MALNAD COLLEGE OF ENGINEERING, HASSAN

(An Autonomous Institution Affiliated to VTU, Belagavi)

Autonomous Programme

Bachelor of Engineering

Department of Electronics and Communication Engineering

SCHEME and SYLLABUS

(2025 Admitted Batch)

Academic Year 2026-27

VISION OF THE INSTITUTE

To be an institute of excellence in engineering education and research, producing socially responsible professionals.

MISSION OF THE INSTITUTE

1. Create conducive environment for learning and research
2. Establish industry and academia collaborations
3. Ensure professional and ethical values in all institutional endeavors

VISION OF THE DEPARTMENT

To produce industry ready, research oriented and socially responsible Electronics & Communication Engineers.

MISSIONOFTHEDEPARTMENT

- To create an ambience for learning.
- To conduct research, beneficial to the society.
- To promote industry-academic interaction at all-levels.
- To be continuously agile to the needs of the stake holders.

PROGRAM EDUCATIONAL OBJECTIVES(PEOs)

The graduates will:

PEO1: Design and test Electronics & Communication systems and be successful professional in the field of ECE and allied areas.

PEO2: Be a good leader, team worker with strong communication skills.

PEO3: Possess capability to pursue higher education and be involved in research in the core and allied areas of E&C engineering and be a lifelong learner.

PROGRAMOUTCOMES(POs)

1. **Engineering knowledge**: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.
2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)
3. **Design/Development of solutions**: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)
4. **Conduct investigations of complex problems**: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).
5. **Engineering tool usage**: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)
6. **Theengineerandtheworld**:Analyzeandevaluatesocietalandenvironmentalaspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).

PROGRAMOUTCOMES(POs)

7. **Ethics**: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)

8. **Individual and collaborative team work**: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary settings.

9. **Communication**: Communicate effectively and inclusively within the community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences.

10. **Project management and finance**: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

11. **Life-long learning**: Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

PROGRAM SPECIFIC OUTCOMES

PSO1: An ability to understand the basic concepts in Electronics and Communication Engineering and to apply them to various areas, like Signal and image processing, VLSI, Embedded systems, photonics, networks, MEMS, antennas, in the design and implementation of complex systems.

PSO2: An ability to solve problems using latest hardware and software tools available in E&C Engineering along with analytical skills to arrive at appropriate, cost effective solution.

Scheme of Evaluation (Theory Courses)

Assessment	Marks
CIE1-Conducted for 50Marks and reduced to 15Marks	**15**
CIE2-Conducted for 50Marks and reduced to 15Marks	**15**
Activities as decided by course faculty	**20**
SEE	**50**
Total	**100**

Scheme of Evaluation (Laboratory Courses)

Assessment		Marks
Continuous Evaluation in every lab session by the Course Coordinator		**10**
Record Writing		**20**
Laboratory CIE conducted by the Course Coordinator		**20**
SEE		**50**
Total		**100**
Examination	**Maximum Marks**	**Minimum marks to qualify**
CIE	50	20(12+8)
SEE	50	20

MALNADCOLLEGEOFENGINEERING,HASSAN
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DEPARTMENT OF ELECTRONICS AND COMMUNICATION

COURSE TYPES

Basic Science Course	BSC
Applied Science Course	ASC
Engineering Science Course	ESC
Emerging Technology Course	ETC
Programming Language Course	PLC
Professional Core Course	PCC
Integrated Professional Core Course	IPCC
Professional Core Course Laboratory	PCCL
Professional Elective Course	PEC
Open Elective Course	OEC
Project/MiniProject/Internship	PI
Humanities and Social Sciences, Management Course	HSMC
Ability Enhancement Course	AEC
Skill Enhancement Course	SEC
Skill Development Course	SDC
Universal Human Value Course	UHV
Non-credit Mandatory Course	MC

