, Drain Characteristics, Transfer Characteristics, MOSFETs Enhancement and Depletion MOSFETs (Text 1)			
<b>Teaching Learning Method:</b>	Chalk and Talk, power point presentation, animations, videos		
<b>RBT Level:</b>	L1, L2		
<b>Module-3</b>			<b>08 Hrs</b>
<b>Signal Generators:</b> BJT Phase Shift Oscillator, BJT Colpitts Oscillator, BJT Hartley Oscillator. (Text 1) <b>Operational Amplifiers:</b> Introduction, The Operational Amplifier, Block Diagram Representation of Typical Op-Amp, Schematic Symbol. (Text 2) <b>Op-Amp Parameters:</b> 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- Inverting Amplifiers, Non-Inverting Amplifiers, Differential Amplifiers. (Text 2)			
<b>Teaching Learning Method:</b>	Chalk and Talk, power point presentation, animations, videos		

<b>RBT Level:</b>	L1, L2
<b>Module-4</b>	
<b>08 Hrs</b>	
<p><b>Boolean Algebra and Logic Circuits:</b> Binary Systems – Binary numbers, Number Base Conversion, octal &amp; Hexa Decimal Numbers, Complements, Basic definitions, Axiomatic Definition of Boolean Algebra, Basic Theorems and Properties of Boolean Algebra, Boolean Functions, Canonical and Standard Forms, Other Logic Operations, Digital Logic Gates (Text 3)</p> <p><b>Combinational logic:</b> Introduction, Design procedure, Adder, Subtractor (Text 3)</p>	
<b>Teaching Learning Method:</b>	Chalk and Talk, power point presentation, animations, videos
<b>RBT Level:</b>	L1, L2
<b>Module-5</b>	
<b>08 Hrs</b>	
<p><b>Synchronous Sequential Logic:</b> Introduction, Flip-flops (SR, D, JK, T): working and Truth Table, Counters (JK) and Memory Unit Introduction, Registers, Shift registers (SISO), MOD-4 Ripple Counters. (Text 3)</p> <p><b>Communications:</b> Introduction to communication, Block Diagram of Communication System, Modulation-Description, Need for modulation, Amplitude Modulation – Amplitude Modulation theory, Representation of AM, Frequency Modulation - Theory of Frequency and Phase Modulation. (Text 4)</p>	
<b>Teaching Learning Method:</b>	Chalk and Talk, power point presentation, animations, videos
<b>RBT Level:</b>	L1, L2
<p><b>Course outcomes:</b></p> <p><b>At the end of the course the student will be able to:</b></p> <p><b>CO1.</b> Summarize the operation, characteristics of diodes, diode application, zener diode Characteristics and its applications.</p> <p><b>CO2.</b> Explain the operation of BJT and JFET with their characteristics and applications.</p> <p><b>CO3.</b> Interpret oscillators and operational amplifiers.</p> <p><b>CO4.</b> Analyze and simplify digital circuits or digital gates.</p> <p><b>CO5.</b> Illustrate the concepts of various sequential logic circuits and their working principles; explain the different modulation schemes.</p>	
<p><b>Suggested Learning Resources:</b></p> <p><b>Text Books:</b></p> <p><b>1:</b> Electronic Devices and Circuits, David A Bell, 5th Edition, Oxford, 2016.</p> <p><b>2:</b> Op-amps and Linear Integrated Circuits, Ramakanth A Gayakwad, Pearson Education, 2007</p> <p><b>3:</b> Digital Logic and Computer Design, M. Morris Mano, PHI Learning, 2017.</p> <p><b>4:</b> Electronic Communication Systems, George Kennedy, TMH, 1999</p> <p><b>Reference Books (if required)</b></p> <p><b>1:</b> Mitchel E. Schultz, ‘Grob’s Basic Electronics’, 11th Edition, McGraw-Hill, 2011.</p> <p><b>2:</b> Electronic Instrumentation and Measurements (3rd Edition) – David A. Bell, Oxford University Press, 2013.</p> <p><b>Web Links:</b> <a href="https://onlinecourses.nptel.ac.in/noc21_ee55/preview">https://onlinecourses.nptel.ac.in/noc21_ee55/preview</a></p>	
<b>Activity Based Learning (Suggested Activities in Class)/ Practical Based learning</b>	

### CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2		1	2				1			1	2	
CO2	3	2	3		2	1				1			1	2	
CO3	3	2	3		3				1	1			1	2	
CO4	3	1	1		2	1			1	1		1	1	2	
CO5	3	1	1		2	1			1	1		1	1	2	

High-3, Medium-2, Low-1

I/II Semester

<b>INTRODUCTION TO ELECTRONICS ENGINEERING</b>			
<b>Course Code:</b>	EST104C/EST204C	<b>CIE Marks:</b>	50
<b>Teaching Hours/Week (L:T:P:S):</b>	3:0:0:0	<b>SEE Marks:</b>	50
<b>Total Hours of Pedagogy:</b>	40	<b>Total Marks:</b>	100
<b>Credits:</b>	03	<b>Exam Hours:</b>	03
<b>Course objectives:</b>			
<p>1.To prepare students with fundamental knowledge/ overview in the field of Electronics and Communication Engineering.</p> <p>2. To equip students with a basic foundation in electronic engineering required for comprehending the operation and application of electronic circuits, logic design, embedded systems, and communication systems.</p> <p>3. Professionalism &amp; 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.</p>			
<b>Module-1</b>			<b>08 hrs</b>
<p><b>Power Supplies</b> –Block diagram, Half-wave rectifier, Full-wave rectifiers and filters, Voltage regulators, Voltage multipliers. (Numerical on Rectifiers &amp; Regulators)</p> <p><b>Amplifiers</b> – Bipolar Junction Transistor-Current components and Voltages, Amplifying action, BJT as a switch: Cut-off and saturation modes. (Text 1)</p>			
<b>Teaching Learning Method:</b>	Chalk and Talk, power point presentation, animations, videos		
<b>RBT Level:</b>	L1, L2		
<b>Module-2</b>			<b>08 hrs</b>
<p><b>Operational amplifiers</b> - 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</p> <p><b>Oscillators</b> – Barkhausen criterion, Ladder network oscillator, Wein bridge oscillator, Crystal controlled oscillators</p> <p>(Only Concepts, working, and waveforms. No mathematical derivations) Numerical</p>			
<b>Teaching Learning Method:</b>	Chalk and Talk, power point presentation, animations, videos		
<b>RBT Level:</b>	L1, L2		
<b>Module-3</b>			<b>08 hrs</b>
<p><b>Binary Systems:</b> Binary numbers, Number Base Conversion, octal &amp; Hexa Decimal Numbers, Complements (1's, 2's, 9's and 10's complements).</p> <p><b>Boolean Algebra and Logic Circuits:</b> Basic definitions, Axiomatic Definition of Boolean Algebra, Basic Theorems and Properties of Boolean Algebra, Boolean Functions, Digital Logic Gates (Text 2)</p> <p><b>Combinational logic:</b> Introduction, Design procedure, Adders- Half adder, Full adder (Text 2)</p>			
<b>Teaching Learning Method:</b>	Chalk and Talk, power point presentation, animations, videos		
<b>RBT Level:</b>	L1, L2		
<b>Module-4</b>			<b>08 hrs</b>

<p><b>Embedded Systems:</b> 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)</p> <p><b>Sensors and Interfacing:</b> Instrumentation and control systems, Transducers, Sensors, Actuators, LED, 7-Segment LED Display. (Text 3)</p>	
<p><b>Teaching Learning Method:</b></p> <p><b>RBT Level:</b></p>	<p>Chalk and Talk, power point presentation, animations, videos</p> <p>L1, L2</p>
<p><b>Module-5</b></p>	
<p><b>Analog Communication Schemes:</b> Modern communication system scheme, Information source and input transducer, Transmitter, Channel or Medium – Hardwired and Soft wired, Noise, Receiver, Types of communication systems. Types of modulation (only concepts) – AM, FM, PM. Concept of Radio wave propagation (Ground, space, sky).</p> <p><b>Digital Modulation Schemes:</b> Advantages of digital communication over analog communication, ASK, FSK, PSK, Multiple access techniques: TDMA, FDMA, CDMA. (Text 4)</p>	
<p><b>Teaching Learning Method:</b></p> <p><b>RBT Level:</b></p>	<p>Chalk and Talk, power point presentation, animations, videos</p> <p>L1, L2</p>
<p><b>Course outcomes:</b></p> <p><b>At the end of the course the student will be able to:</b></p> <p><b>CO1.</b> Understand the diode based and transistor-based circuits like Power supplies and Amplifiers.</p> <p><b>CO2.</b> Analyse and design transistor-based Oscillators and Operational amplifiers.</p> <p><b>CO3.</b> Apply the digital electronics knowledge to build arithmetic blocks for digital systems.</p> <p><b>CO4.</b> Understand the basics of microprocessor, microcontroller, RISC, CISC and Sensors based circuits.</p> <p><b>CO5.</b> Explain the operation and applications of modern communication systems.</p>	
<p><b>Suggested Learning Resources:</b></p> <p><b>Text Books:</b></p> <p><b>1:</b> Mike Tooley, ‘Electronic Circuits, Fundamentals &amp; Applications’, 4th Edition, Elsevier, 2015.</p> <p><b>2:</b> Digital Logic and Computer Design, M. Morris Mano, PHI Learning, 2017.</p> <p><b>3:</b> K V Shibu, ‘Introduction to Embedded Systems’, 2nd Edition, McGraw Hill Education (India) Private Limited, 2016.</p> <p><b>4:</b> S L Kakani and Priyanka Punglia, ‘Communication Systems’, New Age International Publisher, 2017. <a href="https://elib4u.ipublishcentral.com/pdfreader/communication-systems">https://elib4u.ipublishcentral.com/pdfreader/communication-systems</a></p> <p><b>Reference Books:</b></p> <p><b>1:</b> Mitchel E. Schultz, ‘Grob’s Basic Electronics’, 11th Edition, McGraw-Hill, 2011.</p> <p><b>Web Links:</b> <a href="https://onlinecourses.nptel.ac.in/noc21_ee55/preview">https://onlinecourses.nptel.ac.in/noc21_ee55/preview</a></p>	
<p><b>Activity Based Learning (Suggested Activities in Class)/ Practical Based learning</b></p>	

### CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2		1			1	1	1		3	1	2	
CO2	3	2	2		1			1	1	1		3	1	2	
CO3	3	2	2		1			1	1	1		3	1	2	
CO4	3		1		1			1	1	1		3	1	2	
CO5	3		1		1			1	1	1		3	1	2	

High-3, Medium-2, Low-1

I/II Semester

<b>Introduction to Internet of Things (IOT)</b>			
<b>Course Code:</b>	ETT1052/ETT2052	<b>CIE Marks:</b>	50
<b>Teaching Hours/Week (L:T:P:S):</b>	3: 0: 0: 0	<b>SEE Marks:</b>	50
<b>Total Hours of Pedagogy:</b>	40	<b>Total Marks:</b>	100
<b>Credits:</b>	03	<b>Exam Hours:</b>	03
<b>Course objectives:</b>			
<ol style="list-style-type: none"> <li>1. Understand the fundamentals of IoT and its building blocks along with their characteristics.</li> <li>2. Gain knowledge of various sensors and actuators for IoT applications.</li> <li>3. Understand the IoT protocols for processing and communication.</li> <li>4. Gain insights about current trends of associated IoT technologies and IoT Analytics.</li> <li>5. Insight into the recent application domains of IoT in everyday life.</li> </ol>			
<b>Module-1</b>			<b>08 hrs</b>
<b>Basics of Networking:</b> Introduction, Network Types, Layered network models, Addressing. <b>Emergence of IoT:</b> Introduction, Evolution of IoT, Enabling IoT and the Complex Interdependence of Technologies, IoT Networking Components, Addressing Strategies in IoT. <b>Textbook 1:</b> Chapter 1- 1.1 to 1.4 Chapter 4 – 4.1 to 4.5.			
<b>Teaching Learning Method:</b>	Chalk and Talk, PowerPoint Presentation		
<b>RBT Level:</b>	L1, L2		
<b>Module-2</b>			<b>08 hrs</b>
<b>IoT Sensing and Actuation:</b> Introduction, Sensors, Sensor Characteristics, Sensorial Deviations, Sensing Types, Sensing Considerations, Actuators, Actuator Types, Actuator Characteristics. <b>Textbook 1:</b> Chapters 5–5.1 to 5.9.			
<b>Teaching Learning Method:</b>	Chalk and Talk, PowerPoint Presentation		
<b>RBT Level:</b>	L1, L2, L3		
<b>Module-3</b>			<b>08 hrs</b>
<b>IoT Processing Topologies and Types:</b> Data Format, Importance of Processing in IoT, Processing Topologies, IoT Device Design and Selection Considerations, Processing Offloading. <b>IoT Connectivity technologies:</b> IEEE 802.15.4, ZigBee, RFID, NFC, LoRa, Wi-Fi, Bluetooth. <b>Textbook 1:</b> Chapter 6–6.1 to 6.5, Chapter 7–7.2,7.3,7.7, 7.8, 7.13, 7.15,7.16			
<b>Teaching Learning Method:</b>	Chalk and Talk, PowerPoint Presentation		
<b>RBT Level:</b>	L1, L2		
<b>Module-4</b>			<b>08 hrs</b>
<b>Associated IoT Technologies:</b> Cloud Computing: Introduction, Virtualization, Cloud Models, Service-Level Agreement in Cloud Computing, Cloud Implementation, Sensor-Cloud: Sensors-as-a-Service. <b>Textbook 1:</b> Chapter 10–0.1 to 10.6.			
<b>Teaching Learning Method:</b>	Chalk and Talk, PowerPoint Presentation		
<b>RBT Level:</b>	L1, L2		
<b>Module -5</b>			<b>08 hrs</b>
<b>IOT Case Studies and Future Trends:</b> Vehicular IoT and IoT Analytics – Introduction. Agricultural IoT and Healthcare IoT – Introduction and Case studies. <b>Textbook 1:</b> Chapter 12-12.1-12.2, 13– 13.1, 14- 14.1-14.2, 17- 17.1.			
<b>Teaching Learning Method:</b>	Chalk and Talk, Power Point Presentation		
<b>RBT Level:</b>	L1, L2, L3		
<b>Course outcomes:</b>			

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

**CO1.** Describe the evolution of IoT, IoT networking components, and addressing strategies in IoT.

**CO2.** Classify various sensing devices and actuator types.

**CO3.** Illustrate the architecture of IoT applications and communication

**CO4.** Explain associated IoT Technologies.

**CO5.** Demonstrate the processing in IoT.

**Suggested Learning Resources:**

**Text Books:**

**1:** Sudip Misra, Anandarup Mukherjee, Arijit Roy, “Introduction to IoT”, Cambridge University Press 2021.

**Reference Book:**

**1:** S. Misra, C. Roy, and A. Mukherjee, 2020. Introduction to Industrial Internet of Things.and Industry 4.0.CRC Press.

**2:** Vijay Madisetti and Arshdeep Bahga, “Internet of Things (A Hands-on-Approach)”,1<sup>st</sup> Edition, VPT, 2014.

**3:** Francis daCosta, “Rethinking the Internet of Things: A Scalable Approach to Connecting Everything”, 1st Edition, Apress Publications, 2013.

**Online Resources:** <https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-cs31/>

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

**Activity 1:** Group activity for a group of 4 or 5 students -5 marks

**Activity 2:** Two assignments are evaluated for 5 marks: Assignment1 – From Unit 1 and 2, Assignment2 from units 3,4 and 5

### CO-PO Mapping

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PS02	PS03
C01	3	3											1	2	
C02	3	2	2	2									1	2	
C03	3	2	2										1	2	
C04	3	2	2	2									1	2	
C05	3	2	2	2		2	1	1	2	3			1	2	

**High-3, Medium-2, Low-1**

Semester: I/II

<b>INTRODUCTION TO EMBEDDED SYSTEMS</b>			
<b>Course Code:</b>	ETT1059/ETT2059	<b>CIE Marks:</b>	50
<b>Teaching Hours/Week (L:T:P:S):</b>	3:0:0:0	<b>SEE Marks:</b>	50
<b>Total Hours of Pedagogy:</b>	39	<b>Total Marks:</b>	100
<b>Credits:</b>	03	<b>Exam Hours:</b>	03
<b>Course objectives:</b>			
1. Understand the basic concepts of Embedded Systems. 2. Identify a typical Embedded System building blocks and describe role of embedded firmware. 3. Familiarize the characteristics and quality attributes of Embedded Systems. 4. Introduction of Embedded System Software and Hardware development. 5. Exposure to trends of embedded industry.			
<b>Module-1</b>			<b>07 hrs</b>
<b>Introduction to Embedded Systems:</b> Definition of Embedded System, Embedded Systems v/s General Computing Systems, History, Classification, Major Application areas, Purpose of Embedded Systems. Application specific embedded system: Washing machine, Domain specific: Embedded system in the automotive domain, Wearable devices: The Innovative bonding of lifestyle with embedded technologies. <b>TEXT 1</b>			
<b>Teaching Learning Method:</b>	Chalk & white board, PowerPoint presentation		
<b>RBT Level:</b>	L1, L2		
<b>Module-2</b>			<b>10 hrs</b>
<b>Typical Embedded System:</b> Core of the Embedded System, Memory, Sensors and Actuators – Light Emitting Diode (LED), 7-Segment LED Display, Keyboard, Communication Interface – Inter Integrated Circuit ( I2C) Bus, Serial Peripheral Interface ( SPI) Bus, Universal Serial Bus (USB), Infrared (IrDA), Bluetooth (BT), Wi-Fi, Embedded Firmware, Other System Components, PCB and Passive Components. <b>TEXT 1</b>			
<b>Teaching Learning Method:</b>	Chalk & white board, PowerPoint presentation		
<b>RBT Level:</b>	L1, L2		
<b>Module-3</b>			<b>07 hrs</b>
<b>Characteristics and Quality Attributes of Embedded Systems:</b> Characteristics and Quality attributes of Embedded Systems. <b>Hardware Software Co-Design and Program Modelling:</b> Hardware Software Co-Design concept, Typical Embedded product design and development approach, Computational Models in Embedded Design. Electronic Design Automation (EDA) Tools. <b>TEXT 1</b>			
<b>Teaching Learning Method:</b>	Chalk & white board, PowerPoint presentation		
<b>RBT Level:</b>	L1, L2		
<b>Module-4</b>			<b>07 hrs</b>
<b>Embedded Firmware Design and Development:</b> Embedded Firmware Design Approaches, Embedded Firmware Development Languages, Integration of Hardware and Firmware, The embedded system development environment, The Integrated Development Environment (IDE). <b>TEXT 1</b>			
<b>Teaching Learning Method:</b>	Chalk & white board, PowerPoint presentation		
<b>RBT Level:</b>	L1, L2		

<b>Module-5</b>	<b>07 hrs</b>
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**Trends in the Embedded Industry:** Processor trends in embedded system, Embedded OS trends, Development Language Trends, Open Standards, Frameworks and Alliances, Bottlenecks, Development Platform Trends, Cloud, Internet of Things (IoT) and Embedded Systems – The Next Big Thing.  
**Design Case Studies:** Digital camera, Smart Card Reader, Automated Meter Reading System. **TEXT 1**

<b>Teaching Learning Method:</b>	Chalk & white board, PowerPoint presentation, seminars
<b>RBT Level:</b>	L1, L2

**Course outcomes:**  
**At the end of the course the student will be able to:**  
**CO1.** understand the basic concepts of embedded systems.  
**CO2.** identify different elements of a typical embedded system.  
**CO3.** acquire knowledge about characteristics, quality enhancing factors of Embedded system.  
**CO4.** highlight different concepts of Embedded Firmware Design and Development.  
**CO5.** analyse different trends followed in embedded industry and conduct case studies.

