Dr. AMBEDKAR INSTITUTE OF TECHNOLOGY

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

BDA Outer Ring Road, Mallathalli,Bengaluru-56

Board Of Studies 2023-24

Approved
Scheme and Syllabus of
III & IV Semester

For

2022 Batch

Submitted by

Department of Electronics and Communication Engineering

To

DEAN (Academic)

Dr. Ambedkar Institute of Technology, Bengaluru-560056
Outcome Based Education (OBE) and Choice Based Credit System
B.E. Name of the programme: Electronics and Communication Engineering
Tentative Scheme of Teaching and Examination effective from the Academic Year 2023-24
(Applicable to 2022 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: 1	0	0		01	50	50	100	1
					If a course is a laboratory: 0	0	2		02				
9	HS	22CDN309	Aptitude and Verbal Ability Skill-I	Placement Cell	2	0	0		--	50	--	50	PP/NP
10	MC	22NSN310	National Service Scheme (NSS)	NSS coordinator	0	0	2		--	100	---	100	PP/NP
		22PEN310	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		22YON310	Yoga	Yoga Teacher									
									Total	550	350	900	21

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **UHV**: Universal Human Value Course, **MC**: Mandatory Course (Non-credit), **AEC**: Ability Enhancement Course, **SEC**: Skill Enhancement Course, **L:** Lecture, **T**: Tutorial, **P**: Practical, S= Self-Study, **CIE**: Continuous Internal Evaluation, **SEE**:Semester End Evaluation. K: This letter in the course code indicates common to all the streams of Engineering. ESC: Engineering Science Course, ETC: Emerging Technology Course, PLC: Programming Language Course

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Engineering Science Course (ESC/ETC/PLC) 22ECT306x			
22ECT306A	**Signals and system**	**22ECT306C**	**Computer Organization and Architecture**
22ECT306B	**Sensors and Instrumentation**	**22ECT306D**	**Applied Numerical methods**
Ability Enhancement Course – III 22ECT308x OR 2ECL308x			
22ECL308A	**LICs Lab using PSPICE**	**22ECL308C**	**Digital Engineering Course (NASSCOM)**
22ECL308B	**Simulink Programming Basics**	**22ECL308D**	**IOT for Smart Infrastructure**

Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practical of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper.

National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), and Yoga(YOG) with the concerned coordinator of the course during the first Week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the Degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of Degree.

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

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory	Tutorial	Practical/ Drawing	Self - Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					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									
									Total	500	400	900	19

PCC: Professional Core Course, PCCL: Professional Core Course laboratory, UHV: Universal Human Value Course, MC: Mandatory Course (Non-credit), AEC: Ability Enhancement Course, SEC: Skill Enhancement Course, L: Lecture, T: Tutorial, P: Practical, S= Self-Study, CIE: Continuous Internal Evaluation, SEE: Semester End Evaluation. K : This letter in the course code indicates common to all the stream of engineering.

Engineering Science Course (ESC/ETC/PLC) 22ECT405x OR 22ECL405x			
22ECT405A	**8051 Microcontroller**	**22ECT405C**	**Operating Systems**
22ECT405B	**Power Electronics**	**22ECT405D**	**Engineering Statistics and Linear Algebra**
Ability Enhancement Course / Skill Enhancement Course – IV 22XXT405x OR 22XXL406x			
22ECL406A	**C++ Basics**	**22ECL406C**	**LabVIEW Programming**
22ECL406B	**Electronic Devices**	**22ECL406D**	**Risk Management in IOT Implementation**

Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practical of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper.

National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), and Yoga(YOG) with the concerned coordinator of the course during the first Week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the Degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses is mandatory for the award of Degree.

Assessment and Evaluation method

III Semester:

- **22ECU302- Digital System Design using Verilog** shall have the 03 hours of theory examination (SEE), however, practical sessions question shall be included in the theory question papers
- **22ECU303- Analog Electronic Circuits** shall have the 03 hours of theory examination), however, practical sessions question shall be included in the theory question papers.
- **ESC or ETC, of 03 credits Courses** shall have only a theory component (L: T :P:S=3:0:0:0) or if the nature the of course required practical learning then the syllabus shall be designed as an Integrated course (L: T:P:S= 2:0:2:0). All **PLC** courses are Integrated courses.
- **All 01 Credit** courses shall have the SEE of 02 hours duration and the pattern of the question paper shall be MCQ
- **Integrated courses (IPCC)** will have 50 marks CIE and 50 Marks SEE.
- **Non-integrated courses (PCC)** have 50 marks CIE (including 5 marks Assignment and 5 marks Group Activity) and 50 Marks SEE.

IV Semester:

- **22ECU402- Principles of Communication Systems** shall have the 03 hours of theory examination (SEE), however, practical sessions question shall be included in the theory question papers
- **22ECU403- Modern Control systems** shall have the 03 hours of theory examination), however, practical sessions question shall be included in the theory question papers.
- **ESC or ETC, of 03 credits Courses** shall have only a theory component (L: T :P:S=3:0:0:0) or if the nature the of course required practical learning then the syllabus shall be designed as an Integrated course (L: T:P:S= 2:0:2:0). All **PLC** courses are Integrated courses.
- **All 01 Credit-** courses shall have the SEE of 02 hours duration and the pattern of the question paper shall be MCQ
- **Integrated courses (IPCC)** will have 50 marks CIE and 50 Marks SEE.
- **Non-integrated courses (PCC)** have 50 marks CIE (including 5 marks Assignment and 5 marks Group Activity) and 50 Marks SEE.

III Semester

<table>
<tr><th colspan="4">DIGITAL SYSTEM DESIGN USING VERILOG</th></tr>
<tr><td>Course Code:</td><td>22ECU302</td><td>CIE Marks:</td><td>50</td></tr>
<tr><td>Teaching Hours/Week (L:T:P:S):</td><td>04</td><td>SEE Marks:</td><td>50</td></tr>
<tr><td>Total Hours of Pedagogy:</td><td>52</td><td>Total Marks:</td><td>100</td></tr>
<tr><td>Credits:</td><td>04</td><td>Exam Hours:</td><td>03</td></tr>
<tr><td colspan="4">Course objectives:
1. To impart the concepts of simplifying Boolean expression using K-map techniques and Quine-McCluskey minimization techniques.
2. To impart the concepts of designing and analyzing combinational logic circuits.
3. To impart design methods and analysis of sequential logic circuits.
4. To impart the concepts of Verilog HDL data flow and behavioural models for the design of digital systems.</td></tr>
<tr><td colspan="4">Module-1</td></tr>
<tr><td colspan="4">Principles of Combinational Logic: Definition of combinational logic, Canonical forms, Generation of switching equations from truth tables, Karnaugh maps- up to 4 variables, Quine-McCluskey Minimization Technique. Quine-McCluskey using Don’t Care Terms.
(Section 3.1 to 3.5 of Text 1).</td></tr>
<tr><td colspan="2">Teaching Learning Method:
RBT Level:</td><td colspan="2">Chalk and Talk, YouTube videos
L1, L2, L3</td></tr>
<tr><td colspan="4">Module-2</td></tr>
<tr><td colspan="4">Logic Design with MSI Components and Programmable Logic Devices : Binary Adders and Subtractors, Comparators, Decoders, Encoders, Multiplexers, Programmable Logic Devices (PLDs) (Section 5.1 to 5.7 of Text 2)</td></tr>
<tr><td colspan="2">Teaching Learning Method:
RBT Level:</td><td colspan="2">Chalk and Talk, YouTube videos
L1, L2, L3</td></tr>
<tr><td colspan="4">Module-3</td></tr>
<tr><td colspan="4">Flip-Flops and its Applications: The Master-Slave Flip-flops (Pulse-Triggered flip-flops): SR flip-flops, JK flip flops, Characteristic equations, Registers, Binary Ripple Counters, Synchronous Binary Counters, Counters based on Shift Registers, Design of Synchronous mod-n Counter using clocked T, JK, D and SR flip-flops. (Section 6.4, 6.6 to 6.9 (Excluding 6.9.3) of Text 2)</td></tr>
<tr><td colspan="2">Teaching Learning Method:
RBT Level:</td><td colspan="2">Chalk and Talk, YouTube videos
L1, L2, L3</td></tr>
<tr><td colspan="4">Module-4</td></tr>
<tr><td colspan="4">Introduction to Verilog: Typical Design Flow, Data types, Modules, Ports.
Verilog Data flow description: Continuous assignments, Delays, Expressions, Operators, and operands, operator types, Examples (Section1.3, 3.2, 6.1 to 6.5 of Text 3)</td></tr>
<tr><td colspan="2">Teaching Learning Method:
RBT Level:</td><td colspan="2">Chalk and Talk, YouTube videos, Programming assignments
L1, L2, L3</td></tr>
<tr><td colspan="4">Module-5</td></tr>
</table>