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION

THIRD SEMESTER

Sl.No	Course Category	Course Code	Course Title	Teaching Hours/Week					Exam Marks			Credits
				L	T	P	TW (Term Work) + SL (Self-Learning)	TH/S	CIE	SEE	Total	
1	IPCC	25EC301	Control Systems	42	0	28	50	120	50	50	100	4
2	PCC	25EC302	Network Analysis	42	28	0	50	120	50	50	100	4
3	PCC	25EC303	Analog Electronic Circuits & Linear Integrated Circuits	42	0	0	48	90	50	50	100	3
4	PCC	25EC304	Digital circuit design using Verilog	42	0	0	48	90	50	50	100	3
5	PCC	25EC305	VLSI Process Technology	42	0	0	48	90	50	50	100	3
6	PCCL	25EC306	Digital electronics and Verilog Lab	0	0	28	2	30	50	50	100	1
7	AEC	25AEC307	Analog Electronic and Linear Integrated Circuits Laboratory	0	0	28	2	30	50	50	100	1
8	SDC	25SCR	Community Project (Project-Based Learning)/ Societal Project	0	0	30	0	30	50	50	100	1
9	AEC	25PT1	Placement Training I	0	0	30	0	30	50	50	100	A
10	NCMC	25NYP1	NSS,YOGA,PE	0	0	0	28	28	100	-	100	A
11	NCMC	25BCM 301	Bridge Mathematics-I (Non-Credit Mandatory Audit Course for Diploma entry students)	14	0	0	14	0	100	-	100	A
Total												20

Ability Enhancement Course(Laboratory)	
Course Code	**Course Name**
25AEC307	Analog Electronic and Linear Integrated Circuits Laboratory
25AEC308	Scilab Programming Laboratory
25AEC309	C++ Basic Programming
25AEC310	IoT Applications Laboratory
The Ability Enhancement Course Laboratory can be offered either as a single compulsory course or as multiple elective options	

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FOURTH SEMESTER												
Sl.No	Course Category	Course Code	Course Title	Teaching 3Hours/Week					Exam Marks			Credits
				L	T	P	TW (Term Work) + SL (Self-Learning)	TH/S	CIE	SEE	Total	
1	IPCC	25EC401	Basics for Signal Processing	42	0	28	50	120	50	50	100	4
2	PCC	25EC402	Electromagnetics and Transmission lines	28	28	0	34	90	50	50	100	3
3	PCC	25EC403	Principles of Communication Engineering	42	0	0	48	90	50	50	100	3
4	PCC	25EC404	ARM Embedded Systems	42	0	0	48	90	50	50	100	3
5	PCC	25EC405	Microwave and RADAR Communication	42	0	0	48	90	50	50	100	3
6	PCCL	25EC406	Communication Laboratory	0	0	28	2	30	50	50	100	1
7	AEC	25AEC407	ARM Embedded Systems Laboratory	0	0	28	2	30	50	50	100	1
8	SDC	25EVS	Environmental Science Project	0	0	0	30	30	50	50	100	1
9	BSC	25BSC	Biology for Engineers	14	0	0	16	30	50	50	100	1
10	AEC	25PT2	Placement Training II	14	0	0	16	30	100	-	100	A
11	NCMC	25NYP2	NSS,YOGA,PE	0	0	0	28	28	100	-	100	A
12	NCMC	25BCM401	Bridge Mathematics-I (Non-Credit Mandatory Audit Course for Diploma entry students)	14	0	0	14	28	100	-	100	A
Total												20

Ability Enhancement Course(Laboratory)	
Course Code	Course Name
25AEC407	ARM Embedded Systems Laboratory
25AEC409	Statistics with R Lab for machine learning
25AEC408	Programmable Logic Controllers
25AEC410	Lab VIEW Programming
The Ability Enhancement Course Laboratory can be offered either as a single compulsory course or as multiple elective options **Note: Please refer to VTU scheme for different courses offered under AEC Laboratory	

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION
III Semester

Course Title	**Control Systems**		
Course Code	**25EC301**	**(L-T-P) C**	**(3-0-2)-4**
Exam	**3 Hrs**	**Hours/Week**	**5**
SEE	**50 Marks**	**Total Hours**	**42L+28P+40ABL+10EV=120**

Course Objective: To understand the fundamental concepts of control systems, including stability analysis in the time and frequency domains, and state-space representation of control systems

Course Outcomes: With mapping shown against the Program Outcomes (POs)} Upon completion of the course, students shall be able to:

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Interpret the results of practical problems of physical systems using mathematical modeling, block diagram and signal flow graph methods in control systems.	1, 2 ,3,5,8,9	1,2
2	Apply the knowledge of time domain analysis for first and second order systems.	1, 2 ,3,5,8,9	1,2
3	Analyze stability analysis techniques to evaluate the stability and performance of control systems in time and frequency domains.	1, 2 ,3,5,8,9	1,2
4	Analyze state-space modeling of mechanical, electrical systems and closed loop system	1, 2 ,3,5,8,9	1,2

MODULE-1	**No. of Hrs.10**

Introduction: Types of Control Systems, Effect of Feedback System s, Differential equation of Physical Systems –Mechanical Systems, Electrical Systems, Electromechanical systems, Analogous Systems.
Block diagrams: Transfer functions, Block diagram algebra.