**Suggested Learning Resources:**  
**Text Books:**  
**1:** Shibu K V, “Introduction to Embedded Systems”, First Edition, Tata McGraw Hill Education Private Limited, 2017.

**Activity Based Learning (Suggested Activities in Class)/ Practical Based learning**  
**1:** Case studies related to embedded systems in different domains.  
**2:** Presentation about current trends in Embedded industries.

<b>CO-PO Mapping</b>															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	3	2	1			1			1					1	
<b>CO2</b>	3	2	1			1			1					1	
<b>CO3</b>	3	2	1			1								1	
<b>CO4</b>	3	2	1			1								1	
<b>CO5</b>	3	2	1			1			1	1				1	

**High-3, Medium-2, Low-1**

Dr. Ambedkar Institute of Technology, Bengaluru-560056  
Scheme of Teaching and Examination for I/II Semester B.E. CBCS 2022, Academic Year 2024-25  
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)	MAU201D	Mathematics	Maths	2	2	2	0	4+2	3	50	50	100	4	
2	ASC(IC)	PHU202D	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	ESGII	ESX204x	Engineering Science CourseII	Respective Enggdept	3	0	0	0	3	3	50	50	100	3	
5	ETGII	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	Sanskrutika/ 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 skillIII	Humanities	2	0	0	0	2	-	50	---	---	NP/ PP	
Total									26		450	400	800	20	

<p>TD/PSB- Teaching Department / Paper Setting Board,SSSelf Study,ASGApplied Science Course,ESG Engineering Science Course,ETC Emerging Technology Course,AEG Ability Enhancement Course,HSSHumanity and Social Science Course,CE-Continuous Internal Evaluation,SEE Semester End Examination, IC – Integrated Course (Theory Course Integrated with Practical Course)</p>	
<p>Credit Definition:  1-hour Lecture (L) per week=1Credit  2-hoursTutorial (T) per week=1Credit  2-hours Practical / Drawing (P) per week=1Credit</p>	<p>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 125 hours of Teaching Learning sessions</p>
<p><b>Student's Induction Program:</b> 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 skills in his/her study, students' character needs to be nurtured as an essential quality by which he/she would understand and fulfill the responsibility as an engineer. The following activities are to be covered in 21 days. Physical Activity, Creative Arts, Universal Human Values, Literary, Proficiency Modules Lectures by Eminent People, Visits to Local areas, Familiarization with Department/Branch and Innovation, etc. For details refer the ANNEXURE I of Induction Programs notification of the University published at the beginning of the 1<sup>st</sup> semester.</p>	
<p>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 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.</p>	
<p>MAU101D Shall have the 03 hours of theory examination(SEE), however, practical sessions question shall be included in the theory type papers #- PHU202D SEE shall have the 03 hours of theory examination ), however, practical sessions question shall be included in the theory type 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 shall be designed as an Integrated course (L:T:P:S= 2:0:2:0 ). ALL courses are Integrated courses.</p> <p>All 01 Credit - courses shall have the SEE of 02 hours duration and the pattern of the question paper shall be MCQ</p>	

(ESGII) 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.

I/II Semester

<b>BASIC ELECTRONICS</b>			
<b>Course Code:</b>	ECT103/ECT203	<b>CIE Marks:</b>	50
<b>Teaching Hours/Week (L:T:P:S):</b>	3:0:0:0	<b>SEE Marks:</b>	50
<b>Total Hours of Pedagogy:</b>	40	<b>Total Marks:</b>	100
<b>Credits:</b>	03	<b>Exam Hours:</b>	03
<b>Course objectives:</b>			
1. Operation of Semiconductor diode, Zener diode and Special purpose diodes and their applications. 2. Biasing circuits for transistor (BJT) as an amplifier. 3. Study of linear Op-amps and its applications. 4. Logic circuits and their optimization. 5. Principle of basic communication system.			
<b>Module-1</b>			<b>08 Hrs</b>
<b>Semiconductor Diodes:</b> Introduction, PN Junction diode, Characteristics and Parameters- Forward and Reverse Characteristics, Diode Parameters, Diode Approximations-Ideal Diodes and Practical Diodes, Piecewise Linear Characteristics, DC Equivalent Circuits. (Text 1) <b>Diode Applications:</b> Introduction, Half-Wave Rectifier, Full-Wave Rectifier, Bridge Rectifier. Rectifier circuit with RC Filters. (Text 1) (Simple Numerical Examples excluding Derivations) <b>Zener Diodes:</b> Zener diode Characteristics and Parameters, Equivalent Circuit, Zener Diode Voltage Regulators, Regulator Circuit with No Load, Loaded Regulator, Regulator Performance (Text 1) (Simple Numerical Examples excluding Derivations)			
<b>Teaching Learning Method:</b>	Chalk and Talk, power point presentation, animations, videos		
<b>RBT Level:</b>	L1, L2		
<b>Module-2</b>			<b>08 Hrs</b>
<b>Bipolar Junction Transistors:</b> Introduction, BJT Operation- PNP and NPN Transistors and Operation, Bipolar Devices, BJT Voltages and Currents, Terminal Voltages, Transistor Currents. BJT Amplification-Current Amplification, Voltage Amplification. Common Base, Common-Emitter and Common Collector Characteristics- Circuit, Input and output characteristics, Current Gain Characteristics. (Text 1) <b>Field Effect Transistor:</b> Junction Field Effect Transistor - n-channel and p-channel FET, JFET Characteristics-Depletion regions, Drain Characteristics, Transfer Characteristics, MOSFETs Enhancement and Depletion MOSFETs (Text 1)			
<b>Teaching Learning Method:</b>	Chalk and Talk, power point presentation, animations, videos		
<b>RBT Level:</b>	L1, L2		
<b>Module-3</b>			<b>08 Hrs</b>
<b>Signal Generators:</b> BJT Phase Shift Oscillator, BJT Colpitts Oscillator, BJT Hartley Oscillator. (Text 1) <b>Operational Amplifiers:</b> Introduction, The Operational Amplifier, Block Diagram Representation of Typical Op-Amp, Schematic Symbol. (Text 2) <b>Op-Amp Parameters:</b> 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- Inverting Amplifiers, Non-Inverting Amplifiers, Differential Amplifiers. (Text 2)			
<b>Teaching Learning Method:</b>	Chalk and Talk, power point presentation, animations, videos		

<b>RBT Level:</b>	L1, L2
<b>Module-4</b>	
<b>08 Hrs</b>	
<p><b>Boolean Algebra and Logic Circuits:</b> Binary Systems – Binary numbers, Number Base Conversion, octal &amp; Hexa Decimal Numbers, Complements, Basic definitions, Axiomatic Definition of Boolean Algebra, Basic Theorems and Properties of Boolean Algebra, Boolean Functions, Canonical and Standard Forms, Other Logic Operations, Digital Logic Gates (Text 3)</p> <p><b>Combinational logic:</b> Introduction, Design procedure, Adder, Subtractor (Text 3)</p>	
<b>Teaching Learning Method:</b>	Chalk and Talk, power point presentation, animations, videos
<b>RBT Level:</b>	L1, L2
<b>Module-5</b>	
<b>08 Hrs</b>	
<p><b>Synchronous Sequential Logic:</b> Introduction, Flip-flops (SR, D, JK, T): working and Truth Table, Counters (JK) and Memory Unit Introduction, Registers, Shift registers (SISO), MOD-4 Ripple Counters. (Text 3)</p> <p><b>Communications:</b> Introduction to communication, Block Diagram of Communication System, Modulation-Description, Need for modulation, Amplitude Modulation – Amplitude Modulation theory, Representation of AM, Frequency Modulation - Theory of Frequency and Phase Modulation. (Text 4)</p>	
<b>Teaching Learning Method:</b>	Chalk and Talk, power point presentation, animations, videos
<b>RBT Level:</b>	L1, L2
<p><b>Course outcomes:</b></p> <p><b>At the end of the course the student will be able to:</b></p> <p><b>CO1.</b> Summarize the operation, characteristics of diodes, diode application, zener diode Characteristics and its applications.</p> <p><b>CO2.</b> Explain the operation of BJT and JFET with their characteristics and applications.</p> <p><b>CO3.</b> Interpret oscillators and operational amplifiers.</p> <p><b>CO4.</b> Analyze and simplify digital circuits or digital gates.</p> <p><b>CO5.</b> Illustrate the concepts of various sequential logic circuits and their working principles; explain the different modulation schemes.</p>	
<p><b>Suggested Learning Resources:</b></p> <p><b>Text Books:</b></p> <p><b>1:</b> Electronic Devices and Circuits, David A Bell, 5th Edition, Oxford, 2016.</p> <p><b>2:</b> Op-amps and Linear Integrated Circuits, Ramakanth A Gayakwad, Pearson Education, 2007</p> <p><b>3:</b> Digital Logic and Computer Design, M. Morris Mano, PHI Learning, 2017.</p> <p><b>4:</b> Electronic Communication Systems, George Kennedy, TMH, 1999</p> <p><b>Reference Books (if required)</b></p> <p><b>1:</b> Mitchel E. Schultz, ‘Grob’s Basic Electronics’, 11th Edition, McGraw-Hill, 2011.</p> <p><b>2:</b> Electronic Instrumentation and Measurements (3rd Edition) – David A. Bell, Oxford University Press, 2013.</p> <p><b>Web Links:</b> <a href="https://onlinecourses.nptel.ac.in/noc21_ee55/preview">https://onlinecourses.nptel.ac.in/noc21_ee55/preview</a></p>	
<b>Activity Based Learning (Suggested Activities in Class)/ Practical Based learning</b>	

### CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2		1	2				1			1	2	
CO2	3	2	3		2	1				1			1	2	
CO3	3	2	3		3				1	1			1	2	
CO4	3	1	1		2	1			1	1		1	1	2	
CO5	3	1	1		2	1			1	1		1	1	2	

**High-3, Medium-2, Low-1**

I/II Semester

<b>INTRODUCTION TO ELECTRONICS ENGINEERING</b>			
<b>Course Code:</b>	EST104C/EST204C	<b>CIE Marks:</b>	50
<b>Teaching Hours/Week (L:T:P:S):</b>	3:0:0:0	<b>SEE Marks:</b>	50
<b>Total Hours of Pedagogy:</b>	40	<b>Total Marks:</b>	100
<b>Credits:</b>	03	<b>Exam Hours:</b>	03
<b>Course objectives:</b>			
<p>1.To prepare students with fundamental knowledge/ overview in the field of Electronics and Communication Engineering.</p> <p>2. To equip students with a basic foundation in electronic engineering required for comprehending the operation and application of electronic circuits, logic design, embedded systems, and communication systems.</p> <p>3. Professionalism &amp; 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.</p>			
<b>Module-1</b>			<b>08 hrs</b>
<p><b>Power Supplies</b> –Block diagram, Half-wave rectifier, Full-wave rectifiers and filters, Voltage regulators, Voltage multipliers. (Numerical on Rectifiers &amp; Regulators)</p> <p><b>Amplifiers</b> – Bipolar Junction Transistor-Current components and Voltages, Amplifying action, BJT as a switch: Cut-off and saturation modes. (Text 1)</p>			
<b>Teaching Learning Method:</b>	Chalk and Talk, power point presentation, animations, videos		
<b>RBT Level:</b>	L1, L2		
<b>Module-2</b>			<b>08 hrs</b>
<p><b>Operational amplifiers</b> - 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</p> <p><b>Oscillators</b> – Barkhausen criterion, Ladder network oscillator, Wein bridge oscillator, Crystal controlled oscillators</p> <p>(Only Concepts, working, and waveforms. No mathematical derivations) Numerical</p>			
<b>Teaching Learning Method:</b>	Chalk and Talk, power point presentation, animations, videos		
<b>RBT Level:</b>	L1, L2		
<b>Module-3</b>			<b>08 hrs</b>
<p><b>Binary Systems:</b> Binary numbers, Number Base Conversion, octal &amp; Hexa Decimal Numbers, Complements (1's, 2's, 9's and 10's complements).</p> <p><b>Boolean Algebra and Logic Circuits:</b> Basic definitions, Axiomatic Definition of Boolean Algebra, Basic Theorems and Properties of Boolean Algebra, Boolean Functions, Digital Logic Gates (Text 2)</p> <p><b>Combinational logic:</b> Introduction, Design procedure, Adders- Half adder, Full adder (Text 2)</p>			
<b>Teaching Learning Method:</b>	Chalk and Talk, power point presentation, animations, videos		
<b>RBT Level:</b>	L1, L2		
<b>Module-4</b>			<b>08 hrs</b>

<p><b>Embedded Systems:</b> 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)</p> <p><b>Sensors and Interfacing:</b> Instrumentation and control systems, Transducers, Sensors, Actuators, LED, 7-Segment LED Display. (Text 3)</p>	
<p><b>Teaching Learning Method:</b></p> <p><b>RBT Level:</b></p>	<p>Chalk and Talk, power point presentation, animations, videos</p> <p>L1, L2</p>
<p><b>Module-5</b></p>	
<p><b>08 hrs</b></p>	
<p><b>Analog Communication Schemes:</b> Modern communication system scheme, Information source and input transducer, Transmitter, Channel or Medium – Hardwired and Soft wired, Noise, Receiver, Types of communication systems. Types of modulation (only concepts) – AM, FM, PM. Concept of Radio wave propagation (Ground, space, sky).</p> <p><b>Digital Modulation Schemes:</b> Advantages of digital communication over analog communication, ASK, FSK, PSK, Multiple access techniques: TDMA, FDMA, CDMA. (Text 4)</p>	
<p><b>Teaching Learning Method:</b></p> <p><b>RBT Level:</b></p>	<p>Chalk and Talk, power point presentation, animations, videos</p> <p>L1, L2</p>
<p><b>Course outcomes:</b></p> <p><b>At the end of the course the student will be able to:</b></p> <p><b>CO1.</b> Understand the diode based and transistor-based circuits like Power supplies and Amplifiers.</p> <p><b>CO2.</b> Analyse and design transistor-based Oscillators and Operational amplifiers.</p> <p><b>CO3.</b> Apply the digital electronics knowledge to build arithmetic blocks for digital systems.</p> <p><b>CO4.</b> Understand the basics of microprocessor, microcontroller, RISC, CISC and Sensors based circuits.</p> <p><b>CO5.</b> Explain the operation and applications of modern communication systems.</p>	
<p><b>Suggested Learning Resources:</b></p> <p><b>Text Books:</b></p> <p><b>1:</b> Mike Tooley, ‘Electronic Circuits, Fundamentals &amp; Applications’, 4th Edition, Elsevier, 2015.</p> <p><b>2:</b> Digital Logic and Computer Design, M. Morris Mano, PHI Learning, 2017.</p> <p><b>3:</b> K V Shibu, ‘Introduction to Embedded Systems’, 2nd Edition, McGraw Hill Education (India) Private Limited, 2016.</p> <p><b>4:</b> S L Kakani and Priyanka Punglia, ‘Communication Systems’, New Age International Publisher, 2017. <a href="https://elib4u.ipublishcentral.com/pdfreader/communication-systems">https://elib4u.ipublishcentral.com/pdfreader/communication-systems</a></p> <p><b>Reference Books:</b></p> <p><b>1:</b> Mitchel E. Schultz, ‘Grob’s Basic Electronics’, 11th Edition, McGraw-Hill, 2011.</p> <p><b>Web Links:</b> <a href="https://onlinecourses.nptel.ac.in/noc21_ee55/preview">https://onlinecourses.nptel.ac.in/noc21_ee55/preview</a></p>	
<p><b>Activity Based Learning (Suggested Activities in Class)/ Practical Based learning</b></p>	

### CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2		1			1	1	1		3	1	2	
CO2	3	2	2		1			1	1	1		3	1	2	
CO3	3	2	2		1			1	1	1		3	1	2	
CO4	3		1		1			1	1	1		3	1	2	
CO5	3		1		1			1	1	1		3	1	2	

High-3, Medium-2, Low-1

I/II Semester

<b>Introduction to Internet of Things (IOT)</b>			
<b>Course Code:</b>	ETT1052/ETT2052	<b>CIE Marks:</b>	50
<b>Teaching Hours/Week (L:T:P:S):</b>	3: 0: 0: 0	<b>SEE Marks:</b>	50
<b>Total Hours of Pedagogy:</b>	40	<b>Total Marks:</b>	100
<b>Credits:</b>	03	<b>Exam Hours:</b>	03
<b>Course objectives:</b>			
<ol style="list-style-type: none"> <li>1. Understand the fundamentals of IoT and its building blocks along with their characteristics.</li> <li>2. Gain knowledge of various sensors and actuators for IoT applications.</li> <li>3. Understand the IoT protocols for processing and communication.</li> <li>4. Gain insights about current trends of associated IoT technologies and IoT Analytics.</li> <li>5. Insight into the recent application domains of IoT in everyday life.</li> </ol>			
<b>Module-1</b>			<b>08 hrs</b>
<b>Basics of Networking:</b> Introduction, Network Types, Layered network models, Addressing. <b>Emergence of IoT:</b> Introduction, Evolution of IoT, Enabling IoT and the Complex Interdependence of Technologies, IoT Networking Components, Addressing Strategies in IoT. <b>Textbook 1:</b> Chapter 1- 1.1 to 1.4 Chapter 4 – 4.1 to 4.5.			
<b>Teaching Learning Method:</b>	Chalk and Talk, PowerPoint Presentation		
<b>RBT Level:</b>	L1, L2		
<b>Module-2</b>			<b>08 hrs</b>
<b>IoT Sensing and Actuation:</b> Introduction, Sensors, Sensor Characteristics, Sensorial Deviations, Sensing Types, Sensing Considerations, Actuators, Actuator Types, Actuator Characteristics. <b>Textbook 1:</b> Chapters 5–5.1 to 5.9.			
<b>Teaching Learning Method:</b>	Chalk and Talk, PowerPoint Presentation		
<b>RBT Level:</b>	L1, L2, L3		
<b>Module-3</b>			<b>08 hrs</b>
<b>IoT Processing Topologies and Types:</b> Data Format, Importance of Processing in IoT, Processing Topologies, IoT Device Design and Selection Considerations, Processing Offloading. <b>IoT Connectivity technologies:</b> IEEE 802.15.4, ZigBee, RFID, NFC, LoRa, Wi-Fi, Bluetooth. <b>Textbook 1:</b> Chapter 6–6.1 to 6.5, Chapter 7–7.2,7.3,7.7, 7.8, 7.13, 7.15,7.16			
<b>Teaching Learning Method:</b>	Chalk and Talk, PowerPoint Presentation		
<b>RBT Level:</b>	L1, L2		
<b>Module-4</b>			<b>08 hrs</b>
<b>Associated IoT Technologies:</b> Cloud Computing: Introduction, Virtualization, Cloud Models, Service-Level Agreement in Cloud Computing, Cloud Implementation, Sensor-Cloud: Sensors-as-a-Service. <b>Textbook 1:</b> Chapter 10–0.1 to 10.6.			
<b>Teaching Learning Method:</b>	Chalk and Talk, PowerPoint Presentation		
<b>RBT Level:</b>	L1, L2		
<b>Module -5</b>			<b>08 hrs</b>
<b>IOT Case Studies and Future Trends:</b> Vehicular IoT and IoT Analytics – Introduction. Agricultural IoT and Healthcare IoT – Introduction and Case studies. <b>Textbook 1:</b> Chapter 12-12.1-12.2, 13– 13.1, 14- 14.1-14.2, 17- 17.1.			
<b>Teaching Learning Method:</b>	Chalk and Talk, Power Point Presentation		
<b>RBT Level:</b>	L1, L2, L3		
<b>Course outcomes:</b>			

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

**CO1.** Describe the evolution of IoT, IoT networking components, and addressing strategies in IoT.

**CO2.** Classify various sensing devices and actuator types.

**CO3.** Illustrate the architecture of IoT applications and communication

**CO4.** Explain associated IoT Technologies.

**CO5.** Demonstrate the processing in IoT.

**Suggested Learning Resources:**

**Text Books:**

**1:** Sudip Misra, Anandarup Mukherjee, Arijit Roy, “Introduction to IoT”, Cambridge University Press 2021.

**Reference Book:**

**1:** S. Misra, C. Roy, and A. Mukherjee, 2020. Introduction to Industrial Internet of Things.and Industry 4.0.CRC Press.