Verilog Behavioral description: Procedural Assignments, Conditional statements, Multiway branching, Loops, Examples. (Section 7.2, 7.4, 7.5, 7.6 and 7.9 of Text 3)
Verilog Structural description: Gate types, Examples. (Section 5,1 of Text 3) (Gate level description only)

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

PRACTICAL COMPONENT OF IPCC

Using suitable simulation software, demonstrate the operation of the following circuits

Sl. No.	Experiments
1	To simplify the given Boolean expressions and realize using Verilog program.
2	To realize Adder/Subtractor (Full/half) circuits using Verilog data flow description.
3	To realize 4-bit ALU using Verilog program.
4	To realize the following Code converters using Verilog Behavioral description a) a) Gray to binary and vice versa b) Binary to excess3 and vice versa
5	To realize using Verilog Behavioral description: 8:1 mux, 8:3 encoder, Priority encoder
6	To realize using Verilog Behavioral description: 1:8 Demux, 3:8 decoder, 2-bit Comparator
7	To realize using Verilog Behavioral description: Flip-flops: a) JK type b) SR type c) T type and d) D type
8	To realize Counters - up/down (BCD and binary) using Verilog Behavioral description.

Demonstration Experiments (For CIE only – not to be included for SEE)

Use FPGA/CPLD kits for downloading Verilog codes and check the output for interfacing experiments.

9	Verilog Program to interface a Stepper motor to the FPGA/CPLD and rotate the motor in thespecified direction (by N steps).
10	Verilog programs to interface a Relay or ADC to the FPGA/CPLD and demonstrate its working.
11	Verilog programs to interface DAC to the FPGA/CPLD for Waveform generation.
12	Verilog programs to interface Switches and LEDs to the FPGA/CPLD and demonstrate its working.

Course Outcomes

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

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

Suggested Learning Resources:

Text Books

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

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
CO1	3	1	1											2	
CO2	3	1	1											2	
CO3	3	1	1											2	
CO4	3	1	1											2	
CO5	3	1	1											2	

High-3, Medium-2, Low-1

III Semester

ANALOG ELECTRONIC CIRCUITS			
Course Code:	22ECU303	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	3:0:2:0	**SEE Marks:**	50
Total Hours of Pedagogy:	52	**Total Marks:**	100
Credits:	4	**Exam Hours:**	3

Course objectives: This course will enable students to

1. Explain various BJT parameters, connections and configurations.
2. Design and demonstrate the diode circuits and transistor amplifiers.
3. Explain various types of FET biasing and demonstrate the use of FET amplifiers.
4. Analyse Power amplifier circuits in different modes of operation.
5. Construct Feedback and Oscillator circuits using FET.

Module-1	**08 hrs**

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

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

MOSFETs: Biasing in MOS amplifier circuits: Fixing VGS, Fixing VG, Drain to Gate feedback resistor. Small signal operation and modeling: The DC bias point, signal current in drain, voltage gain, small signal equivalent circuit models, transconductance, **Text 1**

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

Module-2	**08 hrs**

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

MOSFET internal capacitances and High frequency model: The gate capacitive effect, Junction capacitances, High frequency model. Frequency response of the CS amplifier: The three frequency bands, high frequency response, Low frequency response.

Oscillators: FET based Phase shift oscillator, LC and Crystal Oscillators (no derivation) **Text 1**

Teaching Learning Method:	Chalk and talk method, Power Point Presentation. Self-study topics: Discrete Circuit MOS Amplifier – The common source amplifier and the source follower.
RBT Level:	L1, L2, L3

Module-3	**08 hrs**

Feedback Amplifier: General feedback structure, Properties of negative feedback, The Four Basic Feedback Topologies, The series-shunt, series-series, shunt-shunt and shunt-series amplifiers (Qualitative Analysis).

Output Stages and Power Amplifiers: Introduction, Classification of output stages, Class A output stage, Class B output stage: Transfer Characteristics, Power Dissipation, Power Conversion efficiency, Class AB output stage, Class C tuned Amplifier. **Text 1**

Teaching Learning Method:	Chalk and talk method, Power Point Presentation. Self-study topics: Class D power amplifier
RBT Level:	L1, L2, L3

Module-4	**08 hrs**

Op-Amp Circuits: Op-amp DC and AC Amplifiers, DAC – Weighted resistor and R-2R ladder, ADC-Successive approximation type, Small Signal half wave rectifier, Absolute value output circuit,
Active Filters, First and second order low-pass and high-pass Butterworth filters, Band-pass filters, Band reject filters. (no derivations only concepts) **Text 2**

Teaching Learning Method:	Chalk and talk method, Power Point Presentation. Self-study topics: Clippers and Clampers, Peak detector, Sample and hold circuit.
RBT Level:	L1, L2, L3

Module-5	**08 hrs**

555 Timer and its applications: Monostable and Astable Multivibrators.
Thyristors: Static Anode-Cathode characteristics and Gate characteristics of SCR, Turn-On methods, Turn-off Mechanism, Turn-Off Methods: Natural and Forced Commutation – Class A without design consideration. **Text 2, 3**

Teaching Learning Method:	Chalk and talk method, Power Point Presentation. Self-study topics: Basic Construction, working and applications of DIAC, TRIAC, IGBT, GTO.
RBT Level:	L1, L2, L3

PRACTICAL COMPONENT OF IPCC

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.

Course Outcomes:

After the completion of the Course the student can:

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.

Suggested Learning Resources:

Text Books:

1. Microelectronic Circuits, Theory and Applications, Adel S Sedra, Kenneth C Smith, 6th 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:978-0-07-063424-4Reference Books (if required)

Web Links:

1. 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

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

High-3, Medium-2, Low-1

III Semester

NETWORK ANALYSIS			
Course Code:	22ECT304	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	2:2:0:0	**SEE Marks:**	50
Total Hours of Pedagogy:	52 Hours	**Total Marks:**	100
Credits:	3 (2:1:0)	**Exam Hours:**	03 Hrs

Course objectives:

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.