MODULE-2	**No. of Hrs.11**

Signal flow graphs: Signal Flow graphs, Masons gain formula (State variable formulation excluded).Signal Flow graphs for block diagrams, electric networks and algebraic equations.
Time Response of feedback control systems & Stability analysis: Standard test signals, Unit step response of First and Second order Systems. Time response specifications, Time response specifications of second order systems, steady state errors and error constants**.**

MODULE-3	**No. of Hrs.10**

Concepts of stability: Necessary conditions for Stability, Routh- stability criterion.
Root–Locus Techniques: Introduction, The root locus concepts, Construction of root loci
Stability in the frequency domain: Mathematical preliminaries, Nyquist Stability criterion, (Inverse polar plots excluded), Assessment of relative stability using Nyquist criterion, (Systems with transportation lag excluded).

MODULE-4	**No. of Hrs.11**

Frequency domain analyses: Correlation between time and frequency response, Bode Plots, Experimental determination of transfer function, Assessment of relative stability using Bode Plots.
Introduction to State variable analysis: Concepts of state, state variable and state models for electrical systems, Solution of state equations.

Prescribed Text Books:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1	Control Systems Engineering	**I J Nagrath, M Gopal**	6th Edition	NEW AGE International Publishers	2022
2	Control Systems	**Dhanesh.N.Malik**	4th	Cengage Learning India Pvt.Ltd	2017

Reference Books:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1	Modern Control Engineering	Katsuhiko Ogata,	5th	Prentice Hall	2015
2	Control Systems Principles and Design	**M Gopal**	5th	TMH	2012

EBooks and online course materials:

1. http://docs.znu.ac.ir/members/pirmohamadi_ali/Control/Katsuhiko%20Ogata%20_%20Modern%20Control%20Engineering%205th%20Edition.pdf
2. https://koracademy.com/sites/default/files/inline-files/norman%20nise.pdf
3. https://my.ece.utah.edu/~bodson/ifs/control.pdf

Online Courses and Video Lectures:

1. https://archive.nptel.ac.in/courses/107/106/107106081/
2. https://nptel.ac.in/courses/108106098

Sl. No	Teaching and Learning Method	No. of Hours/ Week	No. of Weeks	Hours/ Semester
1	Class Room Teaching & Learning	3	14	42
2	Integrated Lab Component	2	14	28
3	Evaluation of Learning Process	--	--	10
4	Activity Based Learning (ABL)			40
	Total Learning Hours/Semester			**120**

Proposed Assessment Plan (for 50 marks of CIE):

Tool	Remarks	Marks
CIE	Two tests conducted for 50markseachandreducedto15 marks.	30
Activity Details	1) Lab Conduction 2) ABL	15 05
Total		**50**

Integrated Lab Component (28 Hours)

Sl. No	Program List	Hours
1	Block diagram reduction technique	2+2
2	Signal Flow graph Technique	2+2
3	To study time response of a system	2
4	Plot poles and zero's locations of a first order and second order transfer functions.	2
5	Simulation of poles and zeros of a transfer function	4
6	To plot Root Locus and identify stability of a system using	4
7	To plot Nyquist plot and identify stability of a system	4
8	To plot Bode plot and identify stability of a system	4
	Total	28

Activity Based Learning (40Hours)

ABL (40Hours): Students engage in a hands-on exploration of circuits using an interactive simulator.		
1	Design of analogous system to find the closed loop transfer function of multi-loop feedback block diagram via block diagram reduction method.	**15**
2	Students present their designed multi-loop feedback, block diagram via block diagram reduction method	**15**
3	Obtain time response from state model of a system	**10**
	Total	**40**

Evaluation of Learning Process (10Hours)

Type of Evaluation	Hours
Test (1,2 and 3)	03
Lab program Execution & demonstration of activity	04
Semester End Exam	03
Total	10.

Course Articulation Matrix

Course Outcomes	**Program Outcomes**												
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	3	2	1		2			1	1			2	1
CO2	3	2	1		2			1	1			2	1
CO3	3	2	1		2			1	1			2	1
CO4	3	2	1		2			1	1			2	1

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION

Course Title:	**Network Analysis**	
Course Code :	**25EC302**	**LTPC: (3-2-0)4**
Exam Hours:	3	Hours / Week: 5
SEE:	**50 Marks**	Total hours: (42L+28T+40ABL+10E) =120

Course Objective: To enable the students to analyze electrical networks using complex time domain and frequency domain approaches.