**2:** Vijay Madisetti and Arshdeep Bahga, “Internet of Things (A Hands-on-Approach)”,1<sup>st</sup> Edition, VPT, 2014.

**3:** Francis daCosta, “Rethinking the Internet of Things: A Scalable Approach to Connecting Everything”, 1st Edition, Apress Publications, 2013.

**Online Resources:** <https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-cs31/>

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

**Activity 1:** Group activity for a group of 4 or 5 students -5 marks

**Activity 2:** Two assignments are evaluated for 5 marks: Assignment1 – From Unit 1 and 2, Assignment2 from units 3,4 and 5

### CO-PO Mapping

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PS02	PS03
C01	3	3											1	2	
C02	3	2	2	2									1	2	
C03	3	2	2										1	2	
C04	3	2	2	2									1	2	
C05	3	2	2	2		2	1	1	2	3			1	2	

High-3, Medium-2, Low-1

Semester: I/II

<b>INTRODUCTION TO EMBEDDED SYSTEMS</b>			
<b>Course Code:</b>	ETT1059/ETT2059	<b>CIE Marks:</b>	50
<b>Teaching Hours/Week (L:T:P:S):</b>	3:0:0:0	<b>SEE Marks:</b>	50
<b>Total Hours of Pedagogy:</b>	39	<b>Total Marks:</b>	100
<b>Credits:</b>	03	<b>Exam Hours:</b>	03
<b>Course objectives:</b>			
1. Understand the basic concepts of Embedded Systems. 2. Identify a typical Embedded System building blocks and describe role of embedded firmware. 3. Familiarize the characteristics and quality attributes of Embedded Systems. 4. Introduction of Embedded System Software and Hardware development. 5. Exposure to trends of embedded industry.			
<b>Module-1</b>			<b>07 hrs</b>
<b>Introduction to Embedded Systems:</b> Definition of Embedded System, Embedded Systems v/s General Computing Systems, History, Classification, Major Application areas, Purpose of Embedded Systems. Application specific embedded system: Washing machine, Domain specific: Embedded system in the automotive domain, Wearable devices: The Innovative bonding of lifestyle with embedded technologies. <b>TEXT 1</b>			
<b>Teaching Learning Method:</b>	Chalk & white board, PowerPoint presentation		
<b>RBT Level:</b>	L1, L2		
<b>Module-2</b>			<b>10 hrs</b>
<b>Typical Embedded System:</b> Core of the Embedded System, Memory, Sensors and Actuators – Light Emitting Diode (LED), 7-Segment LED Display, Keyboard, Communication Interface – Inter Integrated Circuit ( I2C) Bus, Serial Peripheral Interface ( SPI) Bus, Universal Serial Bus (USB), Infrared (IrDA), Bluetooth (BT), Wi-Fi, Embedded Firmware, Other System Components, PCB and Passive Components. <b>TEXT 1</b>			
<b>Teaching Learning Method:</b>	Chalk & white board, PowerPoint presentation		
<b>RBT Level:</b>	L1, L2		
<b>Module-3</b>			<b>07 hrs</b>
<b>Characteristics and Quality Attributes of Embedded Systems:</b> Characteristics and Quality attributes of Embedded Systems.			
<b>Hardware Software Co-Design and Program Modelling:</b>			
Hardware Software Co-Design concept, Typical Embedded product design and development approach, Computational Models in Embedded Design. Electronic Design Automation (EDA) Tools. <b>TEXT 1</b>			
<b>Teaching Learning Method:</b>	Chalk & white board, PowerPoint presentation		
<b>RBT Level:</b>	L1, L2		
<b>Module-4</b>			<b>07 hrs</b>
<b>Embedded Firmware Design and Development:</b> Embedded Firmware Design Approaches, Embedded Firmware Development Languages, Integration of Hardware and Firmware, The embedded system development environment, The Integrated Development Environment (IDE). <b>TEXT 1</b>			
<b>Teaching Learning Method:</b>	Chalk & white board, PowerPoint presentation		
<b>RBT Level:</b>	L1, L2		

<b>Module-5</b>	<b>07 hrs</b>
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**Trends in the Embedded Industry:** Processor trends in embedded system, Embedded OS trends, Development Language Trends, Open Standards, Frameworks and Alliances, Bottlenecks, Development Platform Trends, Cloud, Internet of Things (IoT) and Embedded Systems – The Next Big Thing.  
**Design Case Studies:** Digital camera, Smart Card Reader, Automated Meter Reading System. **TEXT 1**

<b>Teaching Learning Method:</b>	Chalk & white board, PowerPoint presentation, seminars
<b>RBT Level:</b>	L1, L2

**Course outcomes:**  
**At the end of the course the student will be able to:**  
**CO1.** understand the basic concepts of embedded systems.  
**CO2.** identify different elements of a typical embedded system.  
**CO3.** acquire knowledge about characteristics, quality enhancing factors of Embedded system.  
**CO4.** highlight different concepts of Embedded Firmware Design and Development.  
**CO5.** analyse different trends followed in embedded industry and conduct case studies.

**Suggested Learning Resources:**  
**Text Books:**  
**1:** Shibu K V, “Introduction to Embedded Systems”, First Edition, Tata McGraw Hill Education Private Limited, 2017.

**Activity Based Learning (Suggested Activities in Class)/ Practical Based learning**  
**1:** Case studies related to embedded systems in different domains.  
**2:** Presentation about current trends in Embedded industries.

<b>CO-PO Mapping</b>															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	3	2	1			1			1					1	
<b>CO2</b>	3	2	1			1			1					1	
<b>CO3</b>	3	2	1			1								1	
<b>CO4</b>	3	2	1			1								1	
<b>CO5</b>	3	2	1			1			1	1				1	

**High-3, Medium-2, Low-1**

**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 2024-25**  
**(Applicable to 2023 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	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	3	0	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									
<b>Total</b>									<b>550</b>	<b>350</b>	<b>900</b>	<b>21</b>	

**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

<b>Engineering Science Course (ESC/ETC/PLC) 22ECT306x</b>			
<b>22ECT306A</b>	<b>Signals and system</b>	<b>22ECT306C</b>	<b>Computer Organization and Architecture</b>
<b>22ECT306B</b>	<b>Sensors and Instrumentation</b>	<b>22ECT306D</b>	<b>Applied Numerical methods</b>
<b>Ability Enhancement Course – III 22ECT308x OR 2ECL308x</b>			
<b>22ECL308A</b>	<b>LICs Lab using PSPICE</b>	<b>22ECL308C</b>	<b>Digital Engineering Course (NASSCOM)</b>
<b>22ECL308B</b>	<b>Simulink Programming Basics</b>	<b>22ECL308D</b>	<b>IOT for Smart Infrastructure</b>
<p><b>Professional Core Course (IPCC):</b> 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.</p>			
<p><b>National Service Scheme /Physical Education/Yoga:</b> 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.</p>			

### III Semester

<b>DIGITAL SYSTEM DESIGN USING VERILOG</b>			
<b>Course Code:</b>	22ECU302	<b>CIE Marks:</b>	50
<b>Teaching Hours/Week (L:T:P:S):</b>	04	<b>SEE Marks:</b>	50
<b>Total Hours of Pedagogy:</b>	52	<b>Total Marks:</b>	100
<b>Credits:</b>	04	<b>Exam Hours:</b>	03
<b>Course objectives:</b>			
<ol style="list-style-type: none"> <li>To impart the concepts of simplifying Boolean expression using K-map techniques and Quine-McCluskey minimization techniques.</li> <li>To impart the concepts of designing and analyzing combinational logic circuits.</li> <li>To impart design methods and analysis of sequential logic circuits.</li> <li>To impart the concepts of Verilog HDL data flow and behavioural models for the design of digital systems.</li> </ol>			
<b>Module-1</b>			
<b>Principles of Combinational Logic:</b> Definition of combinational logic, Canonical forms, Generation of switching equations from truth tables, Karnaugh maps- up to 4 variables, Quine-McCluskey Minimization Technique. Quine-McCluskey using Don't Care Terms. (Section 3.1 to 3.5 of Text 1).			
<b>Teaching Learning Method:</b>	Chalk and Talk, YouTube videos		
<b>RBT Level:</b>	L1, L2, L3		
<b>Module-2</b>			
<b>Logic Design with MSI Components and Programmable Logic Devices :</b> Binary Adders and Subtractors, Comparators, Decoders, Encoders, Multiplexers, Programmable Logic Devices (PLDs) (Section 5.1 to 5.7 of Text 2)			
<b>Teaching Learning Method:</b>	Chalk and Talk, YouTube videos		
<b>RBT Level:</b>	L1, L2, L3		
<b>Module-3</b>			
<b>Flip-Flops and its Applications:</b> The Master-Slave Flip-flops (Pulse-Triggered flip-flops): SR flip-flops, JK flip flops, Characteristic equations, Registers, Binary Ripple Counters, Synchronous Binary Counters, Counters based on Shift Registers, Design of Synchronous mod-n Counter using clocked T, JK, D and SR flip-flops. (Section 6.4, 6.6 to 6.9 (Excluding 6.9.3) of Text 2)			
<b>Teaching Learning Method:</b>	Chalk and Talk, YouTube videos		
<b>RBT Level:</b>	L1, L2, L3		
<b>Module-4</b>			
<b>Introduction to Verilog:</b> Typical Design Flow, Data types, Modules, Ports. <b>Verilog Data flow description:</b> Continuous assignments, Delays, Expressions, Operators, and operands, operator types, Examples (Section 1.3, 3.2, 6.1 to 6.5 of Text 3)			
<b>Teaching Learning Method:</b>	Chalk and Talk, YouTube videos, Programming assignments		
<b>RBT Level:</b>	L1, L2, L3		
<b>Module-5</b>			

<b>Verilog Behavioral description:</b> Procedural Assignments, Conditional statements, Multiway branching, Loops, Examples. (Section 7.2, 7.4, 7.5, 7.6 and 7.9 of Text 3)	
<b>Verilog Structural description:</b> Gate types, Examples. (Section 5,1 of Text 3) (Gate level description only)	
<b>Teaching Learning Method:</b>	Chalk and Talk, YouTube videos, Programming assignments
<b>RBT Level:</b>	L1, L2, L3
<b>PRACTICAL COMPONENT OF IPCC</b>	
Using suitable simulation software, demonstrate the operation of the following circuits	
<b>Sl. No.</b>	<b>Experiments</b>
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) a) Gray to binary and vice versa b) Binary to excess3 and vice versa
5	To realize using Verilog Behavioral description: 8:1 mux, 8:3 encoder, Priority encoder
6	To realize using Verilog Behavioral description: 1:8 Demux, 3:8 decoder, 2-bit Comparator
7	To realize using Verilog Behavioral description: Flip-flops: a) JK type b) SR type c) T type and d) D type
8	To realize Counters - up/down (BCD and binary) using Verilog Behavioral description.
<b>Demonstration Experiments (For CIE only – not to be included for SEE)</b>	
Use FPGA/CPLD kits for downloading Verilog codes and check the output for interfacing experiments.	
9	Verilog Program to interface a Stepper motor to the FPGA/CPLD and rotate the motor in the specified direction (by N steps).
10	Verilog programs to interface a Relay or ADC to the FPGA/CPLD and demonstrate its working.
11	Verilog programs to interface DAC to the FPGA/CPLD for Waveform generation.
12	Verilog programs to interface Switches and LEDs to the FPGA/CPLD and demonstrate its working.
<b>Course Outcomes</b>	
At the end of the course the student will be able to:	
<ol style="list-style-type: none"> <li>1. Simplify Boolean functions using K-map and Quine-McCluskey minimization technique.</li> <li>2. Analyze and design for combinational logic circuits.</li> <li>3. Analyze the concepts of Flip Flops (SR, D, T and JK) and to design the synchronous sequential using Flip Flops.</li> <li>4. Model Combinational circuits (adders, subtractors, multiplexers) and sequential circuits using Data flow model.</li> <li>5. Model Combinational circuits (multiplexers) and sequential circuits using behavioural and structural model.</li> </ol>	
<b>Suggested Learning Resources:</b>	
<b>Text Books</b>	

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

**Reference Books:**

1. Fundamentals of logic design, by Charles H Roth Jr., Cengage Learning
2. Logic Design, by Sudhakar Samuel, Pearson/Sanguine, 2007
3. Fundamentals of HDL, by Cyril P R, Pearson/Sanguine2010

**MOOCS:**

1. Electronic Design Automation <http://nptel.ac.in/courses/106105083/>
2. Digital system design with PLDs and FPGA  
[shttp://nptel.ac.in/courses/117108040/Fundamentals of HDL](http://nptel.ac.in/courses/117108040/Fundamentals%20of%20HDL)

**Activity Based Learning (Suggested Activities in Class)/Practical Based learning**  
Programming Assignments/Mini Projects can be given to improve programming skills.

**CO-PO Mapping**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C01	3	1	1											2	
C02	3	1	1											2	
C03	3	1	1											2	
C04	3	1	1											2	
C05	3	1	1											2	

**High-3, Medium-2, Low-1**

### III Semester

<b>ANALOG ELECTRONIC CIRCUITS</b>			
<b>Course Code:</b>	22ECU303	<b>CIE Marks:</b>	50
<b>Teaching Hours/Week (L:T:P:S):</b>	3:0:2:0	<b>SEE Marks:</b>	50
<b>Total Hours of Pedagogy:</b>	52	<b>Total Marks:</b>	100
<b>Credits:</b>	4	<b>Exam Hours:</b>	3
<p><b>Course objectives: This course will enable students to</b></p> <ol style="list-style-type: none"> <li>1. Explain various BJT parameters, connections and configurations.</li> <li>2. Design and demonstrate the diode circuits and transistor amplifiers.</li> <li>3. Explain various types of FET biasing and demonstrate the use of FET amplifiers.</li> <li>4. Analyse Power amplifier circuits in different modes of operation.</li> <li>5. Construct Feedback and Oscillator circuits using FET.</li> </ol>			
<b>Module-1</b>			<b>08 hrs</b>
<p><b>BJT Biasing:</b> Biasing in BJT amplifier circuits: The Classical Discrete circuit bias (Voltage-divider bias), Biasing using a collector to base feedback resistor.</p> <p><b>Small signal operation and Models:</b> Collector current and transconductance, Base current and input resistance, Emitter current and input resistance, voltage gain, Separating the signal and the DC quantities, The hybrid <math>\Pi</math> model.</p> <p><b>MOSFETs:</b> Biasing in MOS amplifier circuits: Fixing <math>V_{GS}</math>, Fixing <math>V_G</math>, Drain to Gate feedback resistor. Small signal operation and modeling: The DC bias point, signal current in drain, voltage gain, small signal equivalent circuit models, transconductance, <b>Text 1</b></p>			
<b>Teaching Learning Method:</b>	Chalk and talk method, Power Point Presentation.		
<b>RBT Level:</b>	Self-study topics: Basic BJT Amplifier Configurations- Design of Common Emitter and Common collector amplifier circuits. L1, L2, L3		
<b>Module-2</b>			<b>08 hrs</b>
<p><b>MOSFET Amplifier configuration:</b> Basic configurations, characterizing amplifiers, CS amplifier with and without source resistance <math>R_S</math>, Source follower.</p> <p><b>MOSFET internal capacitances and High frequency model:</b> The gate capacitive effect, Junction capacitances, High frequency model. Frequency response of the CS amplifier: The three frequency bands, high frequency response, Low frequency response.</p> <p><b>Oscillators:</b> FET based Phase shift oscillator, LC and Crystal Oscillators (no derivation) <b>Text 1</b></p>			
<b>Teaching Learning Method:</b>	Chalk and talk method, Power Point Presentation.		
<b>RBT Level:</b>	Self-study topics: Discrete Circuit MOS Amplifier – The common source amplifier and the source follower. L1, L2, L3		
<b>Module-3</b>			<b>08 hrs</b>
<p><b>Feedback Amplifier:</b> General feedback structure, Properties of negative feedback, The Four Basic Feedback Topologies, The series-shunt, series-series, shunt-shunt and shunt-series amplifiers (Qualitative Analysis).</p> <p><b>Output Stages and Power Amplifiers:</b> Introduction, Classification of output stages, Class A output stage, Class B output stage: Transfer Characteristics, Power Dissipation, Power Conversion efficiency, Class AB output stage, Class C tuned Amplifier. <b>Text 1</b></p>			

<b>Teaching Learning Method:</b>	Chalk and talk method, Power Point Presentation. Self-study topics: Class D power amplifier
<b>RBT Level:</b>	L1, L2, L3
<b>Module-4</b>	
<b>08 hrs</b>	
<b>Op-Amp Circuits:</b> Op-amp DC and AC Amplifiers, DAC – Weighted resistor and R-2R ladder, ADC- Successive approximation type, Small Signal half wave rectifier, Absolute value output circuit, Active Filters, First and second order low-pass and high-pass Butterworth filters, Band-pass filters, Band reject filters. (no derivations only concepts) <b>Text 2</b>	
<b>Teaching Learning Method:</b>	Chalk and talk method, Power Point Presentation. Self-study topics: Clippers and Clampers, Peak detector, Sample and hold circuit.
<b>RBT Level:</b>	L1, L2, L3
<b>Module-5</b>	
<b>08 hrs</b>	
<b>555 Timer and its applications:</b> Monostable and Astable Multivibrators. <b>Thyristors:</b> Static Anode-Cathode characteristics and Gate characteristics of SCR, Turn-On methods, Turn-off Mechanism, Turn-Off Methods: Natural and Forced Commutation – Class A without design consideration. <b>Text 2, 3</b>	
<b>Teaching Learning Method:</b>	Chalk and talk method, Power Point Presentation. Self-study topics: Basic Construction, working and applications of DIAC, TRIAC, IGBT, GTO.
<b>RBT Level:</b>	L1, L2, L3
<b>PRACTICAL COMPONENT OF IPCC</b>	
1. Design and verification of voltage follower, inverting amplifier and non- inverting amplifier using OP-AMP.	
2. Design and verification of Integrator and Differentiator using OP-AMP.	
3. Design and Simulation of Function generator to generate square wave and triangular wave generator using OP-AMP.	
4. Analyze Input, Output characteristics of BJT Common emitter	
5. Design and Simulation of input and output characteristics of MOSFET	
6. Analyze of Static characteristics of SCR	
7. Design and Simulation of RC Phase shift Oscillator using FET.	
8. Design and Simulation of R-2R Ladder DAC.	
<b>Course Outcomes:</b> <b>After the completion of the Course the student can:</b> CO1. Understand the characteristics of BJTs and FETs for switching and amplifier circuits. CO2. Design and analyse FET amplifiers and oscillators with different circuit configurations and biasing conditions. CO3. Understand the feedback topologies and approximations in the design of amplifiers and oscillators. CO4. Design of circuits using linear ICs for wide range applications such as ADC, DAC, filters and timers.	
<b>Suggested Learning Resources:</b> <b>Text Books:</b> 1. Microelectronic Circuits, Theory and Applications, Adel S Sedra, Kenneth C Smith, 6 <sup>th</sup> Edition, Oxford,2015. ISBN:978-0-19-808913-1	

2. Op-Amps and Linear Integrated Circuits, Ramakant A Gayakwad, 4th Edition, Pearson Education, 2018. ISBN: 978-93-325-4991-3
3. Electronic Principles, Albert Malvino, David J Bates, 7th Edition, McGraw Hill Education
4. (India) Private Limited, 2017, ISBN: 978-0-07-063424-4 Reference Books (if required)

**Web Links:**

1. [www.nptel.in](http://www.nptel.in)
2. Integrated Electronics: Analog and Digital Circuits and Systems, Jacob Millman, Christos
3. C. Halkias, McGraw-Hill, 2015.
4. Electronic Devices and Circuit, Boylestad & Nashelsky, Eleventh Edition, Pearson, January 2015.