Module-1	**11 hrs**
Introduction: 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. **Methods of Analysis**: 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. **Text Book: 2.1 to 2.7, 4.4, 6.3, 6.5, 3.1 to 3.7, 10.1 to 10.3.**	
Teaching Learning Method: **RBT Level:**	Chalk and Board, Problem Based Learning L1, L2, L3, L4

Module-2	**10 hrs**
Circuit Theorems: Linearity Property, Superposition, Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer theorem. **Resonance**: Series resonance and parallel resonance **Text Book: 4.2,4.3, 4.5, 4.6, 10.4, 10.6, 14.5, 14.6.**	
Teaching Learning Method: **RBT Level:**	Chalk and Board, Problem Based Learning L1, L2, L3, L4

Module-3	**11 hrs**
Transient Behaviour and Initial Conditions: 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. **Text Book: 7.1 to 7.6, 8.1, 8.2**	
Teaching Learning Method: **RBT Level:**	Chalk and Board, Problem Based Learning L1, L2, L3, L4

Module-4	**10 hrs**
Laplace Transforms: Introduction, Definition of the Laplace Transform, Properties of Laplace Transform, Circuit Element Models, and Circuit Analysis using Laplace Transforms. **Text Book: 15.1 to 15.3, 16.1 to 16.3**	
Teaching Learning Method: **RBT Level:**	Chalk and Board, Problem Based Learning L1, L2, L3, L4

Module-5	10 hrs
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**	
Teaching Learning Method:	Chalk and Board, Problem Based Learning
RBT Level:	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
CO1	3	3											3		
CO2	3	3											3		
CO3	3	3											3		
CO4	3	3											3		
CO5	2	2											3		

High-3, Medium-2, Low-1

III Semester

ANALOG AND DIGITAL ELECTRONICS LAB			
Course Code:	22ECL305	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	0:0:2:0	**SEE Marks:**	50
Total Hours of Pedagogy:		**Total Marks:**	100
Credits:	**01**	**Exam Hours:**	03

Course objectives:

This laboratory course enables student to:

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

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

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

High-3, Medium-2, Low-1

III Semester

SIGNALS AND SYSTEM			
Course Code:	22ECT306A	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	3:0:0:0	**SEE Marks:**	50
Total Hours of Pedagogy:	40	**Total Marks:**	100
Credits:	03	**Exam Hours:**	3

Course objectives:

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.

Module-1	**08 Hrs**
Introduction: 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). **Properties of System:** Linear-nonlinear, Time variant-invariant, causal-noncausal, memory-memoryless, stable-unstable.	
Teaching Learning Method:	Chalk and Talk, power point presentation, animations, videos
RBT Level:	L1, L2
Module-2	**08 Hrs**
Time domain representations for Linear Time Invariant Systems: 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.	
Teaching Learning Method:	Chalk and Talk, power point presentation, animations, videos
RBT Level:	L1, L2, L3, L4
Module-3	**08 Hrs**
Fourier representations of signals: 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)	
Teaching Learning Method:	Chalk and Talk, power point presentation, animations, videos
RBT Level:	L1, L2, L3, L4
Module-4	**08 Hrs**
Properties of Fourier Transform: Linearity, Symmetry, Time shift, Frequency shift, Scaling, Differentiation and Integration, Convolution and Modulation, Parsevals relationships and Duality. (Statement and Proof) **Applications of Fourier Representations:** Introduction, Frequency response of LTI system, Fourier Transform representations for periodic signals Sampling-Sampling continuous time signals.	
Teaching Learning Method:	Chalk and Talk, power point presentation, animations, videos
RBT Level:	L1, L2, L3, L4
Module-5	**08 Hrs**

The Z-Transforms: Introduction, the Z transform, properties of the region of convergence, properties of the Z-Transform, Inverse of the Z-transform.	
Teaching Learning Method:	Chalk and Talk, power point presentation, animations, videos
RBT Level:	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", 2nd 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

SENSORS AND INSTRUMENTATION			
Course Code:	22ECT306B	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	3:0:0:0	**SEE Marks:**	50
Total Hours of Pedagogy:	39	**Total Marks:**	100
Credits:	03	**Exam Hours:**	03

Course objectives:

This course will enable students to understand:

1. Operation principle, characteristics, classification of different sensors
2. types of errors in measurement and the operation of different Transducers
3. working of Multirange Ammeters, Voltmeters and Multimeters.
4. principle of operation of digital measuring instruments and Bridges.

Module-1	**08 hrs**
INTRODUCTION: introduction to sensors/transducers. principles, classification, parameters, Environmental parameters, Characterization. **MECHANICAL AND ELECTROMECHANICAL SENSORS:** Introduction, resistive potentiometer, Strain gauge, Inductive sensors, capacitive sensors, Force/stress sensors using Quartz Resonators, Ultrasonic sensors. **TEXT 1**	
Teaching Learning Method:	Chalk and talk method, PowerPoint Presentation
RBT Level:	L1, L2, L3

Module-2	**07 hrs**
THERMAL SENSORS: 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. **TEXT 1**	
Teaching Learning Method:	Chalk and talk method, PowerPoint Presentation
RBT Level:	L1, L2, L3

Module-3	**08 hrs**
MAGNETIC SENSORS: 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. **TEXT 1**	
Teaching Learning Method:	Chalk and talk method, PowerPoint Presentation
RBT Level:	L1, L2, L3

Module-4	**08 hrs**
Principles of Measurement: 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. **TEXT 2**	
Teaching Learning Method:	Chalk and talk method, PowerPoint Presentation
RBT Level:	L1, L2, L3

Module-5	**08 hrs**
Digital Instruments: 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. **TEXT 2**	
Teaching Learning Method:	Chalk and talk method, PowerPoint Presentation
RBT Level:	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

COMPUTER ORGANIZATION AND ARCHITECTURE			
Course Code:	22ECT306C	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	3:0:0:0	**SEE Marks:**	50
Total Hours of Pedagogy:	39	**Total Marks:**	100
Credits:	03	**Exam Hours:**	03hrs

Course objectives:

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.

Module-1	**00 hrs**

Basic Structure of Computers: 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).

Machine Instructions and Programs: 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).

Teaching Learning Method:	Chalk and talk method, Power point presentation
RBT Level:	L1,L2,L3

Module-2	**00 hrs**

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).

Teaching Learning Method:	Chalk and talk method, Power point presentation
RBT Level:	L1,L2,L3

Module-3	**00 hrs**

Input/Output Organization: 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).

Teaching Learning Method:	Chalk and talk method, Power point presentation
RBT Level:	L1,L2,L3

Module-4	**00 hrs**

Memory System: 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).

Teaching Learning Method:	Chalk and talk method, Power point presentation
RBT Level:	L1,L2,L3

Module-5	**00 hrs**

Basic Processing Unit: 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).

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 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

LIC (Linear Integrated Circuits) Lab using PSPICE	
Course Code: **22ECL308A**	CIE Marks:**50**
Teaching Hours/Week (L:T:P: S): **0:0:2:0**	SEE Marks:**50**
Credits: **1**	Exam Hours:**100**

Course objectives:

- To gain hands on experience in designing LIC applications.
- To learn simulation software used to simulate the circuits.
- To learn fundamental principles of applications of linear integrated circuits.
- To design the applications of linear integrated circuits for the given specifications.