Course Outcomes (COs){with mapping shown against the Program Outcomes (POs)}
Upon completion of the course, students shall be able to:

COs	**Statement**	**POs**
1.	Apply fundamental electrical network concepts, circuit laws, and network reduction techniques such as source transformation, shifting, and simplification to analyze electrical circuits	1, 2, 3, 5
2.	Analyze electrical circuits using network theorems and graph theory techniques for solving engineering problems.	1, 2,3,5
3.	Evaluate the performance of resonant circuits, transient responses, two-port networks, and electrical circuits using Laplace Transform techniques.	1, 2,3, 5
4.	Simulate electrical networks using appropriate software tools to validate theoretical concepts and interpret results.	1, 2, 3, 5, 8, 9

Course Contents:

MODULE-1	**Teaching Hours**
Basic Concepts: Loop and node analysis with linearly dependent and independent sources for DC and AC networks, Source transformations & source shift, Concepts of super node and super mesh. (Self-study: Star & delta transformation)	**10 Hours**
MODULE-2	
Network Topology: Graph of a network, Concept of tree and co-tree, incidence matrix, cut-set schedule, tie-set schedule, Formulation of equilibrium equations in matrix form, Solution of resistive networks. **Network Theorems:** Superposition, Thevenin's and Norton's theorems, Maximum Power transfer theorem, Millman's theorem and Reciprocity Theorem. (Self-Study: Principle of duality)	**12 Hours**
MODULE-3	
Resonance: Series and parallel resonance, frequency response of series and Parallel circuits, Q –factor, Bandwidth (relevant derivations and numerical problems). **Two Port Networks:** Two ports and impedance parameters, admittance, hybrid and transmission parameters, Circuit analysis of two-port networks. **(Self-Study:** Relationship between Parameters**)**	**10 Hours**
MODULE-4	
Laplace Transform: Laplace transform and its applications: Step Ramp, Impulse, Solution of networks using Laplace transform. **Behavior and Initial Conditions:** The behavior of circuit elements under switching condition and their Representation, evaluation of initial and final conditions in RL, RC and RLC circuits for AC and DC excitations(only numerical problems). (Self-Study: Initial value and final value theorem of Laplace transform)	**10 Hours**

TEXT BOOKS:

1. M. E. Van Valkenburg, "Network Analysis", PHI / Pearson Education, Revised 3rd Edition, 2019.
2. A. Bruce Carlson, "Circuits", Brooks/Cole, 1st edition, 2008.
3. Schaum's Easy outline of Electric Circuits, 1st edition, 2020, McGraw Hill.

REFERENCE BOOKS:

1. **Roy Choudhury**, "Networks and systems", 2nd edition, New Age International Publications, 2006.
2. **Hayt, Kemmerly and Durbin**, "Engineering circuit analysis", TMH, 6th Edition, 2002.

MOOC/NPTEL COURSES:

1. https://onlinecourses.nptel.ac.in/noc23_ee07/preview
2. https://www.coursera.org/courses?query=network%20analysis
3. https://www.mooc-list.com/tags/network-analysis

ACTIVITIES

Teaching-Learning–Evaluation Scheme:

Sl. No	Teaching and Learning Method	No. of Hours/ Week	No. of Weeks	Hours/ Semester
1.	Class Room Teaching & Learning	5	14	70 (42L+28T)
2.	Activity Based Learning (Activity 1 and 2)	-	-	40
3.	Evaluation of Learning Process	-	-	10
Total Learning Hours/Semester				**120**

Proposed Assessment Plan (for 50marks of CIE):

Tool	Remarks	Marks
Internals	Two tests conducted for 50 marks each and reduced to 15 marks.	30
Activity Details	Details of activities to be conducted Activity1- Simulation (10 Marks). Activity2- Device teardown and function analysis (10 Marks).	20
Total		**50**

Activity Based Learning (38Hours)

Activity 1 (10 marks): Conduct the following experiments using suitable simulation software-**20 Hours**

Sl. No.	Simulation Experiments
1.	Node Analysis
2.	Mesh Analysis
3.	Star-Delta Transformation
4.	Source Shifting
5.	Superposition Theorem
6.	Thevenin's Theorem
7.	Norton's Theorem
8.	Maximum Power Transfer Theorem
9.	Verification of two-port networks
10.	RLC series and parallel resonance circuits-Frequency Response-Determination of Q and Band Width.

Plan of Action:

- Each student will choose any two experiments and simulate four circuits (except for the 10th experiment)
- Each experiment results must be documented and must be verified with theoretical calculation.
- Hardcopy of the report prepared must be submitted at the end of 8th week from commencement of the semester.