**CO-PO Mapping**

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PS02	PS03
C01	3	3											1	1	1
C02	3	3	3										1	1	1
C03	3	3	2										1	1	1
C04	3	2	2										1	1	1

**High-3, Medium-2, Low-1**

### III Semester

<b>NETWORK ANALYSIS</b>			
<b>Course Code:</b>	22ECT304	<b>CIE Marks:</b>	50
<b>Teaching Hours/Week (L:T:P:S):</b>	2:2:0:0	<b>SEE Marks:</b>	50
<b>Total Hours of Pedagogy:</b>	52 Hours	<b>Total Marks:</b>	100
<b>Credits:</b>	3 (2:1:0)	<b>Exam Hours:</b>	03 Hrs
<b>Course objectives:</b>			
1. To familiarize the basic laws, source transformation, source shifting and network analysis techniques. 2. To understand the network theorems and their applications for the analysis of electrical circuits. 3. To understand the transient behaviour of electrical circuits using the initial conditions. 4. To Apply Laplace transforms for the analysis of electrical circuits. 5. To evaluate the two port network parameters for the electrical circuits.			
<b>Module-1</b>			<b>11 hrs</b>
<b>Introduction:</b> Ohm's Law, Nodes, Branches, and Loops, Kirchhoff's Laws, Series Resistors and Voltage division, Parallel Resistors and Current division, Wye-Delta transformations, Source Transformation, Source Shifting, Series and Parallel Capacitors, Series and Parallel Inductors.			
<b>Methods of Analysis:</b> Nodal Analysis, Nodal Analysis with Voltage Sources, Mesh Analysis, Mesh Analysis with Current Sources, Nodal vs Mesh Analysis, Sinusoid steady-state analysis using Nodal Analysis and Mesh Analysis.			
<b>Text Book: 2.1 to 2.7, 4.4, 6.3, 6.5, 3.1 to 3.7, 10.1 to 10.3.</b>			
<b>Teaching Learning Method:</b>	Chalk and Board, Problem Based Learning		
<b>RBT Level:</b>	L1, L2, L3, L4		
<b>Module-2</b>			<b>10 hrs</b>
<b>Circuit Theorems:</b> Linearity Property, Superposition, Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer theorem.			
<b>Resonance:</b> Series resonance and parallel resonance			
<b>Text Book: 4.2,4.3, 4.5, 4.6, 10.4, 10.6, 14.5, 14.6.</b>			
<b>Teaching Learning Method:</b>	Chalk and Board, Problem Based Learning		
<b>RBT Level:</b>	L1, L2, L3, L4		
<b>Module-3</b>			<b>11 hrs</b>
<b>Transient Behaviour and Initial Conditions:</b> Introduction, the Source-Free RC circuit, the Source-Free RL circuit, Singularity Functions, Step Response of an RC circuit, Step Response of an RL Circuit, Finding Initial and Final Values.			
<b>Text Book: 7.1 to 7.6, 8.1, 8.2</b>			
<b>Teaching Learning Method:</b>	Chalk and Board, Problem Based Learning		
<b>RBT Level:</b>	L1, L2, L3, L4		
<b>Module-4</b>			<b>10 hrs</b>
<b>Laplace Transforms:</b> Introduction, Definition of the Laplace Transform, Properties of Laplace Transform, Circuit Element Models, and Circuit Analysis using Laplace Transforms.			
<b>Text Book: 15.1 to 15.3, 16.1 to 16.3</b>			
<b>Teaching Learning Method:</b>	Chalk and Board, Problem Based Learning		
<b>RBT Level:</b>	L1, L2, L3, L4		

<b>Module-5</b>	<b>10 hrs</b>
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**Two-Port Networks:** Introduction, Impedance parameters, Admittance Parameters, Hybrid Parameters, Transmission Parameters, Relationship between Parameters, Interconnection of Networks.

**Text Book: 19.1 to 19.6**

<b>Teaching Learning Method:</b>	Chalk and Board, Problem Based Learning
<b>RBT Level:</b>	L1, L2, L3, L4

**Course outcomes:**  
**At the end of the course the student will be able to:**  
**CO1.** Simplify the electrical network and analyse the electrical circuits using mesh and nodal analysis.  
**CO2.** Solve complex electrical circuits using network theorems and explain series and parallel resonance circuits.  
**CO3.** Evaluate the transient response of electrical circuits using initial conditions.  
**CO4.** Apply Laplace transforms for Circuit Analysis  
**CO5.** Evaluate the performance of two-port networks.

**Suggested Learning Resources:**

**Text Books:**

**1:** Fundamentals of Electric Circuits, Charles K Alexander Matthew N O Sadiku, Mc Graw Hill, 2021.

**Reference Books**

**1:** Engineering Circuit Analysis, William H Hayt et al, Mc Graw Hill, 8th Edition, 2014.

**2:** Network Analysis, M.E. Vanvalkenburg, Pearson, 3rd Edition, 2014.

**Material:**

Material will be provided by the course co-ordinator

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

**Activity 1:** Quizzes

**Activity 2:** Seminars

**Activity 3:** Simulation of Electrical Circuits using PSPICE

**CO-PO Mapping**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	3	3											3		
<b>CO2</b>	3	3											3		
<b>CO3</b>	3	3											3		
<b>CO4</b>	3	3											3		
<b>CO5</b>	2	2											3		

**High-3, Medium-2, Low-1**

### III Semester

<b>ANALOG AND DIGITAL ELECTRONICS LAB</b>			
<b>Course Code:</b>	22ECL305	<b>CIE Marks:</b>	50
<b>Teaching Hours/Week (L:T:P:S):</b>	0:0:2:0	<b>SEE Marks:</b>	50
<b>Total Hours of Pedagogy:</b>		<b>Total Marks:</b>	100
<b>Credits:</b>	<b>01</b>	<b>Exam Hours:</b>	03
<b>Course objectives:</b>			
This laboratory course enables student to:			
<ol style="list-style-type: none"> <li>1. Understand the electronic circuit schematic and its working</li> <li>2. Realize and test amplifier and oscillator circuits for the given specifications</li> <li>3. Realize the opamp circuits for the applications such as DAC, implement mathematical functions</li> <li>4. and precision rectifiers.</li> <li>5. Study the static characteristics of SCR and test the RC triggering circuit.</li> <li>6. Design and test the combinational and sequential logic circuits for their functionalities.</li> <li>7. • Use the suitable ICs based on the specifications and functions.</li> </ol>			
Sl. No.	Experiments		
1	Design and set up the BJT common emitter voltage amplifier and determine the gain, bandwidth, input and output impedances.		
2	Design and set-up BJT/FET i) Colpitts Oscillator ii) Crystal Oscillator		
3	Design and set up the circuits using opamp: i) Adder ii) Integrator iii) Differentiator and iv) Comparator		
4	Obtain the static characteristics of SCR and test SCR Controlled HWR and FWR using RC triggering circuit.		
5	Design and implement (a) Half Adder & Full Adder using basic gates (b) Half subtractor & Full subtractor using basic gates (c) 4-variable function using IC74151(8:1MUX).		
6	Realize (i) Binary to Gray code conversion & vice-versa using gates		
7	a) Realize using NAND Gates: i) Master-Slave JK Flip-Flop, ii) D Flip-Flop and iii) T Flip-Flop		
8	Realize a) Design Mod – N Synchronous Up Counter & Down Counter using 7476 JK Flip-flop b) Mod-N Counter using IC7490 / 7476		
9	Design 4-bit R – 2R Op-Amp Digital to Analog Converter (i) for a 4-bit binary input using toggle switches (ii) by generating digital inputs using mod-16		
10	Test the precision rectifiers using opamp: i) Half wave rectifier ii) Full wave rectifier		
11	Design and test Monostable and Astable Multivibrator using 555 Timer		

**Course outcomes (Course Skill Set):**

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

**CO 1.** Design and analyze the BJT/FET amplifier and oscillator circuits.

**CO 2.** Design and test Opamp circuits to realize the mathematical computations, DAC and precision rectifiers.

**CO 3.** Design and test the combinational logic circuits for the given specifications.

**CO 4.** Test the sequential logic circuits for the given functionality.

**CO 5.** Demonstrate the basic electronic circuit experiments using SCR and 555 timer.

**Suggested Learning Resources:**

1. Fundamentals of Electronic Devices and Circuits Lab Manual, David A Bell, 5th Edition, 2009, Oxford University Press.

2. Op-Amps and Linear Integrated Circuits, Ramakant A Gayakwad, 4th Edition, Pearson Education, 2018. ISBN: 978-93-325-4991-3.

3. Fundamentals of Logic Design, Charles H Roth Jr., Larry L Kinney, Cengage Learning, 7th Edition.

**CO-PO Mapping**

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PS02	PS03
<b>CO1</b>	<b>3</b>	<b>3</b>	<b>3</b>										<b>1</b>	<b>1</b>	<b>1</b>
<b>CO2</b>	<b>3</b>	<b>3</b>	<b>3</b>										<b>1</b>	<b>1</b>	<b>1</b>
<b>CO3</b>	<b>3</b>	<b>3</b>	<b>3</b>										<b>1</b>	<b>1</b>	<b>1</b>
<b>CO4</b>	<b>3</b>	<b>3</b>	<b>3</b>										<b>1</b>	<b>1</b>	<b>1</b>
<b>CO5</b>	<b>3</b>	<b>3</b>	<b>3</b>										<b>1</b>	<b>1</b>	<b>1</b>

**High-3, Medium-2, Low-1**

### III Semester

<b>SIGNALS AND SYSTEM</b>			
<b>Course Code:</b>	22ECT306A	<b>CIE Marks:</b>	50
<b>Teaching Hours/Week (L:T:P:S):</b>	3:0:0:0	<b>SEE Marks:</b>	50
<b>Total Hours of Pedagogy:</b>	40	<b>Total Marks:</b>	100
<b>Credits:</b>	03	<b>Exam Hours:</b>	3
<b>Course objectives:</b>			
1. To prepare students with fundamental knowledge/ overview of signals and systems with their properties. 2. Apply convolution to analyse how signals interact with linear time-invariant (LTI) systems and the analysis of the signals in time domain using difference/differential equations. 3. Understand the basic concepts of the Fourier series and Fourier transform for a given signal. 4. Analyse and apply the concepts of the Fourier Transform and its properties. 5. Understand the concept of the Z-transform and its significance in discrete-time signal analysis.			
<b>Module-1</b>			<b>08 Hrs</b>
<b>Introduction:</b> Definition of signal and systems, classification of signals, basic operations on signals (Amplitude scaling, addition, multiplication, time scaling, time shift and time reversal), Elementary signals/Functions (Unit Step, Unit impulse, ramp, exponential, sinusoidal). <b>Properties of System:</b> Linear-nonlinear, Time variant-invariant, causal-noncausal, memory-memoryless, stable-unstable.			
<b>Teaching Learning Method:</b>	Chalk and Talk, power point presentation, animations, videos		
<b>RBT Level:</b>	L1, L2		
<b>Module-2</b>			<b>08 Hrs</b>
<b>Time domain representations for Linear Time Invariant Systems:</b> Introduction, Convolution: Impulse response representation for LTI systems, Properties of the impulse response representation for LTI systems, Difference and differential equation representations for LTI systems.			
<b>Teaching Learning Method:</b>	Chalk and Talk, power point presentation, animations, videos		
<b>RBT Level:</b>	L1, L2, L3, L4		
<b>Module-3</b>			<b>08 Hrs</b>
<b>Fourier representations of signals:</b> Introduction, Discrete-Time Periodic signals: The Discrete-Time Fourier Series, Continuous-Time Periodic Signals: The Fourier Series, Discrete-Time Non Periodic signals: The Discrete-Time Fourier Transform, Continuous-Time Non Periodic Signals: The Fourier Transform. (Definition and basic problems)			
<b>Teaching Learning Method:</b>	Chalk and Talk, power point presentation, animations, videos		
<b>RBT Level:</b>	L1, L2, L3, L4		
<b>Module-4</b>			<b>08 Hrs</b>
<b>Properties of Fourier Transform:</b> Linearity, Symmetry, Time shift, Frequency shift, Scaling, Differentiation and Integration, Convolution and Modulation, Parsevals relationships and Duality. (Statement and Proof) <b>Applications of Fourier Representations:</b> Introduction, Frequency response of LTI system, Fourier Transform representations for periodic signals Sampling-Sampling continuous time signals.			
<b>Teaching Learning Method:</b>	Chalk and Talk, power point presentation, animations, videos		
<b>RBT Level:</b>	L1, L2, L3, L4		
<b>Module-5</b>			<b>08 Hrs</b>

The Z-Transforms: Introduction, the Z transform, properties of the region of convergence, properties of the Z-Transform, Inverse of the Z-transform.

<b>Teaching Learning Method:</b>	Chalk and Talk, power point presentation, animations, videos
<b>RBT Level:</b>	L1, L2, L3, L4

**Course outcomes:**

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

**CO1.** Demonstrate an understanding of continuous-time and discrete-time signals and perform basic operations on signals, classify systems based on their properties.

**CO2.** Analyse and solve time domain representations for LTI Systems and also able to classify the LTI system based on the properties.

**CO3.** Understand the fundamental concepts of Fourier series, Fourier transforms, and their significance in signal analysis. Apply Fourier analysis techniques to solve problems.

**CO4.** Demonstrate a thorough knowledge of the key properties of the Fourier Transform, including linearity, time shifting, frequency shifting, and scaling. Apply convolution and modulation theorems to solve problems involving the multiplication of signals in the time domain.

**CO5.** Apply the Z-transform to analyse discrete-time signals.

**Suggested Learning Resources:**

**Text Books:**

**1:** Simon Haykin and Barry Van Veen, “Signals and Systems”, 2<sup>nd</sup> Edition, John Wiley & Sons, Oct 2002.

**Reference Books:**

**1:** Alan V Oppenheim, Alan S, Willsky and A Hamid Nawab, “Signals and Systems” Pearson Education Asia / PHI, 2nd edition, 1997. Indian Reprint 2002.

**2:** Michael Roberts, “Fundamentals of Signals & Systems”, 2nd edition, Tata McGraw-Hill, 2010.

**3:** V. Krishnaveni and A. Rajeswari, “Signals and Systems”, Wiley India, Reprint 2012.

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

**Activity 1: Interactive Demos and Simulations:** Use interactive software or online tools to demonstrate signal transformations, system responses, and other concepts. Encourage students to manipulate parameters and observe the effects in real-time.

**Activity 2: Signal Processing Workshops:** Organize workshops where students work in groups to process and analyze real signals (audio, images) using software like MATLAB.

**Activity 3: Case Studies:** Present real-world case studies where understanding Signals and Systems is crucial. Examples include audio compression (MP3), image compression (JPEG), or equalization in audio systems.

**CO-PO Mapping**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1									2	3	1	
CO2	3	2	2									2	3	1	
CO3	3	2	2	2								2	3	1	
CO4	3	2	2	2								2	3	1	
CO5	3	2	2	2								2	3	1	

**High-3, Medium-2, Low-1**

### III Semester

<b>SENSORS AND INSTRUMENTATION</b>			
<b>Course Code:</b>	22ECT306B	<b>CIE Marks:</b>	50
<b>Teaching Hours/Week (L:T:P:S):</b>	3:0:0:0	<b>SEE Marks:</b>	50
<b>Total Hours of Pedagogy:</b>	39	<b>Total Marks:</b>	100
<b>Credits:</b>	03	<b>Exam Hours:</b>	03
<b>Course objectives:</b>			
This course will enable students to understand:			
<ol style="list-style-type: none"> <li>1. Operation principle, characteristics, classification of different sensors</li> <li>2. types of errors in measurement and the operation of different Transducers</li> <li>3. working of Multirange Ammeters, Voltmeters and Multimeters.</li> <li>4. principle of operation of digital measuring instruments and Bridges.</li> </ol>			
<b>Module-1</b>			<b>08 hrs</b>
<b>INTRODUCTION:</b> introduction to sensors/transducers. principles, classification, parameters, Environmental parameters, Characterization.			
<b>MECHANICAL AND ELECTROMECHANICAL SENSORS:</b> Introduction, resistive potentiometer, Strain gauge, Inductive sensors, capacitive sensors, Force/stress sensors using Quartz Resonators, Ultrasonic sensors. <b>TEXT 1</b>			
<b>Teaching Learning Method:</b>	Chalk and talk method, PowerPoint Presentation		
<b>RBT Level:</b>	L1, L2, L3		
<b>Module-2</b>			<b>07 hrs</b>
<b>THERMAL SENSORS:</b> Introduction, Gas thermometric sensors, Thermal expansion type thermometric sensors, Dielectric constant and refractive index thermo sensors. Nuclear thermometer, magnetic thermometer, Resistance change type thermometric sensors, thermo emf sensors, Thermal radiation sensors. <b>TEXT 1</b>			
<b>Teaching Learning Method:</b>	Chalk and talk method, PowerPoint Presentation		
<b>RBT Level:</b>	L1, L2, L3		
<b>Module-3</b>			<b>08 hrs</b>
<b>MAGNETIC SENSORS:</b> Introduction, Sensors and the principle behind, Magneto resistive sensors, Hall effect and sensors, Inductance and eddy current sensors, Angular/rotary movement transducer, Eddy current sensors, Electromagnetic flow meter, Switching magnetic sensor, SQUID sensor. <b>TEXT 1</b>			
<b>Teaching Learning Method:</b>	Chalk and talk method, PowerPoint Presentation		
<b>RBT Level:</b>	L1, L2, L3		
<b>Module-4</b>			<b>08 hrs</b>
<b>Principles of Measurement:</b> Static Characteristics, Error in Measurement, Types of Static Error. Voltmeters: Introduction, Multi range voltmeter. Ammeters: DC Ammeter, Multi-range Ammeter. Digital Voltmeter: Ramp Technique, Dual slope integrating Type DVM, Direct Compensation type and Successive Approximations type DVM. <b>TEXT 2</b>			
<b>Teaching Learning Method:</b>	Chalk and talk method, PowerPoint Presentation		
<b>RBT Level:</b>	L1, L2, L3		
<b>Module-5</b>			<b>08 hrs</b>
<b>Digital Instruments:</b> Introduction, Digital Multimeter, Digital frequency meters, Digital measurement of time. Signal Generators: Function generator, Block diagram of Oscilloscope. Bridges: Wheatstone's Bridge, Capacitance and Inductance Comparison bridge, Maxwell's bridge, Wien's bridge. <b>TEXT 2</b>			
<b>Teaching Learning Method:</b>	Chalk and talk method, PowerPoint Presentation		
<b>RBT Level:</b>	L1, L2, L3		

**Course outcomes:****At the end of the course the student will be able to:**

CO 1: Understand operation principle, classification, characteristics of sensors, mechanical and electrical sensors

CO 2: Understand operation principle, different types, characteristics of thermal sensors.