Sl. No	Experiments using PSPICE NOTE: Every experiment has to be designed, circuit to be drawn / constructed and executed in thespecified software. Results are also to be noted and inferred.
	Note: Standard design procedure to be adopted.
1	To realize using op-amp an Inverting Amplifier and Non-Inverting Amplifier
2	To realize using op-amps i) Summing Amplifier ii)Difference amplifier
3	To realize using op-amps an Instrumentation Amplifier
4	To realize using op-amps i) Differentiator ii)Integrator
5	To realize using op-amps a Full wave Precision Rectifier
6	To realize using op-amps 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

Course outcomes (Course Skill Set):

After studying this course, students will be able to;

CO1: Sketch/draw schematics of linear integrated circuit applications.

CO2: Design the applications of LIC for the given specifications.

CO3: Demonstrate the fundamentals of linear integrated circuits and their applications using PSPICE tool.

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

IV Semester

ENGINEERING ELECTROMAGNETICS			
Course Code:	22ECT401	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	3:0:0:0	**SEE Marks:**	50
Total Hours of Pedagogy:	40	**Total Marks:**	100
Credits:	03	**Exam Hours:**	03

Course objectives:

1. Understanding the concepts of vectors, electric fields for EM waves and to analyze and solve problems using coulomb's law, gauss law.
2. Understanding the concepts of energy density, potential difference and capacitance.
3. Understanding the Biot Savart law, Laplace and Poisson's equations and to acquire knowledge of their practical applications.
4. Understanding the importance of Maxwell's equation and applying them for time varying fields.
5. To understand the importance of wave propagation in free space & dielectrics and applying them for time varying fields.

Module-1	**08 hrs**
Electrostatics: 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), **TEXT 1**	
Teaching Learning Method: Lecture-based learning and Group learning **RBT Level:** L1, L2	
Module-2	**08 hrs**
Energy and potential: 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. **TEXT 1**	
Teaching Learning Method: Lecture-based learning and Group learning **RBT Level:** L1, L2	
Module-3	**08 hrs**
Poisson's and Laplace's equations: Derivations of Poisson's and Laplace's Equations, Uniqueness theorem. **Steady magnetic field:** Biot-Savart law and its applications, Ampere's circuital law and its applications, magnetic flux and flux density **TEXT 1**	
Teaching Learning Method: Lecture-based learning and Group learning **RBT Level:** L1, L2	
Module-4	**08 hrs**
Magnetic forces - Force on a moving charge and differential current element, Force between differential current elements. **Maxwell's equations:** 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. **TEXT 1**	
Teaching Learning Method: Lecture-based learning and Group learning **RBT Level:** L1, L2,L3	
Module-5	**08 hrs**
Electromagnetic waves: Wave propagation in free space and dielectrics, Propagation in good conductors – skin effect, Wave polarization, standing wave ratio. **TEXT 1**	

Teaching Learning Method:	Lecture-based learning and Group learning
RBT Level:	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, 2012Collin RE. Foundations for microwave engineering. John Wiley & Sons; 2007.
2. David K Cheng, "Field and Wave Electromagnetics", 2nd edition, Pearson Education Asia, Indian Reprint – 2001Annapurna 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, 1999Microwave 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
2.www.google.com , david k cheng fields and waves electromagnetics pdf download
3.www.google.com, william h hayt engineering electromagnetics pdf
4.www.youtube/electromagnaticsforengineers

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

PRINCIPLES OF COMMUNICATION SYSTEMS			
Course Code:	22ECU402	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S)	3: 0: 2: 0	**SEE Marks:**	50
Total Hours of Pedagogy:	52	**Total Marks:**	100
Credits:	04	**Exam Hours:**	03

Course objectives:

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

Module-1	**09 hrs**
Amplitude Modulation: Introduction, Amplitude Modulation: Time & Frequency Domain description, switching modulator, Envelop detector. **Double Side Band-Suppressed Carrier Modulation:** Time and Frequency Domain description, Ring modulator, Coherent detection, Costas Receiver, Quadrature Carrier Multiplexing. **SINGLE SIDE–Band and Vestigial Sideband Methods of Modulation:** SSB Modulation, VSB Modulation, Frequency Translation, Frequency Division Multiplexing.	
Teaching Learning Method: Chalk and talk method, Power Point Presentation. **RBT Level:** L1, L2, L3	
Module-2	**08 hrs**
ANGLE MODULATION: Basic definitions, Frequency Modulation: Narrow Band FM, Wide Band FM, Transmission bandwidth of FM Signals, Generation of FM Signals, Demodulation of FM Signals, FM Stereo Multiplexing, Phase– Locked Loop: Nonlinear model of PLL, Linear model of PLL. The Super Heterodyne Receiver.	
Teaching Learning Method: Chalk and talk method, Power Point Presentation, YouTube videos. **RBT Level:** L1, L2, L3	
Module-3	**08 hrs**
NOISE: Shot Noise, Thermal noise, White Noise, Noise Equivalent Bandwidth. **NOISE IN ANALOG MODULATION:** Introduction, Receiver Model, Noise in DSB-SC receivers. Noise in AM receivers, Threshold effect, Noise in FM receivers, Capture effect, FM threshold effect, FM threshold reduction, Pre-emphasis and De-emphasis in FM.	
Teaching Learning Method: Chalk and talk method, Power Point Presentation, YouTube videos. **RBT Level:** L1, L2, L3	
Module-4	**07 hrs**
SAMPLING AND QUANTIZATION: Introduction, Why Digitize Analog Sources? The Low Pass Sampling Process, Pulse Amplitude Modulation. Time Division Multiplexing, Pulse-Position Modulation, Generation of PPM Waves, Detection of PPM Waves.	
Teaching Learning Method: Chalk and talk method, Power Point Presentation, YouTube videos. **RBT Level:** L1, L2, L3	

Module-5	07 hrs
SAMPLING AND QUANTIZATION (Contd): 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)	
Teaching Learning Method:	Chalk and talk method, Power Point Presentation, YouTube videos.
RBT Level:	L1, L2, L3

PRACTICAL COMPONENT OF IPCC	
Sl.No.	**Experiments**
1	Generation and demodulation of Amplitude modulation (AM) wave.
2	Generation and demodulation of Double side band supressed 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)

Course outcomes:

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

CO1. Understand the amplitude and frequency modulation techniques and analyze the perform time and frequency domain transformations.

CO2. Identify the schemes for amplitude and frequency modulation and demodulation of analog signals and compare the performance.

CO3. Characterize the influence of channel noise on analog modulated signals.

CO4. Understand the characteristics of pulse amplitude modulation, pulse position modulation and pulse code modulation systems.

CO5. Illustration of digital formatting representations used for Multiplexers, Vocoders and Video transmission.

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

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

High-3, Medium-2, Low-1

IV Semester

MODERN CONTROL SYSTEMS			
Course Code:	22ECU403	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	2:2:2:0	**SEE Marks:**	50
Total Hours of Pedagogy:	52 Hours	**Total Marks:**	100
Credits:	4 (2:1:1)	**Exam Hours:**	03 Hrs

Course objectives:

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.