Activity 2 (10 Marks):

Device Teardown and Functional Analysis	Hours
Analyze the electrical network of a household and prepare a technical report explaining circuit topology, load connections, safety features, and power consumption patterns. Examples include (but not limited to): Mobile charger, Power Bank, Calculator, Refrigerator, Air Conditioner, Three phase and single phase motor stators, Washing Machine, ATMand etc..	20

Plan of Action:

- The activity will be carried out in a team of two students.
- Select a suitable non-hazardous electrical/electronic device.
- Study its purpose and collect specifications.
- Identify the hardware components and trace the flow of power.
- Draw the simplified block diagram and explain the role of each block.
- Relate observations to Ohm's law, Kirchhoff's law, Series-parallel circuits, power-energy concepts and AC/DC circuit principles.

Evaluation of Learning Process (10Hours)

Type of Evaluation	Hours
Test (1 and 2)	3
Demonstration of activity	4
Semester End Exam	3
Total	**10**

Articulation Matrix

Course Outcomes	Program Outcomes											Program Specific Outcomes	
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PS01**	**PSO2**
CO1	3	2	2		2							2	2
CO2	3	3	2		2							3	2
CO3	3	3	1		2							3	3
CO4	2	2	2		3			1	2			2	3

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DEPARTMENTOFELECTRONICS AND COMMUNICATION ENGINEERING

Course Title	ANALOG ELECTRONICS AND LINEAR INTEGRATED CIRCUITS		
Course Code	25EC303	(L-T-P) C	(3-0-0)3
Exam	3Hours	Hours/Week	03
SEE	50Marks	Total Hours	42L+48ABL=90

Course Objective: To provide a strong foundation in semiconductor devices, transistor biasing, amplifiers, differential amplifiers, and operational amplifier circuits, enabling students to analyze and design analog electronic systems for signal amplification and processing.

Course outcomes:{with mapping shown against the Program Outcomes (POs)} Upon completion of the course, the student shall be able to:

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	**Understand** the construction, operation, and characteristics of MOSFETs and BJTs, including their biasing techniques and operating regions.	1,2	**1,2**
2	**Apply** small-signal models of MOSFETs and BJTs to evaluate amplifier parameters such as gain, input/output resistance in electronic circuits.	1,2,5,8,9,11	**1,2**
3	**Expound** the operation and performance characteristics of differential amplifiers and operational amplifiers, and analyze basic Op-Amp configurations and parameters.	1,2	**1,2**
4	**Analyze** the operation of Op-Amp based linear and non-linear applications, signal generators, multi vibrators, and active filter circuits for electronic systems.	1,2,5,8,9,11	**1,2**

MODULE-1 **11 Hrs.**

Bipolar Junction Transistors (BJTs): Introduction, Device Structure and Physical Operation: Simplified Structure and Modes of Operation, Operation of the NPN Transistor in the Active Mode, Operation in the Saturation Mode. Current–Voltage Characteristics of BJT: Circuit Symbols and Conventions, Graphical Representation of Transistor Characteristics, The Early Effect, An alternative form of Common Emitter Characteristics.

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 trans conductance, Base current and input resistance, Emitter current and input resistance, voltage gain, Separating the signal and the DC quantities, The hybrid π model.

[**Self-learning:** PNP Transistor, Fixed bias circuit and DC load line and Q-Point]

MODULE-2 **10 Hrs.**

MOS Field-Effect Transistors (MOSFETs): Introduction, Device Structure, Operation with Zero Gate Voltage, Creating a Channel for Current Flow, Applying a Small V_{DS}, Operation as $V_{DS}$is Increased, Operation for $V_{DS} \geq V_{OV}$: Channel Pinch-Off and Current Saturation. Circuit Symbol, The $I_D - V_{DS}$ Characteristics, The $I_D - V_{GS}$ Characteristic, Finite Output Resistance in Saturation,

MOSFETs: Biasing in MOS amplifier circuits: Fixing V_{GS}, Fixing V_G, and 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, trans conductance.

[**Self-learning:** The *p*-Channel MOSFET]

MODULE-3 **10 Hrs.**

Operational Amplifier Parameters and Performance: Ideal and Practical Operational Amplifiers, Op-Amp Model, Currents and Impedances, Voltage Gain, Ideal Op-Amp. Basic Op- Amp Internal Circuitry-Current Mirror, Complementary Emitter Follower, Level Shifting Stage. Input, Output, and Supply Voltages- Supply Voltage Options, Input Voltage Range, Output Voltage Range, Common Mode Rejection, Power Supply Rejection. Offset Voltages and Currents-Input and Output Offset Voltages, Input Bias Current Effects, Input Offset Current. Input and Output Impedances- Input Impedance, Output Impedance. Slew Rate and Frequency Limitations.