CO 3: Understand operation principle, different types, characteristics of magnetic sensors.

CO 4: Analyse principle of measurement, operation of different ammeters and voltmeters.

CO 5: Analyse the operation, classification, different types of digital instruments.

**Suggested Learning Resources:****Text Books:**

1. D Patranabis, "Sensors and Transducers", PHI Learning Private Limited, New Delhi – 110 001, Second Edition 2010

2. H. S. Kalsi, "Electronic Instrumentation", 3rd Edition, McGraw Hill, 2012

**Reference Books:**

1. David A. Bel "Electronic Instrumentation & Measurements", 2nd Edition, Oxford University Press PHI, 2006

**Web Links:**

<http://nptel.ac.in/courses>

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

1. Seminar on different types of sensors
2. Seminar on different measuring instruments

**CO-PO Mapping**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2							1	1					
CO2	3	2							1	1					
CO3	3	2							1	1					
CO4	3	2							1	1					
CO5	3	2							1	1					

High-3, Medium-2, Low-1

### III Semester

<b>COMPUTER ORGANIZATION AND ARCHITECTURE</b>			
<b>Course Code:</b>	22ECT306C	<b>CIE Marks:</b>	50
<b>Teaching Hours/Week (L:T:P:S):</b>	3:0:0:0	<b>SEE Marks:</b>	50
<b>Total Hours of Pedagogy:</b>	39	<b>Total Marks:</b>	100
<b>Credits:</b>	03	<b>Exam Hours:</b>	03hrs
<b>Course objectives:</b>			
1. Understand the meaning of basic structure of computers, and machine instructions and programs. 2. Analyze addressing modes and assembly language. 3. Compute the quantitative parameters for functions of input and output organization. 4. Associate the concepts of memory system 5. understanding the concept of simple processor organisation with two controls.			
<b>Module-1</b>			<b>00 hrs</b>
<b>Basic Structure of Computers:</b> Computer Types, Functional Units, Basic Operational Concepts, Bus Structures, Software, Performance – Processor Clock, Basic Performance Equation (upto 1.6.2 of Chap 1 of Text).			
<b>Machine Instructions and Programs:</b> Numbers, Arithmetic Operations and Characters, IEEE standard for Floating point Numbers, Memory Location and Addresses, Memory Operations, Instructions and Instruction Sequencing, (upto 2.4.6 of Chap 2 and 6.7.1 of Chap 6 of Text).			
<b>Teaching Learning Method:</b>	Chalk and talk method, Power point presentation		
<b>RBT Level:</b>	L1,L2,L3		
<b>Module-2</b>			<b>00 hrs</b>
Addressing Modes, Assembly Language, Basic Input and Output Operations, Stacks and Queues, Subroutines, Additional Instructions (from 2.4.7 of Chap 2, except 2.9.3, 2.11 & 2.12 of text).			
<b>Teaching Learning Method:</b>	Chalk and talk method, Power point presentation		
<b>RBT Level:</b>	L1,L2,L3		
<b>Module-3</b>			<b>00 hrs</b>
<b>Input/Output Organization:</b> Accessing I/O Devices, Interrupts – Interrupt Hardware, Enabling and Disabling Interrupts, Handling Multiple Devices, Controlling Device Requests, Direct Memory Access, (upto 4.2.4 and 4.4 except 4.4.1 of Chap 4 of text).			
<b>Teaching Learning Method:</b>	Chalk and talk method, Power point presentation		
<b>RBT Level:</b>	L1,L2,L3		
<b>Module-4</b>			<b>00 hrs</b>
<b>Memory System:</b> Basic Concepts, Semiconductor RAM Memories-Internal organization of memory chips, Static memories, Asynchronous DRAMS, Read Only Memories, Cash Memories, Virtual Memories, Secondary Storage-Magnetic Hard Disks (5.1, 5.2, 5.2.1, 5.2.2, 5.2.3, 5.3, 5.5 (except 5.5.1 to 5.5.4), 5.7 (except 5.7.1), 5.9, 5.9.1 of Chap 5 of Text).			
<b>Teaching Learning Method:</b>	Chalk and talk method, Power point presentation		
<b>RBT Level:</b>	L1,L2,L3		
<b>Module-5</b>			<b>00 hrs</b>
<b>Basic Processing Unit:</b> Some Fundamental Concepts, Execution of a Complete Instruction, Multiple Bus Organization, Hardwired Control, Microprogrammed Control (upto 7.5 except 7.5.1 to 7.5.6 of Chap 7 of Text).			
<b>Teaching Learning Method:</b>	Chalk and talk method, Power point presentation		
<b>RBT Level:</b>	L1,L2,L3		

**Course outcomes:****At the end of the course the student will be able to:****CO1.** Explain the basic organization of a computer system.**CO2.** Describe the addressing modes, instruction formats and program control statement.**CO3.** Explain different ways of accessing an input/ output device including interrupts.**CO4.** Illustrate the organization of different types of semiconductor secondary storage memories.**CO5.** Illustrate simple processor organization based on hardwired control and micro programmed control.**Suggested Learning Resources:****Text Books:****1:** Carl Hamacher, Zvonko Vranesic, Safwat Zaky: Computer Organization, 5th Edition, Tata McGraw Hill, 2002.**Reference Books (if required)****1:** David A. Patterson, John L. Hennessy: Computer Organization and Design – The Hardware / Software Interface ARM Edition, 4th Edition, Elsevier, 2009.**2:** William Stallings: Computer Organization & Architecture, 7th Edition, PHI, 2006.**3:** Vincent P. Heuring & Harry F. Jordan: Computer Systems Design and Architecture, 2nd Edition, Pearson Education, 2004.**Web Links:** <https://archive.nptel.ac.in/courses/106/105/106105163/>**Activity Based Learning (Suggested Activities in Class)/ Practical Based learning****Activity 1:** Programming Assignments / Mini Projects can be given**CO-PO Mapping**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2			2							1			
CO2	3	2			2							1			
CO3	3	2			2							1			
CO4	3	2		2	2							1			
CO5	3	2			3							1			

**High-3, Medium-2, Low-1**

<b>LIC (Linear Integrated Circuits) Lab using PSPICE</b>	
Course Code: <b>22ECL308A</b>	CIE Marks: <b>50</b>
Teaching Hours/Week (L:T:P: S): <b>0:0:2:0</b>	SEE Marks: <b>50</b>
Credits: <b>1</b>	Exam Hours: <b>100</b>
<p><b>Course objectives:</b></p> <ul style="list-style-type: none"> <li>• To gain hands on experience in designing LIC applications.</li> <li>• To learn simulation software used to simulate the circuits.</li> <li>• To learn fundamental principles of applications of linear integrated circuits.</li> <li>• To design the applications of linear integrated circuits for the given specifications.</li> </ul>	
<b>Experiments using PSPICE</b>	
<b>Sl. No</b>	NOTE: Every experiment has to be designed, circuit to be drawn / constructed and executed in the specified software. Results are also to be noted and inferred.
<i>Note: Standard design procedure to be adopted.</i>	
1	To realize using op-amp an Inverting Amplifier and Non-Inverting Amplifier
2	To realize using op-amps i) Summing Amplifier ii) Difference amplifier
3	To realize using op-amps an Instrumentation Amplifier
4	To realize using op-amps i) Differentiator ii) Integrator
5	To realize using op-amps a Full wave Precision Rectifier
6	To realize using op-amps i) Inverting and Non-Inverting Zero Crossing Detectors ii) Positive and Negative Voltage level detectors
7	To realize using op-amp an Inverting Schmitt Trigger
8	To realize using op-amp an Astable Multivibrator
9	To design and implement using op-amps i) Butterworth I & II order Low Pass Filter ii) Butterworth I & II order High Pass Filter

10	To design and implement using op-amp a RC Phase Shift Oscillator
11	To design and implement Mono-stable Multivibrator using 555 timer
12	To design and implement 4 - bit R-2R Digital to Analog Converter
<p><b>Course outcomes (Course Skill Set):</b></p> <p>After studying this course, students will be able to;</p> <p><b>CO1:</b> Sketch/draw schematics of linear integrated circuit applications.</p> <p><b>CO2:</b> Design the applications of LIC for the given specifications.</p> <p><b>CO3:</b> Demonstrate the fundamentals of linear integrated circuits and their applications using PSPICE tool.</p>	

### CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3							1	2	2			3	2	
CO2	3	3						1	2	2			3	2	
CO3	3	3			2			1	2	2			3	2	

**High-3, Medium-2, Low-1**

**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 2024-25**  
**(Applicable to 2023 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	T	P	S					
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									
<b>Total</b>									<b>500</b>	<b>400</b>	<b>900</b>	<b>19</b>	

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
<p><b>Professional Core Course (IPCC):</b> 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.</p> <p><b>National Service Scheme /Physical Education/Yoga:</b> 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.</p>			

## IV Semester

<b>ENGINEERING ELECTROMAGNETICS</b>			
<b>Course Code:</b>	22ECT401	<b>CIE Marks:</b>	50
<b>Teaching Hours/Week (L:T:P:S):</b>	3:0:0:0	<b>SEE Marks:</b>	50
<b>Total Hours of Pedagogy:</b>	40	<b>Total Marks:</b>	100
<b>Credits:</b>	03	<b>Exam Hours:</b>	03
<b>Course objectives:</b>			
<ol style="list-style-type: none"> <li>1. Understanding the concepts of vectors, electric fields for EM waves and to analyze and solve problems using coulomb's law, gauss law.</li> <li>2. Understanding the concepts of energy density, potential difference and capacitance.</li> <li>3. Understanding the Biot Savart law, Laplace and Poisson's equations and to acquire knowledge of their practical applications.</li> <li>4. Understanding the importance of Maxwell's equation and applying them for time varying fields.</li> <li>5. To understand the importance of wave propagation in free space &amp; dielectrics and applying them for time varying fields.</li> </ol>			
<b>Module-1</b>			<b>08 hrs</b>
<b>Electrostatics:</b> Coulomb's Law and electric field intensity, Field due to continuous volume charge distribution, Field of a line charge. Field of a sheet of charge. Electric flux density, Gauss' law and its applications. Divergence, Maxwell's First equation (Electrostatics), <b>TEXT 1</b>			
<b>Teaching Learning Method:</b>	Lecture-based learning and Group learning		
<b>RBT Level:</b>	L1, L2		
<b>Module-2</b>			<b>08 hrs</b>
<b>Energy and potential:</b> Energy expended in moving a point charge in an electric field, The line integral, Definition of potential difference and Potential, The potential field of a point charge, Potential gradient , Energy density in an electrostatic field. <b>TEXT 1</b>			
<b>Teaching Learning Method:</b>	Lecture-based learning and Group learning		
<b>RBT Level:</b>	L1, L2		
<b>Module-3</b>			<b>08 hrs</b>
<b>Poisson's and Laplace's equations:</b> Derivations of Poisson's and Laplace's Equations, Uniqueness theorem.			
<b>Steady magnetic field:</b> Biot-Savart law and its applications, Ampere's circuital law and its applications, magnetic flux and flux density <b>TEXT 1</b>			
<b>Teaching Learning Method:</b>	Lecture-based learning and Group learning		
<b>RBT Level:</b>	L1, L2		
<b>Module-4</b>			<b>08 hrs</b>
<b>Magnetic forces</b> - Force on a moving charge and differential current element, Force between differential current elements.			
<b>Maxwell's equations:</b> Inductance and examples, Faraday's law, Displacement current. Maxwell's equation in point and Integral form, Boundary conditions for perfect dielectric materials, magnetic boundary conditions. <b>TEXT 1</b>			
<b>Teaching Learning Method:</b>	Lecture-based learning and Group learning		
<b>RBT Level:</b>	L1, L2,L3		
<b>Module-5</b>			<b>08 hrs</b>
<b>Electromagnetic waves:</b> Wave propagation in free space and dielectrics, Propagation in good conductors – skin effect, Wave polarization, standing wave ratio. <b>TEXT 1</b>			

<b>Teaching Learning Method:</b>	Lecture-based learning and Group learning
<b>RBT Level:</b>	L1, L2, L4

**Course outcomes:**

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

- CO1. Able to define electrostatic field and its laws such as Coulomb’s law, Gauss’ law & Divergence.
- CO2. Able to understand energy expanded, potential difference, Potential gradient & Energy density in electrostatic field
- CO3. Able to apply and solve Ampere’s circuital law and apply Maxwell’s equations in wave propagation.
- CO4. Able to analyze magnetic forces and Maxwell’s equations.
- CO5. Able to understand propagation of waves in different medium with its fundamental concepts of skin effect and standing wave ratio .

**Suggested Learning Resources:**

**Text Books:**

1. William H Hayt Jr. and John A Buck, “Engineering Electromagnetics”, 8th edition, McGraw- Hill, 2012 Collin RE. Foundations for microwave engineering. John Wiley & Sons; 2007.
2. David K Cheng, “Field and Wave Electromagnetics”, 2nd edition, Pearson Education Asia, Indian Reprint – 2001 Annapurna Das, Sisir K Das, Microwave Engineering, TMH Publication, 2001

**Reference Books**

1. John Krauss and Daniel A Fleisch, “Electromagnetics with Applications”, 5th edition, McGraw-Hill, 1999 Microwave Devices and circuits- Liao / Pearson Education. 1992
2. Edward C. Jordan and Keith G Balmain,, “Electromagnetic Waves and Radiating Systems”, 2nd Edition, Prentice – Hall of India / Pearson Education, Reprint – 2002 M.Kulkarni., "Microwave devices and Radar Engg." Umesh Publications, 2011

**Web Links:**

1. [www.nptel.in](http://www.nptel.in)
2. [www.google.com](http://www.google.com) , david k cheng fields and waves electromagnetics pdf download
3. [www.google.com](http://www.google.com), william h hayt engineering electromagnetics pdf
4. [www.youtube.com/electromagneticsforengineers](http://www.youtube.com/electromagneticsforengineers)

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

**1:** Creating physical modules

**2:** Exploring new technologies and presenting

**CO-PO Mapping**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2												2	
CO2	3	3	2											2	
CO3	3	2	2											2	
CO4	3	3	2											2	
CO5	3	3	2										2	2	

**High-3, Medium-2, Low-1**

#### IV Semester

<b>PRINCIPLES OF COMMUNICATION SYSTEMS</b>			
<b>Course Code:</b>	22ECU402	<b>CIE Marks:</b>	50
<b>Teaching Hours/Week (L:T:P:S)</b>	3: 0: 2: 0	<b>SEE Marks:</b>	50
<b>Total Hours of Pedagogy:</b>	52	<b>Total Marks:</b>	100
<b>Credits:</b>	04	<b>Exam Hours:</b>	03
<b>Course objectives:</b>			
<ol style="list-style-type: none"> <li>1. Understand and analyse concepts of Analog Modulation schemes viz; AM, FM., Low pass sampling and Quantization as a random process.</li> <li>2. Understand and analyse concepts digitization of signals viz; sampling, quantizing and encoding.</li> <li>3. Evolve the concept of SNR in the presence of channel induced noise and study Demodulation of analog modulated signals.</li> <li>4. Evolve the concept of quantization noise for sampled and encoded signals and study the concepts of reconstruction from these samples at a receiver.</li> </ol>			
<b>Module-1</b>			<b>09 hrs</b>
<b>Amplitude Modulation:</b> Introduction, Amplitude Modulation: Time & Frequency Domain description, switching modulator, Envelop detector.			
<b>Double Side Band-Suppressed Carrier Modulation:</b> Time and Frequency Domain description, Ring modulator, Coherent detection, Costas Receiver, Quadrature Carrier Multiplexing.			
<b>SINGLE SIDE-Band and Vestigial Sideband Methods of Modulation:</b> SSB Modulation, VSB Modulation, Frequency Translation, Frequency Division Multiplexing.			
<b>Teaching Learning Method:</b>	Chalk and talk method, Power Point Presentation.		
<b>RBT Level:</b>	L1, L2, L3		
<b>Module-2</b>			<b>08 hrs</b>
<b>ANGLE MODULATION:</b> Basic definitions, Frequency Modulation: Narrow Band FM, Wide Band FM, Transmission bandwidth of FM Signals, Generation of FM Signals, Demodulation of FM Signals, FM Stereo Multiplexing, Phase- Locked Loop: Nonlinear model of PLL, Linear model of PLL. The Super Heterodyne Receiver.			
<b>Teaching Learning Method:</b>	Chalk and talk method, Power Point Presentation, YouTube videos.		
<b>RBT Level:</b>	L1, L2, L3		
<b>Module-3</b>			<b>08 hrs</b>
<b>NOISE:</b> Shot Noise, Thermal noise, White Noise, Noise Equivalent Bandwidth.			
<b>NOISE IN ANALOG MODULATION:</b> Introduction, Receiver Model, Noise in DSB-SC receivers. Noise in AM receivers, Threshold effect, Noise in FM receivers, Capture effect, FM threshold effect, FM threshold reduction, Pre-emphasis and De-emphasis in FM.			
<b>Teaching Learning Method:</b>	Chalk and talk method, Power Point Presentation, YouTube videos.		
<b>RBT Level:</b>	L1, L2, L3		
<b>Module-4</b>			<b>07 hrs</b>
<b>SAMPLING AND QUANTIZATION:</b> Introduction, Why Digitize Analog Sources? The Low Pass Sampling Process, Pulse Amplitude Modulation. Time Division Multiplexing, Pulse-Position Modulation, Generation of PPM Waves, Detection of PPM Waves.			
<b>Teaching Learning Method:</b>	Chalk and talk method, Power Point Presentation, YouTube videos.		
<b>RBT Level:</b>	L1, L2, L3		

<b>Module-5</b>		<b>07 hrs</b>
<b>SAMPLING AND QUANTIZATION (Contd):</b> The Quantization Random Process, Quantization Noise, Pulse–Code Modulation: Sampling, Quantization, Encoding, Regeneration, Decoding, Filtering, Multiplexing; Delta Modulation, Application examples - (a) Video + MPEG (Text1:7.11) and (b) Vocoders (refer Section 6.8 of Reference Book 1)		
<b>Teaching Learning Method:</b>		Chalk and talk method, Power Point Presentation, YouTube videos.
<b>RBT Level:</b>		L1, L2, L3
<b>PRACTICAL COMPONENT OF IPCC</b>		
Sl.No.	Experiments	
1	Generation and demodulation of Amplitude modulation (AM) wave.	
2	Generation and demodulation of Double side band suppressed carrier (DSB-SC) wave.	
3	Generation and demodulation of Frequency modulation (FM) wave.	
4	Phase locked loop Synthesis	
5	Generation and demodulation of Pulse Amplitude Modulation.	
6	Generation and demodulation of Pulse Position Modulation.	
7	Time division multiplexing of two band limited signals.	
8	Illustrate the process of sampling and reconstruction of low pass signals using Matlab.	
9	Illustration of Pulse Code Modulation using Matlab	
10	Illustration of Delta Modulation using Matlab.	
11	Noise in AM receiver using (Matlab/ Simulink/Scilab)	
12	Noise in FM receiver using (Matlab/ Simulink/Scilab)	
<p><b>Course outcomes:</b></p> <p><b>At the end of the course the student will be able to:</b></p> <p><b>CO1.</b> Understand the amplitude and frequency modulation techniques and analyze the perform time and frequency domain transformations.</p> <p><b>CO2.</b> Identify the schemes for amplitude and frequency modulation and demodulation of analog signals and compare the performance.</p> <p><b>CO3.</b> Characterize the influence of channel noise on analog modulated signals.</p> <p><b>CO4.</b> Understand the characteristics of pulse amplitude modulation, pulse position modulation and pulse code modulation systems.</p> <p><b>CO5.</b> Illustration of digital formatting representations used for Multiplexers, Vocoders and Video transmission.</p>		

**Suggested Learning Resources:****Text Books:**

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

2: Simon Haykins, An Introduction to Analog and Digital Communication, John Wiley India Pvt. Ltd., 2008, ISBN 978–81–265–3653–5.