Module-1	**08 hrs**
Introduction to Control Systems: Open loop control system, Closed loop control system, Examples of Control System. **Mathematical Modelling:** Introduction, Differential equations of Physical Systems (Only Electrical and Mechanical Systems), Transfer function of Linear Systems, Analogous Systems. **Text Book1: 1.1, 1.3, 2.1, 2.2, 2.5.**	
Teaching Learning Method: **RBT Level:**	Chalk and Board, Problem Based Learning L1, L2, L3, L4
Module-2	**08 hrs**
Block Diagrams: Block Diagram Models, Block Diagram Reduction, Applications. **Signal Flow Graphs**: Signal-Flow Graph Models, Mason's Gain Formula, Applications. **State Variable Models:** 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. **Text Book1: 2.6, 2.7, 3.1 to 3.4, 3.6, 3.7**	
Teaching Learning Method: **RBT Level:**	Chalk and Board, Problem Based Learning L1, L2, L3, L4
Module-3	**08 hrs**
Transient and Steady-State Response Analysis: 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. **Text Book2: 5.1 to 5.3, 5.7, 5.8**	
Teaching Learning Method: **RBT Level:**	Chalk and Board, Problem Based Learning L1, L2, L3, L4
Module-4	**08 hrs**
Stability of Control Systems: Routh's Stability Criterion, Relative Stability. **Text Book2: 5.6.** **The Root-Locus Method:** Introduction, The Root Locus Concept, The Root Locus Procedure, Examples. **Text Book1: 7.1 to 7.3**	
Teaching Learning Method:	Chalk and Board, Problem Based Learning

RBT Level:	L1, L2, L3, L4

Module-5	**08 hrs**

Frequency Response Analysis: Introduction, Correlation between Time and Frequency Response, Bode Plots, experimental determination of Transfer functions.

Text Book3: 8.1, 8.2, 8.4, 8.6

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

Modern Control Systems **Integrated Laboratory Component**	**12 hrs**

Sl. No	**Experiments using PSPICE** NOTE: Every experiment has to be designed, necessary diagrams/plots to be drawn / constructed and executed in thespecified software. Results are also to be noted and inferred.
	Note: Standard design procedure to be adopted.
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^{nd} order system.
4	Find the Time Response Specifications of unit step response of 2^{nd} 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.

Course outcomes:

At the end of the course the student will be able to:.3

CO1. Obtain the mathematical model of control systems.

CO2. Simplify the control systems using graphical methods and represent the given system in state space approach.

CO3. Evaluate the system performance through time domain specifications and steady state error.

CO4. Examine stability using Routh's Criterion and Root-Locus method.

CO5. Evaluate the system performance in frequency domain.

Suggested Learning Resources:

Text Books:

1: Modern Control Systems, Richard C. Dorf and Robert H. Bishop, Pearson, 13th Edition, 2017.

2: Modern Control Engineering, Katsuhiko Ogata, Prentice Hall, 5th Edition, 2010.

3: Control Systems Engineering, I J Nagrath and M Gopal, New Age International Publishers, 4th 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
CO1	3	3											3		
CO2	3	3											3		
CO3	3	3											3		
CO4	3	3											3		
CO5	3	3											3		

High-3, Medium-2, Low-1

IV Semester

COMMUNICATION LABORATORY			
Course Code:	22ECL404	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S)	0: 0: 2: 0	**SEE Marks:**	50
Total Hours of Pedagogy:	13	**Total Marks:**	100
Credits:	1	**Exam Hours:**	3

Course objectives:

1. Demonstrate the Analog modulation techniques.
2. Model an optical communication system and study its characteristics.
3. Simulate the digital communication concepts and compute and display various parameters along with plots/figures
4. Design, Demonstrate and Analyze filters using op-amp.

Sl. No.	Experiments
	Part –A discrete Experiments
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.
	Part –B Simulation using Simulink
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

Course outcomes:

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

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

High-3, Medium-2, Low-1

IV Semester

8051 MICROCONTROLLER			
Course Code:	22ECT405A	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	3:0:0	**SEE Marks:**	50
Total Hours of Pedagogy:	40	**Total Marks:**	100
Credits:	03	**Exam Hours:**	03

Course objectives:

This course will enable students to:

• Understand the difference between a microprocessor and a microcontroller and embedded microcontrollers.
• Familiarize the basic architecture of 8051 micro controller.
• Program 8051microprocessor using Assembly Level Language and C.
• Understand the interrupt system of 8051 and the use of interrupts.
• Understand the operation and use of inbuilt Timers/Counters and the Serial port of 8051.
• Interface 8051 to external memory and I/O devices using its I/O ports.

Module-1	**08 hrs**
8051 Microcontroller: Microprocessor Vs Microcontroller, Embedded Systems, Embedded Microcontrollers, 8051 Architecture- Registers, Pin diagram, I/O ports functions, Internal Memory organization. External Memory (ROM & RAM) interfacing. **Text2 :** Chapter 1 section 1.1 to 1.3, chapter 3 sections 3.1 to 3.3	
Teaching Learning Method: Chalk and talk method, Power Point Presentation, **RBT Level:** L1, L2, L3	

Module-2	**08 hrs**
8051 Instruction Set: Addressing Modes, Data Transfer instructions, Arithmetic instructions, Logical instructions, Bit manipulation instructions. Simple Assembly language program examples (without loops) to use these instructions. **Text2 :** Chapter 5 , chapter 6, chapter 7, chapter 8	
Teaching Learning Method: Chalk and talk method, Power Point Presentation **RBT Level:** L1, L2, L3	

Module-3	**08 hrs**
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. **Text2 :** chapter 8 section 8.1 to 8.4.**Text1** : chapter 7 section 7.1 to 7.3	
Teaching Learning Method: Chalk and talk method, Power Point Presentation **RBT Level:** L1, L2, L3	

Module-4	**08 hrs**
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: **RBT Level:**	Chalk and talk method, Power Point Presentation, 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: **RBT Level:**	Chalk and talk method, Power Point Presentation 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

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

1: Programming 8051 using Assembly and C programs.

CO-PO Mapping

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

High-3, Medium-2, Low-1

IV Semester

POWER ELECTRONICS			
Course Code:	22ECT405B	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	3:0:0:0	**SEE Marks:**	50
Total Hours of Pedagogy:	40	**Total Marks:**	100
Credits:	03	**Exam Hours:**	03

Course objectives:

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.

Module-1	**08 hrs**
INTRODUCTION: Applications of power electronics, power semiconductor devices, control characteristics, types of power electronic circuits, peripheral effects **THYRISTORS:** Introduction, characteristics, two transistor model, turn-on and turn off methods, di/dt and dv/dt protection.	
Teaching Learning Method: Chalk and talk method, Power Point Presentation, **RBT Level:** L1, L2,L3	

Module-2	**08 hrs**
COMMUTATION TECHNIQUES: Introduction, natural commutation, forced commutation: self-commutation, impulse commutation, resonant pulse commutation and complementary commutation.	
Teaching Learning Method: Chalk and talk method, Power Point Presentation, **RBT Level:** L1,L2,L3	

Module-3	**08 hrs**
AC VOLTAGE CONTROLLERS: Introduction, principle of ON-OFF and phase control, single-phase bidirectional controllers with resistive loads. **CONTROLLED RECTIFIERS**: Introduction, principle of phase controlled converter operation, single-phase semi converters, full converters and dual converters	
Teaching Learning Method: Chalk and talk method, Power Point Presentation, **RBT Level:** L1,L2,L3	

Module-4	**08 hrs**
DC CHOPPERS: 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).	
Teaching Learning Method: Chalk and talk method, Power Point Presentation, **RBT Level:** L1,L2,L3	

Module-5	**08 hrs**
INVERTERS: 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).	

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. 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

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

High-3, Medium-2, Low-1

IV Semester

OPERATING SYSTEMS			
Course Code:	22ECT405C	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	3: 0: 0: 0	**SEE Marks:**	50
Total Hours of Pedagogy:	39	**Total Marks:**	100
Credits:	03	**Exam Hours:**	03

Course objectives:

This course will enable students to understand:

1. the history and types of operating systems.
2. the design issues associated with operating systems development.
3. the process management and scheduling of operating system.
4. the concepts of memory management of operating system.
5. the file and I/O operations of operating system.

Module 1	**07 hrs**

INTRODUCTION: Goals of an O.S, Operation of an O.S

OVERVIEW OF OPERATING SYSTEMS: 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. **TEXT 1**

Teaching Learning Method:	Chalk and Board, PowerPoint Presentation
RBT Level:	L1, L2

Module 2	**08 hrs**

STRUCTURE OF THE OPERATING SYSTEMS: 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. **TEXT1**

Teaching Learning Method:	Chalk and Board, PowerPoint Presentation
RBT Level:	L1, L2, L3

Module 3	**08 hrs**

PROCESS MANAGEMENT: Process and programs, Programmer view of processes, OS view of processes, Threads.

SHEDULING: Preliminaries, Non pre-emptive scheduling policies, pre-emptive scheduling policies, scheduling in practice. **TEXT 1**

Teaching Learning Method:	Chalk and Board, Power Point Presentation
RBT Level:	L1, L2, L3

Module 4	**08 hrs**

MEMORY MANAGEMENT: 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.

VIRTUAL MEMORY: Virtual memory Basics, Demand paging, page replacement policies. **TEXT 1**

Teaching Learning Method: **RBT Level:**	Chalk and Board, PowerPoint Presentation L1, L2

Module 5	**08 hrs**

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**

Teaching Learning Method: **RBT Level:**	Chalk and Board, Power Point Presentation L1, L2

Course outcomes

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.

Suggested Learning Resources:

Text Book:

1. D. M. Dhamdhare, "Operating Systems", Second Edition, TMH, 2008

Reference Books:

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

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

1. Seminar on different types of Operating System.
2. Problems on Scheduling Policies.
3. Posters about Fundamental Functions of Operating System.

CO-PO Mapping

	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			

High-3, Medium-2, Low-1

IV Semester

C++ Basics			
Course Code	22ECL406A	**CIE Marks**	50
Teaching Hours/Week (L: T:P: S)	0:0:2:0	**SEE Marks**	50
Credits	01	**Exam Hours**	03

Course objectives:

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

Sl. No	Experiments
1	Write a C++ program to find largest, smallest & second largest of three numbers using inline functions MAX & Min.
2	Write a C++ program to calculate the volume of different geometric shapes like cube, cylinder and sphere using function overloading concept.
3	Define a STUDENT class with USN, Name & Marks in 3 tests of a subject. Declare an array of 10 STUDENT objects. Using appropriate functions, find the average of the two better marks for each student. Print the USN, Name & the average marks of all the students.
4	Write a C++ program to create class called MATRIX using two-dimensional array of integers, by overloading the operator == which checks the compatibility of two matrices to be added and subtracted. Perform the addition and subtraction by overloading + and – operators respectively. Display the results by overloading the operator <<. If (m1 == m2) then m3 = m1 + m2 and m4 = m1 – m2 else display error
5	Demonstrate simple inheritance concept by creating a base class FATHER with data members: *First Name, Surname, DOB & bank Balance* and creating a derived class SON, which inherits: Surname & Bank Balance feature from base class but provides its own feature: First Name & DOB. Create & initialize F1 & S1 objects with appropriate constructors & display the FATHER & SON details.
6	Write a C++ program to define class name FATHER & SON that holds the income respectively. Calculate & display total income of a family using Friend function.
7	Write a C++ program to accept the student detail such as name & 3 different marks by get_data()method & display the name & average of marks using display() method. Define a friend function for calculating the average marks using the method mark_avg().
8	Write a C++ program to explain virtual function (Polymorphism) by creating a base class polygon which has virtual function areas two classes rectangle & triangle derived from polygon & theyhave 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 theuse 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, 4th Edition, Tata McGraw Hill, 2003.
3. Object Oriented Programming with C++, E Balaguruswamy, 4th Edition, Tata McGraw Hill, 2006.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	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, BEGALURU – 560056.
(An Autonomous Institution Affiliated to Visvesvaraya Technological University, Belgaum)

Department of Electronics & Communication Engineering

Ref. No: AIT /EC /BOS / 467 /2023-24 **Date:** 12-08-2023
3

To
Dean (Academic)
Dr Ambedkar Institute of Technology
Bengaluru-56

Sir,

Sub: Regarding the details of the BOS meeting held on 12-08-2023

The External BOS 2023-24 meeting was held in blended mode in the department of the Electronics and communication Engineering and through Google meet link: https://meet.google.com/iun-vhbc-tfs on Saturday, 12-08-2023 10:30 am.

The BOS committee has approved the following:

1. NEP based Scheme and I & II semester syllabus of UG Courses of the 2023 Batch Students.
2. NEP based Scheme and III & IV semester syllabus of UG Courses of the 2022 Batch Students.
3. NEP Based Scheme and V & VI semester Syllabus of UG Courses of the 2021 Batch Students.
4. VII & VIII semester Syllabus of UG Courses of the 2020 Batch Students.
5. Skill Lab for 2023 batch students.
6. Scheme and Syllabus of I and II-year PG course.
7. The List of BOE members.
8. The list of Valuers / Examiners.

Thanking you

Tarulipa V Nandy
CHAIRMAN BOS
Dept. of ECE

HOD
Dept. of Electronics and Communication Engg.
Dr. Ambedkar Institute of Technology
Bengaluru - 560056

Enclosures:

1. List of Members of BOS.
2. Curriculum Design –UG
3. Minutes of the BOS Meeting.
4. Scheme & Syllabus of I/II Semester Basic Electronics and Communication Engineering for the academic year 2023-24.
5. Scheme & Syllabus of 3rd and 4th Semesters for the academic year 2023-24.
6. Scheme & Syllabus of 5th and 6th Semesters for the academic year 2023-24.
7. Scheme & Syllabus of 7th and 8th Semesters for the academic year 2023-24.
8. List of BOE Members.
9. List of valuers / Examiners.