**Reference Books:**

1: B P Lathi and Zhi Ding, Modern Digital and Analog Communication Systems, Oxford University Press., 4th edition, 2010, ISBN: 97801980738002.

2: H Taub & D L Schilling, Principles of Communication Systems, TMH, 2011.

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

- Quizzes
- Surprise Tests
- Assignments
- Seminars
- Micro Projects can be given to improve the skills

**CO-PO Mapping**

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PS02	PS03
C01	3	2	1					1	1	1		1	3	3	
C02	3	2	1					1	1	1		1	3	3	
C03	3	2	1					1	1	1		1	3	3	
C04	3	2	1					1	1	1		1	3	3	
C05	3	2	1					1	1	1		1	3	3	

High-3, Medium-2, Low-1

## IV Semester

<b>MODERN CONTROL SYSTEMS</b>			
<b>Course Code:</b>	22ECU403	<b>CIE Marks:</b>	50
<b>Teaching Hours/Week (L:T:P:S):</b>	2:2:2:0	<b>SEE Marks:</b>	50
<b>Total Hours of Pedagogy:</b>	52 Hours	<b>Total Marks:</b>	100
<b>Credits:</b>	4 ( 2:1:1)	<b>Exam Hours:</b>	03 Hrs
<b>Course objectives:</b>			
1. To familiarize the basic laws, source transformation, source shifting and network analysis techniques. 2. To understand the network theorems and their applications for the analysis of electrical circuits. 3. To understand the transient behaviour of electrical circuits using the initial conditions. 4. To Apply Laplace transforms for the analysis of electrical circuits. 5. To evaluate the two port network parameters for the electrical circuits.			
<b>Module-1</b>			<b>08 hrs</b>
<b>Introduction to Control Systems:</b> Open loop control system, Closed loop control system, Examples of Control System.			
<b>Mathematical Modelling:</b> Introduction, Differential equations of Physical Systems (Only Electrical and Mechanical Systems), Transfer function of Linear Systems, Analogous Systems.			
<b>Text Book1: 1.1, 1.3, 2.1, 2.2, 2.5.</b>			
<b>Teaching Learning Method:</b>	Chalk and Board, Problem Based Learning		
<b>RBT Level:</b>	L1, L2, L3, L4		
<b>Module-2</b>			<b>08 hrs</b>
<b>Block Diagrams:</b> Block Diagram Models, Block Diagram Reduction, Applications.			
<b>Signal Flow Graphs:</b> Signal-Flow Graph Models, Mason's Gain Formula, Applications.			
<b>State Variable Models:</b> Introduction, the state variables of a dynamic system, the state differential equation, signal flow graph and block diagram models, the transfer function from the state equation, the time response and the State Transition Matrix.			
<b>Text Book1: 2.6, 2.7, 3.1 to 3.4, 3.6, 3.7</b>			
<b>Teaching Learning Method:</b>	Chalk and Board, Problem Based Learning		
<b>RBT Level:</b>	L1, L2, L3, L4		
<b>Module-3</b>			<b>08 hrs</b>
<b>Transient and Steady-State Response Analysis:</b> Introduction, First-Order Systems, Second-Order Systems, Effects of Proportional, Integral and Derivative Control Actions on System Performance, Steady-State Errors in Unity-feedback Control Systems.			
<b>Text Book2: 5.1 to 5.3, 5.7, 5.8</b>			
<b>Teaching Learning Method:</b>	Chalk and Board, Problem Based Learning		
<b>RBT Level:</b>	L1, L2, L3, L4		
<b>Module-4</b>			<b>08 hrs</b>
<b>Stability of Control Systems:</b> Routh's Stability Criterion, Relative Stability.			
<b>Text Book2: 5.6.</b>			
<b>The Root-Locus Method:</b> Introduction, The Root Locus Concept, The Root Locus Procedure, Examples.			
<b>Text Book1: 7.1 to 7.3</b>			
<b>Teaching Learning Method:</b>	Chalk and Board, Problem Based Learning		

<b>RBT Level:</b>	L1, L2, L3, L4
<b>Module-5</b>	
<b>08 hrs</b>	
<b>Frequency Response Analysis:</b> Introduction, Correlation between Time and Frequency Response, Bode Plots, experimental determination of Transfer functions. <b>Text Book3: 8.1, 8.2, 8.4, 8.6</b>	
<b>Teaching Learning Method:</b>	Chalk and Board, Problem Based Learning
<b>RBT Level:</b>	L1, L2, L3, L4
<b>Modern Control Systems</b>	
<b>Integrated Laboratory Component</b>	
<b>12 hrs</b>	
<b>Experiments using PSPICE</b>	
<b>Sl. No</b>	NOTE: Every experiment has to be designed, necessary diagrams/plots to be drawn / constructed and executed in the specified software. Results are also to be noted and inferred.
<i>Note: Standard design procedure to be adopted.</i>	
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 2 <sup>nd</sup> order system.
4	Find the Time Response Specifications of unit step response of 2 <sup>nd</sup> order System.
5	Draw root locus using MATLAB
6	Draw BODE PLOTS using MATLAB
7	Study the effect of PI controller using MATLAB
8	Study the effect of PD controller using MATLAB
9	Study the effect of PID controller using MATLAB
10	Study of speed characteristics of DC motors using MATLAB.
<b>Course outcomes:</b> <b>At the end of the course the student will be able to:3</b> <b>CO1.</b> Obtain the mathematical model of control systems. <b>CO2.</b> Simplify the control systems using graphical methods and represent the given system in state space approach. <b>CO3.</b> Evaluate the system performance through time domain specifications and steady state error. <b>CO4.</b> Examine stability using Routh's Criterion and Root-Locus method. <b>CO5.</b> Evaluate the system performance in frequency domain.	

**Suggested Learning Resources:****Text Books:**

**1:** Modern Control Systems, Richard C. Dorf and Robert H. Bishop, Pearson, 13<sup>th</sup> Edition, 2017.

**2:** Modern Control Engineering, Katsuhiko Ogata, Prentice Hall, 5<sup>th</sup> Edition, 2010.

**3:** Control Systems Engineering, I J Nagrath and M Gopal, New Age International Publishers, 4<sup>th</sup> edition, 2006.

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

**Activity 1:** Quizzes

**Activity 2:** Seminars

**Activity 3:** Simulation using MATLAB

**Activity 4:** Case studies

**CO-PO Mapping**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	3	3											3		
<b>CO2</b>	3	3											3		
<b>CO3</b>	3	3											3		
<b>CO4</b>	3	3											3		
<b>CO5</b>	3	3											3		

**High-3, Medium-2, Low-1**

#### IV Semester

<b>COMMUNICATION LABORATORY</b>			
<b>Course Code:</b>	22ECL404	<b>CIE Marks:</b>	50
<b>Teaching Hours/Week (L:T:P:S)</b>	0: 0: 2: 0	<b>SEE Marks:</b>	50
<b>Total Hours of Pedagogy:</b>	13	<b>Total Marks:</b>	100
<b>Credits:</b>	1	<b>Exam Hours:</b>	3
<b>Course objectives:</b>			
<ol style="list-style-type: none"> <li>1. Demonstrate the Analog modulation techniques.</li> <li>2. Model an optical communication system and study its characteristics.</li> <li>3. Simulate the digital communication concepts and compute and display various parameters along with plots/figures</li> <li>4. Design, Demonstrate and Analyze filters using op-amp.</li> </ol>			
<b>Sl. No.</b>	<b>Experiments</b>		
	<b>Part –A discrete Experiments</b>		
1	Time division multiplexing and de-multiplexing using IC 8038		
2	Generation and detection of standard Amplitude modulation.		
3	Generation and detection of Pulse Amplitude modulation.		
4	Pre-Emphasis and De-Emphasis Circuits		
5	Coupling and bending loss in optical fiber communication.		
6	Attenuation loss and numerical aperture in optical communication.		
	<b>Part –B Simulation using Simulink</b>		
1	Design of active second order Butterworth low pass filter.		
2	Design of active second order Butterworth high pass filter.		
3	Design of active second order Butterworth Band pass filter.		
4	Design of active second order Butterworth Band elimination filter.		
5	Pulse Width Modulation and Demodulation		
6	Pulse Position Modulation and Demodulation		
<b>Course outcomes:</b>			
At the end of the course the student will be able to:			
CO1: Simulate the digital modulation schemes with the display of waveforms and computation of performance parameters. ·			
CO2: Design and test the analog/digital modulation circuits/systems and display the waveforms.			
CO3: Design and illustrate the operation of instrumentation amplifier, LPF, HPF, DAC and oscillators using linear IC.			

### CO-PO Mapping

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PS02	PS03
C01	3	3	2					1	1	1		1	3	3	
C02	3	3	2					1	1	1		1	3	3	
C03	3	3	2					1	1	1		1	3	3	
C04	3	3	2					1	1	1		1	3	3	
C05	3	3	2					1	1	1		1	3	3	

High-3, Medium-2, Low-1

#### IV Semester

<b>8051 MICROCONTROLLER</b>			
<b>Course Code:</b>	22ECT405A	<b>CIE Marks:</b>	50
<b>Teaching Hours/Week (L:T:P:S):</b>	3:0:0	<b>SEE Marks:</b>	50
<b>Total Hours of Pedagogy:</b>	40	<b>Total Marks:</b>	100
<b>Credits:</b>	03	<b>Exam Hours:</b>	03
<b>Course objectives:</b>			
<b>This course will enable students to:</b>			
<ul style="list-style-type: none"> <li>• Understand the difference between a microprocessor and a microcontroller and embedded microcontrollers.</li> <li>• Familiarize the basic architecture of 8051 micro controller.</li> <li>• Program 8051 microprocessor using Assembly Level Language and C.</li> <li>• Understand the interrupt system of 8051 and the use of interrupts.</li> <li>• Understand the operation and use of inbuilt Timers/Counters and the Serial port of 8051.</li> <li>• Interface 8051 to external memory and I/O devices using its I/O ports.</li> </ul>			
<b>Module-1</b>			<b>08 hrs</b>
8051 Microcontroller: Microprocessor Vs Microcontroller, Embedded Systems, Embedded Microcontrollers, 8051 Architecture- Registers, Pin diagram, I/O ports functions, Internal Memory organization. External Memory (ROM & RAM) interfacing.			
<b>Text2</b> : Chapter 1 section 1.1 to 1.3, chapter 3 sections 3.1 to 3.3			
<b>Teaching Learning Method:</b>	Chalk and talk method, Power Point Presentation,		
<b>RBT Level:</b>	L1, L2, L3		
<b>Module-2</b>			<b>08 hrs</b>
8051 Instruction Set: Addressing Modes, Data Transfer instructions, Arithmetic instructions, Logical instructions, Bit manipulation instructions. Simple Assembly language program examples (without loops) to use these instructions.			
<b>Text2</b> : Chapter 5 , chapter 6, chapter 7, chapter 8			
<b>Teaching Learning Method:</b>	Chalk and talk method, Power Point Presentation		
<b>RBT Level:</b>	L1, L2, L3		
<b>Module-3</b>			<b>08 hrs</b>
8051 Jump and Call instructions & Embedded C Jump and Call Instructions, Calls & Subroutine instructions. Assembly language program examples of subroutines and involving loops.			
8051 Programming in C: Data Types and Time delay in 8051 C, I/O programming in 8051 C, Logical Operations in C.			
<b>Text2</b> : chapter 8 section 8.1 to 8.4. <b>Text1</b> : chapter 7 section 7.1 to 7.3			
<b>Teaching Learning Method:</b>	Chalk and talk method, Power Point Presentation		
<b>RBT Level:</b>	L1, L2, L3		
<b>Module-4</b>			<b>08 hrs</b>
8051 Timers and Serial Port 8051 Timers and Counters – Operation and Assembly language programming to generate a pulse using Mode-1 and a square wave using Mode- 2 on a port pin.			
8051 Serial Communication- Basics of Serial Data Communication, RS- 232 standard, 9 pin RS232 signals, Simple Serial Port programming in Assembly and C to transmit a message and to receive data serially.			

**Text1:** Chapter 9 section 9.1 Chapter 10 section 10.1 to 10.5

**Teaching Learning Method:** Chalk and talk method, Power Point Presentation,  
**RBT Level:** L1, L2, L3

**Module-5** **08 hrs**

8051 Interrupts and Interfacing Applications.8051 Interrupts. 8051 Assembly language programming to generate an external interrupt using a switch, 8051 C programming to generate a square waveform on a port pin using a timer interrupt. Interfacing 8051 to ADC-0804, DAC, LCD and Stepper motor and their 8051 Assembly and C language interfacing programming.

**Text 1:** Chapter 11 section 11.1 and 11.2 Chapter 13 section 13.1 to 13.2, chapter 12 section 12.1, chapter 17 section 17.2

**Teaching Learning Method:** Chalk and talk method, Power Point Presentation  
**RBT Level:** L1, L2, L3

**Course outcomes:**

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

- CO1.** Explain the difference between Microprocessors & Microcontrollers, Architecture of 8051 Microcontroller, Interfacing of 8051 to external memory and instruction set of 8051.
- CO2.** Develop 8051 Assembly level programs using the 8051-instruction set.
- CO3.** Develop 8051 Assembly / C language program to generate timings and waveform using 8051 timers, to send & receive serial data using 8051 serial ports.
- CO4.** Develop 8051 Assembly / C language programs to generate square wave on 8051 I/O port pin using interrupt and C Programme to send & receive serial data using 8051 serial port.
- CO5.** Interface various peripheral devices to 8051 using I/O ports.

**Suggested Learning Resources:**

**Text Books:**

- 1: Kenneth J. Ayala,** “The 8051 Microcontroller”, Kenneth J Ayala, 3rd Edition, Thomson/Cengage Learning.
- 2: Muhammad Ali Mazidi, Janice Gillespie Mazidi and Rollin D. McKinlay,** “The 8051 Microcontroller and Embedded Systems – using assembly and C”, PHI, 2006 / Pearson, 2006.

**Reference Books:**

- 1.** “The 8051 Micro controller Based Embedded Systems”, Manish K Patel, McGraw Hill, 2014, ISBN: 978-93-329-0125-4.
- 2.** “Microcontrollers: Architecture, Programming, Interfacing and System Design”, Raj Kamal, Pearson Education, 2005.

**Web Links:** [https://swayam.gov.in/nd1\\_noc20\\_cs25](https://swayam.gov.in/nd1_noc20_cs25)

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

- 1:** Programming 8051 using Assembly and C programs.

**CO-PO Mapping**

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PS02	PS03
<b>CO1</b>	3	3							1					2	
<b>CO2</b>	3	3	2		1				1					2	
<b>CO3</b>	3	3	2		1				1					2	
<b>CO4</b>	3	3	2		1				1					2	
<b>CO5</b>	3	3	2		1				1					2	

**High-3, Medium-2, Low-1**

#### IV Semester

<b>POWER ELECTRONICS</b>			
<b>Course Code:</b>	22ECT405B	<b>CIE Marks:</b>	50
<b>Teaching Hours/Week (L:T:P:S):</b>	3:0:0:0	<b>SEE Marks:</b>	50
<b>Total Hours of Pedagogy:</b>	40	<b>Total Marks:</b>	100
<b>Credits:</b>	03	<b>Exam Hours:</b>	03
<b>Course objectives:</b>			
1. To get an overview of different types of power semi-conductor devices. 2. To understand the operation, characteristics of thyristors. 3. To Understand the fundamental principles of basic power electronic converters. 4. To describe the need and functions of different types of power electronics converters.			
<b>Module-1</b>			<b>08 hrs</b>
<b>INTRODUCTION:</b> Applications of power electronics, power semiconductor devices, control characteristics, types of power electronic circuits, peripheral effects			
<b>THYRISTORS:</b> Introduction, characteristics, two transistor model, turn-on and turn off methods, di/dt and dv/dt protection.			
<b>Teaching Learning Method:</b>	Chalk and talk method, Power Point Presentation,		
<b>RBT Level:</b>	L1, L2,L3		
<b>Module-2</b>			<b>08 hrs</b>
<b>COMMUTATION TECHNIQUES:</b> Introduction, natural commutation, forced commutation: self-commutation, impulse commutation, resonant pulse commutation and complementary commutation.			
<b>Teaching Learning Method:</b>	Chalk and talk method, Power Point Presentation,		
<b>RBT Level:</b>	L1,L2,L3		
<b>Module-3</b>			<b>08 hrs</b>
<b>AC VOLTAGE CONTROLLERS:</b> Introduction, principle of ON-OFF and phase control, single-phase bidirectional controllers with resistive loads.			
<b>CONTROLLED RECTIFIERS:</b> Introduction, principle of phase controlled converter operation, single-phase semi converters, full converters and dual converters			
<b>Teaching Learning Method:</b>	Chalk and talk method, Power Point Presentation,		
<b>RBT Level:</b>	L1,L2,L3		
<b>Module-4</b>			<b>08 hrs</b>
<b>DC CHOPPERS:</b> Introduction, principle of step-down operation, step-down chopper with RL loads, Principle of step-up operation, step-up chopper with Resistive load, performance parameters, Chopper classification (Class A to Class E).			
<b>Teaching Learning Method:</b>	Chalk and talk method, Power Point Presentation,		
<b>RBT Level:</b>	L1,L2,L3		
<b>Module-5</b>			<b>08 hrs</b>
<b>INVERTERS:</b> Introduction, principle of operation, performance parameters, single phase bridge inverters, Three phase inverters, voltage control of single phase inverters, current source inverter, principles of switched mode power supply (SMPS).			

<b>Teaching Learning Method:</b>	Chalk and talk method, Power Point Presentation,
<b>RBT Level:</b>	L1,L2,L3

**Course outcomes:**

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

CO1. To give an overview of applications power electronics, different types of power semiconductor devices, explain the construction, working and characteristics of SCR

CO2. To analyse different commutation techniques of SCR

CO3. To explain the analysis techniques, performance parameters and characteristics of controlled rectifiers and Voltage controllers

CO4. To explain the analysis techniques, performance parameters and characteristics of DC-to-DC converters

CO5. To explain the analysis techniques, performance parameters and characteristics of DC to AC converters

**Suggested Learning Resources:**

**Text Books:**

**1:** Ned Mohan, Tore M. Undeland, William P Robbins, “Power Electronics: Converters, Applications, and Design”, John Wiley and Sons Inc., New York, 2003.