Members of BOS:

Sl No.	*CATEGORY*	*Nomination of the Committee*	*Name of the Person with Designation*
1	Head of the Department	**Chairperson**	Dr. Mahalinga V Mandi, Dean (P&D), Professor & Head, Department of ECE, Dr. AIT, Bengaluru-56
2	Faculty Members at Different Levels Bearing Different Specializations	**Member 1.**	Dr. Umadevi H. Professor, Department of ECE, Dr. AIT, Bengaluru-56
		Member 2.	Dr. Ramesh S, Dean (Exam), Professor, Department of ECE, Dr. AIT, Bengaluru-56
		Member 3.	Smt. Sudha B S. Associate Professor, Department of ECE, Dr. AIT, Bengaluru-56
		Member 4.	Dr. Shivaputra Assistant Professor Department of ECE, Dr. AIT, Bengaluru-56
		Member 5.	Dr. Meenakshi.L.R. Assistant Professor, Department of ECE, Dr. AIT, Bengaluru-56
		Member 6.	Mr. Mohan Kumar V Assistant Professor, Department of ECE, Dr. AIT, Bengaluru-56
		Member 7.	Dr. Jambunath S Baligar Associate Professor Department of ECE, Dr. AIT, Bengaluru-56
		Member 8.	Dr. Chetan. S Assistant Professor, Department of ECE, Dr. AIT, Bengaluru-56
3	Subject Experts from outside the College Nominated by Academic Council	**Member 1.**	Dr. Devendra Jalihal Professor, EEE department IIT Madras, Chennai-600 036

		Member 2.	Prof. Santanu Mahapatra Professor, Department of Electronic Systems Engineering, Indian Institute of Science Bangalore, Bengaluru- 560012
		Member 3.	Dr. Mandeep Singh Professor, Department of ECE, NITK, Surathkal
		Member 4.	Prof. P.Nagaraju Associate Professor, Dept. of TCE, RVCE, Bengaluru-560 059
4	Expert from outside College, Nominated by Vice Chancellor (VTU)	**VTU Nominee**	Dr. Manajanaik N Professor, Department of ECE, UBDT, Davangere, Karnataka
5	Representative from Industry /Corporate Sector/Allied area related to Placement Nominated by Academic council	**Member 1.**	Mr. Kubendra.K Senior Design Engineer VLSI Group, Samsung India,Outer ring Road, Near Marathahalli, Bengaluru
		Member 2.	Mr. Somshekar H Mobileum India Pvt ltd., Director of Engineering.
		Member 3.	Mr. Sampath Kumar Srinivas Mitel, Senior Staff Software Engineer Manyata Tech Park, Bangalore
6	Post Graduate Meritorious alumnus nominated by Principal	**Member**	Mr. Premkumar M N Senior Manager, Intel, India Bengaluru

Tarakeshwar V. Nandi

CHAIRMAN

BOS Dept. of ECE

HOD

Dept. of Electronics and Communication Engg.,
Dr. Ambedkar Institute of Technology
Bengaluru - 560056

Dr. AMBEDKAR INSTITUTE OF TECHNOLOGY, BEGALURU – 560056.
(An Autonomous Institution Affiliated to Visvesvaraya Technological University, Belgaum)

Department of Electronics & Communication Engineering

MINUTES OF THE MEETING OF THE BOARD OF STUDIES 2023-24

DATED: Saturday, 12th August 2023

Dr. AMBEDKAR INSTITUTE OF TECHNOLOGY, BEGALURU – 560056.
(An Autonomous Institution Affiliated to Visvesvaraya Technological University, Belgaum)

Department of Electronics & Communication Engineering

BOS Meeting Notice

Sub: Board of Studies Meeting is convened on 12-08-2023

With reference to the above subject, External Board of Studies Meeting of the department is convened on Saturday, the 12th August 2023 at 10:30 a.m. in Department of ECE for finalizing the scheme and syllabus of UG in B.E. (E & C) and PG, M.Tech in VLSI Design and Embedded Systems for the academic year 2023-24 with the following agenda.

Agenda:

1. Approval of the NEP Scheme and Syllabus of 1st to 8th Semesters B.E (E &C) for the Batch-2023
2. Approval of the NEP Scheme and Syllabus of 3rd to 8th Semester B.E(E & C) for the Batch -2022
3. Approval of the NEP Scheme and Syllabus of 5th to 8th Semester B.E(E & C) for the Batch-2021
4. Approval of the Scheme and Syllabus of 7th to 8th Semester B.E(E & C) for the Batch-2020
5. Approval of Basic IoT Skill Lab for the Batch-2023 students.
6. Approval of the Scheme and Syllabus for the 1st and 2nd Semester PG for the Batch-2023
7. Approval of the Scheme and Syllabus for the 3rd and 4th Semester PG for the Batch-2022.
8. Approval of the courses for the Major, Minor Degree
9. Approval of List of Examiners

Minutes of Board of Studies (BOS) Meeting:

The Meeting of Board of Studies (BOS) for Department of Electronics and Communication Engineering was held on 12-08-2023 at 10:30 a.m. under the Chairmanship of the Dr. Mahalinga V. Mandi, Dean (P&D), Professor and Head, Department of Electronics and Communication Engineering in the department of Electronics and Communication engineering and through Google meet link: https://meet.google.com/iun-vhbc-tfs.

At the very outset, the Chairman welcomed all the Internal and External members of BOS to the meeting and gave a preliminary presentation on the agenda items with reference to the scheme and syllabus of UG and PG for the academic year 2023-24

The chairman along with BOS coordinators gave a detailed presentation of the courses to be offered to the students in both Core and Elective subjects in semester wise at the Under Graduate level and Post Graduate level, also briefed the members about the Curriculum Design of the Department for the UG and PG Courses.

PROCEEDINGS/RESOLUTIONS:

The following are the Suggestions of the members of BOS with reference to the presentations:

I and II semester for 2023 batch:

- Subject Expert Devendra Jalihal Suggested to reduce the syllabus for "Basic electronics" (Module 1) for ECE
  Sol. Internal BOS members clarified that most of the topics will be dealt up to Remembering & Understand level (L1, L2)

- Subject Expert Mandeep Singh suggested to include recent edition text books for the course Introduction to Electronics Engineering (22EST104C/204C).
  Sol. Recent edition text books prescribed for subject Introduction to Electronics Engineering (22EST104C/204C).

III and IV Semesters for 2022 batch:

- Subject Expert Devendra Jalihal suggested to rearrange the contents of the topic Fourier Transforms in the subject "Signals and Systems".
  Sol. Topic Fourier Transforms in the subject "Signals and Systems" is rearranged as per the suggestions.

- Subject Expert Dr. Nagaraju P remarked regarding the IPCC subject Analog Electronic Circuits (21ECT303) that JFET experiment was added in practical component while only concepts of MOSFET were dealt in theory.
  Sol. JFET experiments in practical component is replaced by MOSFET experiments.

- Subject Expert Dr. Nagaraju P suggested to reduce the contents of 7th and 8th experiments in Analog and Digital Electronics Lab (22ECL305).
  Sol. Redundant experiments are removed as per suggestions.

- Subject Expert Dr. Nagaraju P suggested to include Proportional controller concept in module 3 in the IPCC subject Modern Control Systems as these concepts were included in practical component.
  Sol. Proportional Controller Concepts included in module 3.

V and VI Semesters for 2021 batch:

- Industry Expert Sampath Kumar Srinivas seek clarification regarding the duration for mini project.
- Industry Expert Sampath Kumar Srinivas suggested to include IPV6 concept in **Computer Communication Networks (21ECT503).**
  Sol. IPV6 concept included as per suggestion.

- Subject Expert Dr. Nagaraju P suggested to include recent edition books for the subject Microwave and Antenna.
  Sol. Prescribed Textbooks updated to recent editions.