**2:** Rashid M.H., “Power Electronics Circuits, Devices and Applications ”, Prentice Hall , India, New Delhi, 2004.

**3:** Joseph Vithayathil, e, “Power Electronics, Principles and Applications”, Tata McGraw-Hill Edition, 2010.

**Reference Books:**

**1:** Singh M.D., Khanchandani K B, “Power Electronics”, Tata McGraw Hill, 2nd Edition, New Delhi, 2007.

**2:** Dr.P.S.Bimbra., ”Power Electronics”, Khanna Publications, 3rd Edition, 2003.

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

**Activity 1:**

**Activity 2:**

**Activity 3:**

**CO-PO Mapping**

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PS02	PS03
C01	2	2											2	3	
C02	3	3											2	3	
C03	3	3											2	3	
C04	3	3											2	3	
C05	3	3											2	3	

**High-3, Medium-2, Low-1**

## IV Semester

<b>OPERATING SYSTEMS</b>			
<b>Course Code:</b>	22ECT405C	<b>CIE Marks:</b>	50
<b>Teaching Hours/Week (L:T:P:S):</b>	3: 0: 0: 0	<b>SEE Marks:</b>	50
<b>Total Hours of Pedagogy:</b>	39	<b>Total Marks:</b>	100
<b>Credits:</b>	03	<b>Exam Hours:</b>	03
<b>Course objectives:</b>			
This course will enable students to understand:			
<ol style="list-style-type: none"> <li>1. the history and types of operating systems.</li> <li>2. the design issues associated with operating systems development.</li> <li>3. the process management and scheduling of operating system.</li> <li>4. the concepts of memory management of operating system.</li> <li>5. the file and I/O operations of operating system.</li> </ol>			
<b>Module 1</b>			<b>07 hrs</b>
<b>INTRODUCTION:</b> Goals of an O.S, Operation of an O.S			
<b>OVERVIEW OF OPERATING SYSTEMS:</b> OS and computer system, Efficiency, system performance and user convenience, Classes of operating systems, O.S and the computer system, Batch processing system, Multi programming systems, Time sharing systems, Real time operating systems. <b>TEXT 1</b>			
<b>Teaching Learning Method:</b>	Chalk and Board, PowerPoint Presentation		
<b>RBT Level:</b>	L1, L2		
<b>Module 2</b>			<b>08 hrs</b>
<b>STRUCTURE OF THE OPERATING SYSTEMS:</b> Operation of an O.S, Structure of an operating system, Operating systems with monolithic structure, Layered design of an operating system, Virtual machine operating systems, Kernel based operating systems. <b>TEXT1</b>			
<b>Teaching Learning Method:</b>	Chalk and Board, PowerPoint Presentation		
<b>RBT Level:</b>	L1, L2, L3		
<b>Module 3</b>			<b>08 hrs</b>
<b>PROCESS MANAGEMENT:</b> Process and programs, Programmer view of processes, OS view of processes, Threads.			
<b>SCHEDULING:</b> Preliminaries, Non pre-emptive scheduling policies, pre-emptive scheduling policies, scheduling in practice. <b>TEXT 1</b>			
<b>Teaching Learning Method:</b>	Chalk and Board, Power Point Presentation		
<b>RBT Level:</b>	L1, L2, L3		
<b>Module 4</b>			<b>08 hrs</b>
<b>MEMORY MANAGEMENT:</b> Managing the memory hierarchy, static and dynamic memory allocations, memory allocation to a process, reuse of memory, contiguous and non contiguous memory allocation, paging, segmentation, segmentation with paging.			
<b>VIRTUAL MEMORY:</b> Virtual memory Basics, Demand paging, page replacement policies. <b>TEXT 1</b>			

<b>Teaching Learning Method:</b>	Chalk and Board, PowerPoint Presentation														
<b>RBT Level:</b>	L1, L2														
<b>Module 5</b>													<b>08 hrs</b>		
<b>FILE SYSTEMS: File system and IOCS, Files and file organization, Fundamentals of file organizations, Directory structures, File protection, Interface between file system and IOCS, Allocation of disk space. implementation of file access. TEXT 1</b>															
<b>Teaching Learning Method:</b>	Chalk and Board, Power Point Presentation														
<b>RBT Level:</b>	L1, L2														
<b>Course outcomes</b>															
CO1: Understand the evolution of operating systems and various types of operating systems in practice															
CO2: Analyse the structure of operating system.															
CO3: Analyse the concepts of process management and different scheduling management.															
CO4: Understand the design issues in memory management and virtual memory.															
CO5: Understand the file and I/O management techniques.															
<b>Suggested Learning Resources:</b>															
<b>Text Book:</b>															
1. D. M. Dhamdhare, "Operating Systems", Second Edition, TMH, 2008															
<b>Reference Books:</b>															
1. Stalling William, "Operating Systems", Sixth edition, Pearson Education,															
2. Avi Silberchatz, Peter Baer Galvin, Greg Gagne, "Operating system Concepts", Ninth edition, John wiley & Sons															
<b>Activity Based Learning (Suggested Activities in Class)/ Practical Based learning</b>															
1. Seminar on different types of Operating System.															
2. Problems on Scheduling Policies.															
3. Posters about Fundamental Functions of Operating System.															
<b>CO-PO Mapping</b>															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2		2								1			
CO2		2	2	2						2		2			
CO3	2	2	2			1	1					1			
CO4	2	2		2							1	1			
CO5	2	2									1	1			
<b>High-3, Medium-2, Low-1</b>															

#### IV Semester

<b>C++ Basics</b>			
<b>Course Code</b>	22ECL406A	<b>CIE Marks</b>	50
<b>Teaching Hours/Week (L: T:P: S)</b>	0:0:2:0	<b>SEE Marks</b>	50
<b>Credits</b>	01	<b>Exam Hours</b>	03
<b>Course objectives:</b>			
<ol style="list-style-type: none"> <li>1. Understand object-oriented programming concepts, and apply them in solving problems.</li> <li>2. To create, debug and run simple C++ programs.</li> <li>3. Introduce the concepts of functions, friend functions, inheritance, polymorphism and function overloading.</li> <li>4. Introduce the concepts of exception handling and multithreading.</li> </ol>			
<b>Sl. No</b>	<b>Experiments</b>		
1	Write a C++ program to find largest, smallest & second largest of three numbers using inline functions MAX & Min.		
2	Write a C++ program to calculate the volume of different geometric shapes like cube, cylinder and sphere using function overloading concept.		
3	Define a STUDENT class with USN, Name & Marks in 3 tests of a subject. Declare an array of 10 STUDENT objects. Using appropriate functions, find the average of the two better marks for each student. Print the USN, Name & the average marks of all the students.		
4	Write a C++ program to create class called MATRIX using two-dimensional array of integers, by overloading the operator == which checks the compatibility of two matrices to be added and subtracted. Perform the addition and subtraction by overloading + and – operators respectively. Display the results by overloading the operator <<. If (m1 == m2) then m3 = m1 + m2 and m4 = m1 – m2 else display error		
5	Demonstrate simple inheritance concept by creating a base class FATHER with data members: <i>First Name, Surname, DOB &amp; bank Balance</i> and creating a derived class SON, which inherits: Surname & Bank Balance feature from base class but provides its own feature: First Name & DOB. Create & initialize F1 & S1 objects with appropriate constructors & display the FATHER & SON details.		
6	Write a C++ program to define class name FATHER & SON that holds the income respectively. Calculate & display total income of a family using Friend function.		
7	Write a C++ program to accept the student detail such as name & 3 different marks by get_data() method & display the name & average of marks using display() method. Define a friend function for calculating the average marks using the method mark_avg().		
8	Write a C++ program to explain virtual function (Polymorphism) by creating a base class polygon which has virtual function areas two classes rectangle & triangle derived from polygon & they have area to calculate & return the area of rectangle & triangle respectively.		
9	Design, develop and execute a program in C++ based on the following requirements: An EMPLOYEE class containing data members & members functions: i) Data members: employee number (an integer), Employee_ Name (a string of characters), Basic_ Salary (in integer), All_ Allowances (an integer), Net_Salary (an integer). (ii) Member functions: To read the data of an employee, to calculate Net_Salary & to print the values of all the data members. (All_Allowances = 123% of Basic, Income Tax (IT) =30% of gross salary (=basic_ Salary_All_Allowances_IT).		
10	Write a C++ program with different class related through multiple inheritance & demonstrate the use of different access specified by means of members variables & members functions.		

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

**Suggested Learning Resources:**

1. Object oriented programming in TURBO C++, Robert Lafore, Galgotia Publications, 2002
2. The Complete Reference C++, Herbert Schildt, 4<sup>th</sup> Edition, Tata McGraw Hill, 2003.
3. Object Oriented Programming with C++, E Balaguruswamy, 4<sup>th</sup> Edition, Tata McGraw Hill, 2006.

**CO-PO Mapping**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2							1	1					
CO2	3	2							1	1					
CO3	3	2							1	1					
CO4	3	2							1	1					
CO5	3	2							1	1					

**High-3, Medium-2, Low-1**

**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 2024-25**  
(Applicable to 2022 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	S 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	ECE	3	0	0		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									
<b>Total</b>										<b>500</b>	<b>300</b>	<b>800</b>	<b>22</b>

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**

<b>22ECT505A</b>	<b>System Verilog for verification</b>	<b>22ECT505D</b>	<b>Multicore Architecture</b>
<b>22ECT505B</b>	<b>Artificial Intelligence</b>	<b>22ECT505E</b>	<b>Advanced Control Systems</b>
<b>22ECT505C</b>	<b>Fundamentals of Virtual Reality</b>	<b>22ECT505F</b>	<b>Programming with Python</b>

**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.

V Semester

<b>TECHNOLOGICAL INNOVATION MANAGEMENT AND ENTREPRENEURSHIP</b>			
<b>Course Code:</b>	22ECT501	<b>CIE Marks:</b>	50
<b>Teaching Hours/Week (L:T:P:S):</b>	3:0:2:0	<b>SEE Marks:</b>	50
<b>Total Hours of Pedagogy:</b>	52	<b>Total Marks:</b>	100
<b>Credits:</b>	04	<b>Exam Hours:</b>	03
<b>Course objectives:</b>			
<ol style="list-style-type: none"> <li>1. Understand basic skills of Management.</li> <li>2. Understand the need for Entrepreneurs and their skills.</li> <li>3. Identify the Management functions and Social responsibilities.</li> <li>4. Understand the Ideation Process, creation of Business Model.</li> </ol>			
<b>Module-1</b>			<b>08 hrs</b>
<p><b>Management:</b> Nature and Functions of Management- Importance, Definition, Management Functions, Levels of Management, Roles of Manager, Managerial Skills, Management &amp; Administration, Management as a Science, Art &amp; Profession (Selected topics of Chapter 1, Text 1).</p> <p><b>Planning:</b> Planning-Nature, Importance, Types, Steps and Limitations of Planning; Decision Making-Meaning, Types and Steps in Decision Making (Selected topics from Chapters 4 &amp; 5, Text 1). L1,L2</p>			
<b>Teaching Learning Method:</b>	Chalk and Talk, PowerPoint Presentation		
<b>RBT Level:</b>	L1, L2		
<b>Module-2</b>			<b>07 hrs</b>
<p><b>Organizing and Staffing:</b> 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 &amp; 11, Text 1).</p> <p><b>Directing and Controlling:</b> 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).</p>			
<b>Teaching Learning Method:</b>	Chalk and Talk, PowerPoint Presentation		
<b>RBT Level:</b>	L1, L2		
<b>Module-3</b>			<b>08 hrs</b>
<p><b>Social Responsibilities of Business:</b> 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).</p> <p><b>Entrepreneurship:</b> 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).</p>			

<b>Teaching Learning Method:</b>	Chalk and Talk, PowerPoint Presentation	
<b>RBT Level:</b>	L1, L2	
<b>Module-4</b>		<b>08 hrs</b>
<p><b>Family Business:</b> 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).</p> <p><b>Idea Generation and Feasibility Analysis-</b> Idea Generation; Creativity and Innovation; Identification of Business Opportunities; Market Entry Strategies; Marketing Feasibility. (Selected topics from Chapter 6(Page No. 111-117) &amp; Chapter 7(Page No. 140-142), Text 2)</p>		
<b>Teaching Learning Method:</b>	Chalk and Talk, Power point presentations	
<b>RBT Level:</b>	L1, L2	
<b>Module-5</b>		<b>08 hrs</b>
<p><b>Business model-</b> 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)</p>		
<b>Teaching Learning Method:</b>	Chalk and Talk, Power point presentations	
<b>RBT Level:</b>	<b>RBT Level:</b> L1, L2	
<p><b>Course outcomes:</b>  <b>At the end of the course the student will be able to:</b>  <b>CO 1.</b> Understand the fundamental concepts of Management and Entrepreneurship and opportunities in order to setup a business  <b>CO 2.</b> Identify the various organizations' architecture  <b>CO 3.</b> Describe the functions of Managers, Entrepreneurs and their social responsibilities  <b>CO 4.</b> Understand the components in developing a business plan  <b>CO 5.</b> Recognize the various sources of funding and institutions supporting entrepreneurs.</p>		
<p><b>Suggested Learning Resources:</b>  <b>Text Books:</b>  <b>1.</b> Principles of Management - P.C Tripathi, P.N Reddy, McGraw Hill Education, 11th Edition, 2017. ISBN-13:978-93-5260-5354.  <b>2.</b> Entrepreneurship Development Small Business Enterprises- Poomima MCharantimath, Pearson Education 2008, ISBN 978-81-7758-260-4.  <b>3.</b> Dynamics of Entrepreneurial Development and Management by Vasant Desai. HPH 2007, ISBN: 978-81-8488-801-2.  <b>4.</b> Robert D. Hisrich, Mathew J. Manimala, Michael P Peters and Dean A. Shepherd, "Entrepreneurship", 11th Edition, Tata Mc-Graw Hill Publishing Co.Ltd.- New Delhi, 2012</p>		
<p><b>Reference Books:</b>  <b>1.</b> Essentials of Management: An International, Innovation and Leadership perspective by Harold Koontz, Heinz Weihrich McGraw Hill Education, 10th Edition 2016. ISBN- 978-93-392-2286-4.</p>		
<p><b>Activity Based Learning (Suggested Activities in Class)/ Practical Based learning</b></p> <ul style="list-style-type: none"> <li>•</li> </ul>		

**CO-PO Mapping**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3

**High-3, Medium-2, Low-1**

## VI Semester

<b>ARM Microcontrollers</b>			
<b>Course Code:</b>	22ECU502	<b>CIE Marks:</b>	50
<b>Teaching Hours/Week (L: T:P:S):</b>	3:0:0:0	<b>SEE Marks:</b>	50
<b>Total Hours of Pedagogy:</b>	39	<b>Total Marks:</b>	100
<b>Credits:</b>	03	<b>Exam Hours:</b>	03
<b>Course objectives:</b>			
<ol style="list-style-type: none"> <li>1. to describe the architectural features and instructions of 32-bit microcontroller ARM Cortex M3.</li> <li>2. to Program ARM Cortex M3 for different applications.</li> <li>3. to analyse the Thumb instruction set and different C-Programming concepts.</li> <li>4. to describe Cortex M Architecture</li> <li>5. to program ARM Cortex M3/M4 MCUs:</li> </ol>			
<b>6. Module-1</b>			<b>07 hrs</b>
<b>ARM Embedded System:</b> RISC Design Philosophy, ARM design Philosophy, Embedded System hardware and Embedded System software.			
<b>ARM Processor Fundamentals:</b> Registers, Current Program Status Registers, Pipeline, Exceptions, Interrupts and the Vector table, Core Extensions, Architecture Revisions, ARM processor families.			
<b>Text 1</b>			
<b>Teaching Learning Method:</b>	Chalk and Talk, PowerPoint Presentation		
<b>RBT Level:</b>	L1, L2, L3		
<b>Module-2</b>			<b>07 hrs</b>
<b>Introduction to the ARM Instruction set:</b> Introduction, Data processing instructions, Load - Store instruction, Software interrupt instructions, Program status register instructions, Loading constants, ARMv5E extensions, Conditional Execution.			
<b>Text 1</b>			
<b>Teaching Learning Method:</b>	Chalk and Talk, PowerPoint Presentation		
<b>RBT Level:</b>	L1, L2, L3		
<b>Module-3</b>			<b>07 hrs</b>
<b>Introduction to the THUMB instruction set:</b> Introduction, THUMB register usage, ARM – THUMB interworking, other branch instructions, Data processing instructions, Stack instructions, Software interrupt instructions.			
<b>Efficient C Programming:</b> Overview of C Compilers and optimization, Basic C Data types, C looping structures.			
<b>Text 1</b>			
<b>Teaching Learning Method:</b>	Chalk and Talk, PowerPoint Presentation, YouTube videos		
<b>RBT Level:</b>	L1, L2, L3		
<b>Module-4</b>			<b>08 hrs</b>
<b>Cortex M Architecture:</b> 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.			
<b>Text 2</b>			
<b>Teaching Learning Method:</b>	Chalk and Talk, Power point presentations		
<b>RBT Level:</b>	L1, L2, L3		

<b>Module-5</b>		<b>10 hrs</b>
<b>ARM Cortex M3/M4 MCUs:</b> 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.		
<b>Text 3</b>		
<b>Teaching Learning Method:</b>	Chalk and Talk, Power point presentations	
<b>RBT Level:</b>	<b>RBT Level:</b> L1, L2, L3	
<b>PRACTICAL COMPONENT OF IPCC</b>		
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		
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	
<b>Demonstration Experiments (For CIE only not for SEE)</b>		
Conduct the following experiments on an ARM CORTEX M3 evaluation board using evaluation version of Embedded 'C' & Keil $\mu$ vision-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.	
<b>Course outcomes:</b>		
<b>At the end of the course the student will be able to:</b>		
<b>CO 1:</b> Describe the architectural features and instructions of 32-bit microcontroller ARM Cortex M3.		
<b>CO 2:</b> Apply the instruction set to Program ARM Cortex M3 for different applications.		
<b>CO 3:</b> Analyse Thumb Instruction set and C-Programming Concepts to Program ARM Cortex M3.		
<b>CO 4:</b> Analyse advantages, instructions set of Cortex M Architecture.		
<b>CO 5:</b> Program ARM Cortex M3/M4 MCUs for interfacing different sensors and actuators		
<b>Suggested Learning Resources:</b>		
<b>Text Books:</b>		
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.		
<b>Reference Books:</b>		
1. Reference manuals: STM32F411, LPC1768.		

### CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2												3	
CO2	3	2												3	
CO3	3	2												3	
CO4	3	2	2		2		1		1					3	
CO5	3	2	2		2		1		1					3	

**High-3, Medium-2, Low-1**

V Semester

<b>Digital Signal Processing</b>			
<b>Course Code:</b>	22ECU503	<b>CIE Marks:</b>	50
<b>Teaching Hours/Week (L: T:P:S):</b>	4:0:0:0	<b>SEE Marks:</b>	50
<b>Total Hours of Pedagogy:</b>	52	<b>Total Marks:</b>	100
<b>Credits:</b>	04	<b>Exam Hours:</b>	03
<b>Course objectives:</b>			
<ol style="list-style-type: none"> <li>1. To learn and understand Discrete Fourier Transforms, Fast Fourier Transforms, IIR filters , FIR filters and their structures</li> <li>2. To apply the concept of sampling theorem, DFT, FFT algorithms, IIR and FIR filters</li> <li>3. To illustrate the DFT, FFT algorithms, IIR and FIR filters</li> <li>4. To design the analog IIR, digital IIR and FIR filters</li> <li>5. To interpret the introduction to machine learning and classification</li> </ol>			
<b>Module-1</b>			<b>08 hrs</b>
<b>Discrete Fourier Transform (DFT) and its Properties:</b> 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.			
<b>TEXT 1 and TEXT 2</b>			
<b>Teaching Learning Method:</b>	Chalk and Talk, PowerPoint Presentation		
<b>RBT Level:</b>	L1, L2, L3		
<b>Module-2</b>			<b>07 hrs</b>
<b>Fast-Fourier-Transform (FFT) Algorithms:</b> 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.			
<b>TEXT 1</b>			
<b>Teaching Learning Method:</b>	Chalk and Talk, PowerPoint Presentation		
<b>RBT Level:</b>	L1, L2, L3		
<b>Module-3</b>			<b>07 hrs</b>
<b>IIR Filter Design:</b> Characteristics of commonly used analog filters – Butterworth and Chebyshev filters, analog to analog frequency transformation.			
<b>Design of IIR Digital filters from analog filters (Butterworth and Chebyshev Type):</b> Impulse Invariance method and Bilinear transformation method, Derivation and design problems.			
<b>TEXT 1</b>			
<b>Teaching Learning Method:</b>	Chalk and Talk, PowerPoint Presentation, YouTube videos		
<b>RBT Level:</b>	L1, L2, L3		
<b>Module-4</b>			<b>07 hrs</b>
<b>FIR Filter Design:</b>			
Introduction to FIR filters, Design of FIR filters using Rectangular, Hamming and Hanning windows.			
<b>TEXT 1 and TEXT 2</b>			
<b>Teaching Learning Method:</b>	Chalk and Talk, Power point presentations		
<b>RBT Level:</b>	L1, L2, L3		
<b>Module-5</b>			<b>10 hrs</b>

**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**

<b>Teaching Learning Method:</b>	Chalk and Talk, Power point presentations
<b>RBT Level:</b>	<b>RBT Level:</b> L1, L2, L3

**Course outcomes:**  
**At the end of the course the student will be able to:**  
**CO 1** - Define Discrete Fourier Transforms and their properties.  
**CO 2** - Analyse the digital signals using various digital transforms DFT, FFT  
**CO 3** - Apply design steps in Butterworth and Chebyshev Filter design  
**CO 4** - Apply different windowing techniques and analyze their performance  
**CO 5** - Theory behind machine learning and its classification

**Suggested Learning Resources:**

**Text Books:**

- 1. Proakis & Monalakis**, “Digital Signal Processing-Principles, Algorithms & Applications”, Fourth Edition, Pearson Education, New Delhi, 2009
- 2. Emmanuel C Ifeakor 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

**CO-PO Mapping**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	1	2								2	2	
CO2	3	2	3	1	2								2	2	
CO3	3	3	3	1	2								2	2	
CO4	3	2	3	1	2								2	2	
CO5	3	2	2	1	2								2	2	

**High-3, Medium-2, Low-1**

## V Semester

Digital Signal Processing Lab															
<b>Course Code</b>		22ECL504				<b>CIE Marks</b>		50							
<b>Teaching Hours/Week (L: T: P: S)</b>		0:0:2:0				<b>SEE Marks</b>		50							
<b>Credits</b>		01				<b>Exam Hours</b>		03							
<p><b>Course objectives:</b>            This laboratory course enables students to</p> <ol style="list-style-type: none"> <li>1. To analyze the sampling process, impulse response, convolution, frequency domain response of LTI systems</li> <li>2. To analyze and design of digital IIR and FIR filters</li> <li>3. To demonstrate the DSP algorithms using Matlab software</li> <li>4. To demonstrate the DSP algorithms using Code Composer Studio and DSP kit TMS320C6748</li> </ol>															
<b>Sl. No.</b>	<b>Experiments</b>														
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														
<b>Hardware programs using TMS320C6748 DSK</b>															
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.														
<p><b>Course outcomes (Course Skill Set):</b>            On the completion of this laboratory course, the students will be able to:</p> <p><b>CO1</b> Define and verify the sampling theorem, impulse response, convolution and frequency response of the system</p> <p><b>CO2</b> Understand basic algorithms of DSP</p> <p><b>CO3</b> Design an IIR and FIR digital filter</p> <p><b>CO4</b> Implementation of DSP algorithms using Matlab software and using Code Composer Studio (CCS) on DSP processor</p> <p><b>CO5</b> Conduction of DSP experiments on virtual laboratory</p>															
<b>CO-PO Mapping</b>															
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PS02	PS03
CO1	3	2	3	2									2	2	
CO2	3	2	3	2									2	2	
CO3	3	2	3	2									2	2	
CO4	3	2	3	2									2	2	
CO5	3	2	3	2									2	2	
<b>High-3, Medium-2, Low-1</b>															



V Semester

<b>SYSTEM VERILOG FOR VERIFICATION</b>			
<b>Course Code:</b>	22ECT505A	<b>CIE Marks:</b>	50
<b>Teaching Hours/Week (L:T:P:S):</b>	3:0:0:0	<b>SEE Marks:</b>	50
<b>Total Hours of Pedagogy:</b>	40	<b>Total Marks:</b>	100
<b>Credits:</b>	03	<b>Exam Hours:</b>	03
<b>Course objectives:</b>			
<ol style="list-style-type: none"> <li>1. Insight to apply System Verilog concepts to do synthesis, analysis and architecture design.</li> <li>2. Understanding of System Verilog and SVA for verification, and understand the improvements in verification efficiency.</li> <li>3. Analyze coverage driven verification for given design under test (DUT).</li> <li>4. Understand advanced verification features, such as the practical use of classes, randomization, checking, and coverage.</li> <li>5. Knowledge to communicate the purpose and results of a design experiment in written and oral presentations.</li> </ol>			
<b>Module-1</b>			<b>08 hrs</b>
<b>Verification Guidelines:</b> Introduction, Verification Process, Verification Plan, Verification Methodology Manual, Basic Test bench Functionality, Directed Testing, Methodology Basics, Constrained-Random Stimulus, Functional Coverage.			
<b>Text 1</b>			
<b>Teaching Learning Method:</b>	Chalk and Talk, PowerPoint Presentation		
<b>RBT Level:</b>	L1, L2, L3		
<b>Module-2</b>			<b>08 hrs</b>
<b>Data Types:</b> Built-in Data Types, Fixed-Size Arrays, Dynamic Arrays, Queues, Creating New Types with typedef, Creating User-Defined Structures, Enumerated Types, Constants, Strings.			
<b>Text 1</b>			
<b>Teaching Learning Method:</b>	Chalk and Talk, PowerPoint Presentation		
<b>RBT Level:</b>	L1, L2, L3		
<b>Module-3</b>			<b>08 hrs</b>
<b>Basic Object-Oriented Programming:</b> Where to Define a Class, OOP Terminology, Understanding Dynamic Objects.			
<b>System Verilog Assertions:</b> Types of Assertions and examples.			
<b>Text 1</b>			
<b>Teaching Learning Method:</b>	Chalk and Talk, PowerPoint Presentation, YouTube videos		
<b>RBT Level:</b>	L1, L2, L3		
<b>Module-4</b>			<b>08 hrs</b>
<b>Threads and Inter-process Communication:</b> 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.			
<b>Text 1 and Text 2</b>			

<b>Teaching Learning Method:</b>	Chalk and Talk, Powerpoint presentations
<b>RBT Level:</b>	L1, L2, L3

<b>Module-5</b>	<b>08 hrs</b>
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**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**

<b>Teaching Learning Method:</b>	Chalk and Talk, Powerpoint presentations
<b>RBT Level:</b>	<b>RBT Level:</b> L1, L2, L3

**Course outcomes:**  
**At the end of the course the student will be able to:**  
 CO1. Use System Verilog to create correct, efficient, and reusable models for digital designs.  
 CO2. Use System Verilog to create test benches for digital designs.  
 CO3. Understand and effectively exploit new constructs in System Verilog for verification.  
 CO4. Use of threads and inter-process communication for system Verilog.  
 CO5. Understand the process of formal verification.

**Text Book:**  
 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<sup>nd</sup> Edition, Springer.

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

Co-po Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		3	2	1											
CO2		2	2	1	1										
CO3		2	2	2	1										
CO4		3	2	2											
CO5		2	2	1											

High-3, Medium-2, Low-1



V Semester

<b>ARTIFICIAL INTELLIGENCE</b>			
<b>Course Code:</b>	22ECT505B	<b>CIE Marks:</b>	50
<b>Teaching Hours/Week (L: T:P:S):</b>	3:0:0:0	<b>SEE Marks:</b>	50
<b>Total Hours of Pedagogy:</b>	40	<b>Total Marks:</b>	100
<b>Credits:</b>	03	<b>Exam Hours:</b>	03
<b>Course objectives:</b>			
1. Identify the problems where AI is required and the different methods available 2. Compare and contrast different AI techniques available. 3. Define and explain learning algorithms			
<b>4. Module-1</b>			<b>08 hrs</b>
What is artificial intelligence?, Problems, Problem Spaces and search TextBook1: Ch 1, 2			
<b>Teaching Learning Method:</b>	Chalk and Talk, PowerPoint Presentation		
<b>RBT Level:</b>	L1, L2, L3		
<b>Module-2</b>			<b>08 hrs</b>
Knowledge Representation Issues, Using Predicate Logic, Representing knowledge using Rules, TextBook1: Ch 4, 5 and 6			
<b>Teaching Learning Method:</b>	Chalk and Talk, PowerPoint Presentation		
<b>RBT Level:</b>	L1, L2, L3		
<b>Module-3</b>			<b>08 hrs</b>
Symbolic Reasoning under Uncertainty, Statistical reasoning TextBook1: Ch 7, 8			
<b>Teaching Learning Method:</b>	Chalk and Talk, PowerPoint Presentation, YouTube videos		
<b>RBT Level:</b>	L1, L2, L3		
<b>Module-4</b>			<b>08 hrs</b>
Game Playing, Natural Language Processing TextBook1: Ch 12 and 15			
<b>Teaching Learning Method:</b>	Chalk and Talk, Power point presentations		
<b>RBT Level:</b>	L1, L2, L3		
<b>Module-5</b>			<b>08 hrs</b>
Learning, Expert Systems. TextBook1: Ch 17 and 20			
<b>Teaching Learning Method:</b>	Chalk and Talk, Power point presentations		
<b>RBT Level:</b>	<b>RBT Level:</b> L1, L2, L3		
<b>Course outcomes:</b>			
<b>At the end of the course the student will be able to:</b>			
CO1: Identify the AI based problems			
CO2: Apply techniques to solve the AI problems			
CO3: Define learning and explain various learning techniques			
CO4: Discuss on expert systems			
<b>Suggested Learning Resources:</b>			

**Text Books:**

1. E. Rich , K. Knight & S. B. Nair - Artificial Intelligence, 3/e, McGraw Hill.

**Reference Books:**

1. Artificial Intelligence: A Modern Approach, Stuart Rusell, Peter Norving, Pearson Education 2nd Edition.
2. Dan W. Patterson, Introduction to Artificial Intelligence and Expert Systems – Prentice Hal of India.
3. G. Luger, “Artificial Intelligence: Structures and Strategies for complex problem Solving”, Fourth Edition, Pearson Education, 2002.
4. Artificial Intelligence and Expert Systems Development by D W Rolston-Mc Graw hill.
5. N.P. Padhy “Artificial Intelligence and Intelligent Systems”, Oxford University Press-2015

**CO-PO Mapping**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1															
CO2															
CO3															
CO4															
CO5															

**High-3, Medium-2, Low-1**

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' - " • † ' „ Æ † ... - < ~ † • ā 1 Tobecomefamiliar with the basic concepts of virtual reality Technology and input devices 2 Tounderstandthe output devices. 3 Tostudytheconceptsof Modeling in virtual 4 Tounderstand the human factors in VR 5 Tobecome familiar with the applications of VR			
' † - Ž †			
INTRODUCTION: T K U H H , † V R I Y L U W X D O U H D O L f w e c l a s s i c c o m p l e t e n t s i n a VR system. Input Devices: 3D position trackers Tracker Performance Parameters Ultrasonic Trackers, Optical Trackers 1 D Y L J D W L R Q 0 D Q U L S X K N O ' 3 U R E H V 7 H   W E R R N			
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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 Convolution 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			
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MODELING : Geometric modeling Virtual Object Shape Kinematics modeling Homogeneous Transformation Matrices Physical modeling Collision Detection 7 H   W E R R N D Q G			
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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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APPLICATIONS: Medical applications, Education, arts and entertainment, Military applications, Robotics applications.  
 Text book 1: 8.18.2, 8.3 and 9.2

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Course outcomes:  
 At the end of the course the student will be able to:  
 CO1 Describe the basic concepts of virtual reality and input devices.  
 CO2 Compare the input and output devices  
 CO3 Use the virtual reality modeling techniques  
 CO4 Illustrate the human factors in virtual reality  
 CO5 Understanding and identifying the applications of virtual reality

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Suggested Learning Resources:  
 Text Books:  
 1: Virtual Reality Technology, Second Edition Gregory C. Burdea & Philippe Coiffet, John Wiley & Sons. 3<sup>rd</sup> edition 2024  
 2: Introduction to Virtual Reality, John Vince, Springer, London, Springer Verlag London Limited 2004  
 5 H I H U H Q F H % R R N V L I U H T X L U H G  
 1: Virtual Reality Systems. John Vince, Pearson Education, 2007  
 : H E / L Q K I W W S V G R L R U J - - - - -  
 www.nptelcoursematerial  
[www.youtube.com/virtual](http://www.youtube.com/virtual)  
[Introduction-Learning Virtual Reality \[Book\] \(oreilly.com\)](http://Introduction-Learning Virtual Reality [Book] (oreilly.com))  
<https://www.geeksforgeeks.org/virtual-reality-introduction>

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V Semester

<b>MULTICORE ARCHITECTURE</b>			
<b>Course Code:</b>	22ECT505D	<b>CIE Marks:</b>	50
<b>Teaching Hours/Week (L: T:P:S):</b>	3:0:0:0	<b>SEE Marks:</b>	50
<b>Total Hours of Pedagogy:</b>	39	<b>Total Marks:</b>	100
<b>Credits:</b>	03	<b>Exam Hours:</b>	03
<b>Course objectives:</b>			
<ol style="list-style-type: none"> <li>1. Provide the knowledge of Multi-core Architecture.</li> <li>2. Understand the importance of Threading in systems.</li> <li>3. Cover the Fundamental Concepts of Parallel Programming.</li> <li>4. Understand the Threading and Parallel Programming Constructs.</li> <li>5. Explain the different aspects of OpenMP in the context of threading.</li> </ol>			
<b>Module-1</b>			<b>08 hrs</b>
<b>Introduction to Multi-core Architecture:</b> 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.			
<b>Text 1</b>			
<b>Teaching Learning Method:</b>	Chalk and Talk, PowerPoint Presentation		
<b>RBT Level:</b>	L1, L2, L3		
<b>Module-2</b>			<b>07 hrs</b>
<b>System Overview of Threading:</b> 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.			
<b>Text 1</b>			
<b>Teaching Learning Method:</b>	Chalk and Talk, PowerPoint Presentation		
<b>RBT Level:</b>	L1, L2, L3		
<b>Module-3</b>			<b>07 hrs</b>
<b>Fundamental Concepts of Parallel Programming:</b> Designing for Threads, Task Decomposition, Data Decomposition, Data Flow Decomposition, Implications of Different Decompositions, and Challenges You will Face, Parallel Programming Patterns.			
<b>A Motivating Problem:</b> Error Diffusion, Analysis of the Error Diffusion Algorithm.			
<b>An Alternate Approach:</b> Parallel Error Diffusion, Other Alternatives.			
<b>Text 1</b>			
<b>Teaching Learning Method:</b>	Chalk and Talk, PowerPoint Presentation, YouTube videos		
<b>RBT Level:</b>	L1, L2, L3		
<b>Module-4</b>			<b>07 hrs</b>
<b>Threading and Parallel Programming Constructs:</b> Synchronization, Critical Sections, Deadlock, Synchronization Primitives, Semaphores, Locks, Condition Variables, Messages, Flow Control-based Concepts, Fence, Barrier, Implementation dependent Threading Features.			
<b>Text 1</b>			
<b>Teaching Learning Method:</b>	Chalk and Talk, Power point presentations		
<b>RBT Level:</b>	L1, L2, L3		

<b>Module-5</b>	<b>10 hrs</b>
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**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.

**Text 1**

<b>Teaching Learning Method:</b>	Chalk and Talk, Power point presentations
<b>RBT Level:</b>	<b>RBT Level:</b> L1, L2, L3

**Course outcomes:**

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

**CO 1** - Apply the knowledge of multi-core architectures to solve the parallel programming problems.

**CO 2** - Analyse the concept of threads creation, flow of threads among different cores of the CPU.

**CO 3** - Solve the different challenges of parallel programming.

**CO 4** - Apply the knowledge gained to solve different Parallel Programming Constructs.

**CO 5** - Create the threads to run on the multicore systems with the knowledge of OpenMP.

**Suggested Learning Resources:**

**Text Books:**

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.

**CO-PO Mapping**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	3	3	1	1	2										
<b>CO2</b>	3	2	2	1	2										
<b>CO3</b>	3	3	2	1	2										
<b>CO4</b>	3	2	2	1	2										
<b>CO5</b>	3	2	2	1	2										

**High-3, Medium-2, Low-1**

V Semester

<b>ADVANCED CONTROL SYSTEMS</b>			
<b>Course Code:</b>	<b>22ECT505E</b>	<b>CIE Marks:</b>	50
<b>Teaching Hours/Week (L:T:P:S):</b>	3:0:0:0	<b>SEE Marks:</b>	50
<b>Total Hours of Pedagogy:</b>	52 Hours	<b>Total Marks:</b>	100
<b>Credits:</b>	3 ( 3:0:0)	<b>Exam Hours:</b>	03 Hrs
<b>Course objectives:</b>			
<b>From this course, the students can learn</b>			
1. Basic concepts of state space representation and analysis. 2. Designing of state feedback controllers. 3. Analysing non-linear systems 4. Stability analysis of linear and non-linear systems.			
<b>Module-1</b>			
<b>State Variable Description (8 hours)</b>			
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.			
<b>Teaching Learning Method:</b>	Chalk and Board, Problem Based Learning		
<b>RBT Level:</b>	L1, L2, L3, L4		
<b>Module-2</b>			
<b>Solution of state equations (10 hours)</b>			
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.			
<b>Teaching Learning Method:</b>	Chalk and Board, Problem Based Learning		
<b>RBT Level:</b>	L1, L2, L3, L4		
<b>Module-3</b>			
<b>Controllability and observability (8 hours)</b>			
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.			
<b>Teaching Learning Method:</b>	Chalk and Board, Problem Based Learning		
<b>RBT Level:</b>	L1, L2, L3, L4		
<b>Module-4</b>			
<b>Stability (8 hours)</b>			
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.			
<b>Teaching Learning Method:</b>	Chalk and Board, Problem Based Learning		
<b>RBT Level:</b>	L1, L2, L3, L4		
<b>Module-5</b>			









































































































































