- Industry Expert Kubendra suggested to include RISC V concepts in Microprocessor and Microcontroller subject.
  Sol. RISCV concepts included as Module 4 and Module 5 in Microprocessor and Microcontroller subject.

- Subject Expert Dr. Nagaraju P suggested to include Embedded C experiments instead of Assembly Programs in the subject CO & ARM Processor.
  Sol. Assembly Programs replaced with embedded C programs.

- Subject Expert Dr. Nagaraju P suggested to update prescribed text books for the subject ANN
  Sol. Prescribed text books updated to recent editions.

- Discussed about the Scheme and syllabus of 7th and 8th semester for 2020 batch
- No comments on final year subjects, so retained same syllabus.
- Discussed about the Scheme and syllabus of 1st and 2nd year PG program.
- Subject Expert Devendra Jalihal remarked that the number of electives are more.
  Sol. PG coordinator clarified that scheme and syllabus is framed as per VTU guidelines.
- Subject Expert Dr. Nagaraju P suggested to include recent edition text books.
  Sol. Recent edition text books are prescribed.

- The meeting was ended with vote of thanks by Dr. Mahalinga V. Mandi, Dean (P&D), Professor and Head, Department of ECE.

Finally, the BOS members approved the following after incorporating the suggested modifications

- Approved the Curriculum Design for the semesters I to VIII of UG Course for the students of the Batch 2023
- Approved the NEP Based Syllabus of Basic Electronics and Communication Engineering for the semesters I/II of UG Course for the academic year 2023-24.
- Approved the NEP Based Scheme and syllabus for semesters III and IV of UG Course for the academic year 2023-24.
- Approved the NEP Based Scheme and syllabus for semesters V and VI of UG Course for the academic year 2023-24.
- Approved the Scheme and syllabus for semesters VII and VIII of UG Course for the academic year 2023-24.
- Approved Basic IoT Skill Lab for 2023 batch students.
- Approved I and II-year scheme and syllabus of PG Course for academic year 2023-24.
- Approved the courses for the Major, Minor Degree
- Approved the List of BOE members.
- Approved the list of Valuers / Examiners.

Mahalinga V. Mandi

CHAIRMAN

BOS Dept. of ECE

BOS Coordinators	**Signatures**
1. **Prof. B. S. Sudha**	Sudha B S 1/12/2023
2. **Mr. Anand H D**	

Dr. AMBEDKAR INSTITUTE OF TECHNOLOGY, BEGALURU – 560056.
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Department of Electronics & Communication Engineering

List of BOE Members:

SL. NO.	NAME AND ADDRESS
1.	Dr. Mahalinga V. Mandi, Dean (P & D), Professor and Head, Department of ECE
External BOE members:	
1.	Dr. Dinesh P., Professor and Dean, Department of ECE, DSCE, Bengaluru
2.	Prof. Nagraju P, Associate Professor, Department of TCE, RVCE, Bengaluru
3.	Dr. Rajeshwari Hegade, Professor and Head, Department of TCE, BMSCE, Bengaluru-19
4.	Dr. Revanna, Associate Professor, Department of ECE, Govt. Engineering College, Ramanagara
Internal BOE Members:	
1.	Dr. Umadevi H., Professor
2.	Smt. Sudha B. S., Associate Professor
3.	Dr. Shivaputra, Assistant Professor
4.	Smt. Meenakshi L. Rathod, Assistant Professor
5.	Mr. Mohankumar V., Assistant Professor
6.	Smt. Girija S., Assistant Professor

Mahalinga V. Mandi

CHAIRMAN

BOS, Dept. of ECE

HOD

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Dr. AMBEDKAR INSTITUTE OF TECHNOLOGY

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Department of Electronics & Communication Engineering

12-08-2023

Attendance list:

Sl. No	Position	Name		Signature with date
1.	Chairman	**Dr. Mahalinga V. Mandi** Professor and Head Department of ECE, Dr. AIT, Bengaluru-56		Mahalinga V. Mandi 12/8/23
2.	VTU Nominee	**Dr. Manajanaik N** Professor, Department of ECE, UBDT, Davangere, Karnataka		ABSENT
3.	External Subject Experts	1.	**Dr. Devendra Jalihal** Professor, EEE department IIT Madras, Chennai-600 036	Present Online.
		2.	**Dr. Santanu Mahapatra** Professor, Department of Electronic Systems Engineering, Indian Institute of Science Bangalore,560012	ABSENT
		3.	**Dr. Mandeep Singh** Professor, Department of ECE, NITK, Surathkal	Present Online.
		4.	**Dr. P. Nagaraju** Associate Professor, Dept. of TCE, RVCE, Bengaluru-560 059	P. Nagaraju 12/08/2023
4.	Industry Expert	1.	**Mr. Kubendra K** Senior Design Engineer VLSI Group, Samsung India, Outer ring Road, Near Marathahalli, Bengaluru	Present Online.
		2.	**Mr. Somshekar H** Mobileum India Pvt ltd., Director of Engineering.	ABSENT
		3.	**Mr. Sampath Kumar Srinivas** Mitel, Senior Staff Software Engineer Manyata Tech Park, Bangalore	S. Sampath Kumar 12/8/2023

5.	**Alumni with PG Degree**	**Mr. Premkumar M N** Senior Manager, Intel, India Bengaluru		ABSENT.
6.	**Internal Members**	1.	**Dr. Umadevi H.** Professor, Department of ECE, Dr.AIT, Bengaluru-56	H Umadevi 12/8/2023
		2.	**Dr. Ramesh S.** Professor, Dean (E) Department of ECE, Dr. AIT, Bengaluru-56	12-8-23
		3.	**Smt. Sudha B. S.** Associate Professor, Department of ECE, Dr. AIT, Bengaluru-56	Sudha B.S 12/8/2023.
		4.	**Dr. Shivaputra** Assistant Professor Department of ECE, Dr. AIT, Bengaluru-56	on Leave
		5.	**Dr. Meenakshi L. R.** Assistant Professor, Department of ECE, Dr. AIT, Bengaluru-56	12/08/2023.
		6.	**Mr. Mohan Kumar V.** Assistant Professor, Department of ECE, Dr. AIT, Bengaluru-56	12/08/2023
		7.	**Dr. Jambunath S. Baligar** Associate Professor Department of ECE, Dr. AIT, Bengaluru-56	12/8/23
		8.	**Dr. Chetan S.** Assistant Professor, Department of ECE, Dr. AIT, Bengaluru-56	12/8/23
7.	**Student Representatives:**	1.	Yogesh.N.V 1DA21EC170	Yogeshv
		2.	Yalawathi.V 1DA21EC168	Yalawathi N
		3.	Shulini RR 1DA22EC426	Shulini RR
		4.	LIKHITHA.B 1DA20EC066	Likhitha
		5.	Divyashree.K 1DA20EC041	Diya

		6.	Jagruthi.S 1DA20EC053	Jagruthi
		7.	Spndhu.Hosamani 1DA22LVS03	
		8.	Rashmi.R 1DA22LVS02	Rashmi

Dayalipa V. Nandi 12/8/23

Signature

HOD, Dept. of ECE

BOS Chairman

HOD

Dept. of Electronics and Communication Engg.

Dr. Ambedkar Institute of Technology

Bengaluru - 560056