Op-Amps as DC Amplifiers: Direct-coupled voltage Follower, Non-inverting Amplifier, Inverting amplifier, Summing amplifier, Difference amplifier. **[Self-learning:** Combined Effect of Input Error Sources and Offset Nulling**]**	
MODULE-4	**11 Hrs**
Op-Amps as AC Amplifiers & Op-Amp linear applications: Capacitor coupled-Voltage follower, Instrumentation amplifier, differentiating circuits, Integrating circuits, Precision half-wave rectifiers, Precision full-wave rectifiers. **Op-Amp Signal Generators & Filters:** Voltage level detectors, Inverting Schmitt trigger circuit, Non-inverting Schmitt trigger circuit, Astable- multi vibrator, Monostable- multivibrator, 555Timer Monostable. Filter types and characteristics, First-Order active filters, Band-Pass filters, Notch filters **[Self-learning:** Square wave generator, Basic Phase-Locked Loop System**]**	

Prescribed Text Books:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1.	Microelectronic Circuits, Theory and Applications	Adel S. Sedra Kenneth C. Smith	7th	Oxford university press	2009
2.	Operational Amplifiers and Linear IC's'	David A.Bell	3rd	Oxford University Press 2011	2011
3.	Linear Integrated Circuits	D. Roy Choudhury and Shail B.Jain	4th	New Age International(P) Ltd	2010

Reference Books:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1.	Fundamentals of Microelectronics	BehzadRazavi	2nd	Wiley India Pvt. Ltd	2014
2.	Electronic Devices And Circuits Theory	Robert L. Boylestad and Louis Nashelsky,	10th	Pearson,	2012
3.	Op Amps and Linear Integrated Circuits	Ramakant A Gayakwad	4th	Pearson Education	2015

e-Books and Online course material:

- https://drive.google.com/file/d/19N3FtJ0hjQl6U_EvcypqR7MU-O_HTU53/view?usp=sharing
- https://docs.google.com/document/d/1GaMRTevTsduyEiPW9rfLMeIx73ZTQQxaWg-BHtk-ulk/edit?tab=t.0

Teaching-Learning–Evaluation Scheme:

Sl.No	Teaching and Learning Method	No. of Hours/ Week	No. of Weeks	Hours/ Semester
1.	Class Room Teaching &Learning	3	14	42
2.	Activity Based Learning (ABL1&ABL2)	-	-	38
3.	Evaluation of Learning Process	-	-	10
Total Learning Hours/Semester				**90**

Proposed Assessment Plan (for 50 marks of CIE):

Tool	Remarks	Marks
CIE	Two tests conductedfor 50markseachandreducedto15 marks.	30
Activity Details	Details of activities to be conducted	

	Activity1-Simulation of analog and linear integrated circuits using MULTISIM live circuit simulator or LT-spice or P-Spice software. Verify manual calculation and simulation results and preparation of report. Activity2- Assignment and Quiz each carry 5 marks.	10 10

Activity-Based Learning (50Hours)

ABL1(20 Hours): Activity1-Simulation of analog and linear integrated circuits using MULTISIM live circuit simulator or LT-spice or P-Spice software. Verify manual calculation and simulation results. List of Circuits given below.		**Hours**
1.	Design a Power Supply Circuit	2
2.	FET Characteristics (JFET/MOSFET)	2
3.	BJT Characteristics and Biasing	2
4.	Frequency Response of CE Amplifier	2
5.	Design and Simulate Clipping and Clamping Circuits	2
6.	Design of Zener Diode Voltage Regulator	2
7.	Design of Half-Wave and Full-Wave Rectifiers with Filters	2
8.	Inverting and Non-Inverting Amplifier using Op-Amp, Instrumentation amplifiers	2
9.	Op-Amp as Adder, Subtractor, Integrator, Differentiator, Precision Rectifiers	2
10.	Schmitt Trigger using Op-Amp	2
Total		**20**
ABL2(18Hours): Assignment and Quiz each carry 5 marks.		**Hours**
1.	Writing the Solution for previous SEE question papers (At least **TWO**).	09
2.	Conducting the quiz at the end of the Semester.	09
Total Learning Hours/Semester		**18**

Evaluation of Learning Process(10Hours)

Type of Evaluation	**Hours**
CIE(1,2and3)	3
Activity	4
Semester End Exam	3
Total	**10**

Course Articulation Matrix:

Course Outcomes	**Program Outcomes**												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO1 1**	**PSO 1**	**PSO 2**
CO1	3	2										2	-
CO2	2	3			2			1	1		1	2	2
CO3	3	2										2	-
CO4	3	2			2			1	1		1	2	2

MALNAD COLLEGE OF ENGINEERING, HASSAN
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DEPARTMENTOF ELECTRONICS AND COMMUNICATION

Course Title	DIGITAL CIRCUIT DESIGN USING VERILOG		
Course Code	25EC304	(L-T-P) C	(3-0-0)3
Exam	3Hours	Hours/Week	03
SEE	50Marks	Total Hours	42L+38ABL+10E=90

Course Objective: This course will enable students to apply Boolean algebra, combinational and sequential circuit design principles, and Verilog hardware description language to analyze, design, implement, and verify digital systems.

Course outcomes: {with mapping shown against the Program Outcomes (POs)} Upon completion of the course, the student shall be able to:

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Apply various simplification techniques for solving Boolean functions.	1,2	1,2
2	Comprehend the fundamental logic functions and logic building blocks of MSI circuits.	1	1
3	Design combinational logic circuits using relevant building blocks and HDL tools for functional verification of digital logic designs.	1, 2, 3, 5,8, 9	1,2
4	Implement sequential logic circuits using the characteristics of various flip-flops and HDL tools for functional verification of digital logic designs.	1, 2, 3, 5,8, 9	1,2

MODULE-1	11 Hrs.

Introduction to digital systems: Introduction**,** Canonical forms, Karnaugh maps-2, 3 and 4 Variables, incompletely specified functions (Don't Care terms), Simplifying Max term equations.

Introduction of HDL: Typical design flow, Verilog data types, Modules andports, Gate types, Gate delays, Verilog operators. Different types of modelling (Data flow,Behavioural& Structural in brief)

MODULE-2	10 Hrs.

Combinational Circuits: Introduction**,** Decoder, Encoder, Priority Encoder, Multiplexer, Binary adder and subtractor, Parallel adder and subtractor, Carry look ahead adder, Decimal adder, Comparator, Code Converters.

HDL Concepts: Verilog Models (Structural & Data flow model) for Combinational Circuits.

Self -Study: Half and full adders, Half and full subtractors

MODULE-3	10 Hrs.

Sequential Circuits I : Introduction**,** he basic bistable element, latches, Clocked S-R flip flop, clocked JK flip flop, Master-Slave J-K flip flop, D and T Flip flop, characteristic equations, Shift registers-Register with Parallel load and universal shift register.

HDL Concepts: Verilog statements (if else, case, loops, always). Verilog Models for Sequential Circuits (Behavioural).

MODULE-4	11 Hrs

Sequential Circuits II : Introduction**,** Counters, Asynchronous and synchronous counter, Design of synchronous counter, Ring and Johnson Counters, Design of Sequence Detector.

HDL Concepts: Verilog Models for Synchronous sequential circuits.

Digital IC Technology: Gate Performance considerations: Noise margins, Fan- Out, Propagation Delays, Power Dissipation (Definitions Only)

Prescribed Text Books:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1.	Digital Design	M. Morris Mano & Michael D. Ciletti	6th	Pearson India	2018
2.	HDL with Digital Design: VHDL and Verilog	Nazeih Botros	1st	Mercury Learning and Information LLC	2015
3.	VerilogHDL	Samir Palnitkar	2nd	PearsonEducation	2003

Reference Books:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1.	Digital Principles and Design	Donald D. Givone	1st	McGraw Hill	2012
2.	HDL Programming: VHDL and Verilog	Nazeih M. Botros	Reprint Edition	Dreamtech Press	2009
3.	The Verilog Hardware Description Language	Donald E. Thomas, Philip R. Moorby	5th	Springer	2002

E Books and Online course material:

1. https://www.scribd.com/document/337249525/Engineering-series-Botros-Nazeih-HDL-with-digital-design-VHDL-and-Verilog-Mercury-Learning-and-Information-2015-pdf
2. https://www.mpgcamb.com/wp-content/uploads/2024/12/M.-Morris-Mano-Digital-Design-Prentice-Hall-1995.pdf

Online course and video lecture:

1. https://nptel.ac.in/courses/117106086
2. https://www.digimat.in/nptel/courses/video/108105113/L27.html
3. https:// nptel.ac.in/courses/106/105/106105165/

Teaching-Learning–Evaluation Scheme:

Sl.No	Teaching and Learning Method	No.of Hours/ Week	No.of Weeks	Hours/ Semester
4.	ClassRoom Teaching & Learning	3	14	42
5.	Activity Based Learning (ABL1&ABL2)	-	-	38
6.	Evaluation of Learning Process	-	-	10
Total Learning Hours/Semester				**90**

Proposed Assessment Plan (for50marksofCIE):

Tool	Remarks	Marks
CIE	Two tests conducted for 50markseachandreducedto15 marks.	30
Activity Details	Details of activities to be conducted Activity1- Poster Presentation (10 Marks). Activity2- Simulation of Digital Circuits using Verilog(10 Marks).	20
Total		**50**

Activity Based Learning (38Hours)

ABL1(15 hours): Poster Presentation **Objective:** To enable the students to identify the need/requirement of digital building blocks in various engineering applications.		**Hours**
1.	Mobile Phone/ Smart card	15
2.	Digital Cathode Ray Oscilloscope/ Digital watch	15
3.	Traffic lights/ Elevator	15
4.	Fitness trackers	15
5.	Smart Watch	15
6.	Digital Voltmeter/ Ammeter/ Multimeter	15
7.	Low-Cost File Alarm Circuit	15
8.	Digital Object Counter	15
9.	Digital Panel Meter	15
10.	Digital IC Tester	15
11.	Audio Meter	15
12.	Digital Combinational Lock	15
Total		**15**

Plan of Action:

- The poster presentation must be done in a group of 2 students.
- Each group must prepare a title that relates to any engineering discipline and the title must emulate any real-world situation related to applications of Digital Electronics.
- Submit the title of the poster presentation by the end of week 2 to the respective faculty.
- Poster presentation to be presented at the end of week 4.
- Students have to be able to take a complex topic and demonstrate their understanding of it by summarizing the main points in both visual and oral presentations.
- To prepare for their presentations students to do background reading on a topic of their choosing.
- They are required to prepare a visual poster presentation of their topic that incorporates graphic elements and a short-written summary of their topic.
- In class, students are required to give a five-minute oral presentation using their poster to illustrate their talk.
- They must then answer questions from their classmate and instructor.
- The final element of this assignment requires students to evaluate the work of their classmates and to ask questions about the topics other students present.

ABL2 (23 hours): Simulation of Digital Circuits using Verilog **Objective:** To allow the student to conduct various experiments without any constraints on place or time, in contrast to the constraints of real labs.		**Hours**
1	Logic Gates	23
2	Realization of Boolean Function	23
3	Universal Gates Realization	23
4	Adders	23

5	Subtractors	23
6	Multiplier	
7	Master-Slave JK Flip-flop	23
8	Seven Segment Display	23
9	Shift Register-SISO, SIPO, PIPO, PISO	23
10	Universal Shift Register	23
	Total	**23**

Plan of Action: **Hours**

- The simulation activity to be carried out individually using Verilog.
- Students can choose circuits from the theory component of any topic (excluding lab experiments) of their interest related to the course.
- Simulation report to be presented at the end of week 10.

REPORT: Report layout is as follows: –Aim–Components required –simulation tool used – circuit-truth table –Result.

Total Learning Hours/Semester	**38**

Evaluation of Learning Process (10Hours)

Type of Evaluation	**Hours**
Test(1and 2)	3
Demonstration of activity	4
Semester End Exam	3
Total	**10**

Course Articulation Matrix

	Program Outcomes[POs]											**Program Specific Outcomes**	
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	2	3										2	1
CO2	2											1	-
CO3	2	3	3		2			1	2			2	2
CO4	2	3	3		2			1	2			2	2

COURSE TITLE: VLSI PROCESS TECHNOLOGY		
Course Code: 25ESC305	**(L-T-P) C**	**(3-0-0)3**
Exam Hours: 3hours	**Hours/Week**	**3**
SEE: **50 Marks**	**Total Hours**	**42L+48ABL=90**

Course Objective: This course provide students with a comprehensive understanding of VLSI fabrication processes, including wafer preparation, thin-film deposition, doping, etching, lithography, characterization techniques, process integration, and packaging technologies used in semiconductor device manufacturing.

Course Outcomes (COs){with mapping shown against the Program Outcomes (POs)}

Upon completion of the course, students shall be able to:

COs	Statement	POs	PSO
1.	Comprehend the crystal growth, wafer preparation, oxidation, and impurity incorporation processes involved in IC fabrication.	1,2	1,2
2.	Apply appropriate thin-film deposition, metallization, and annealing techniques for semiconductor device fabrication.	1,2,5,8,9	1,2
3.	Analyze lithography processes and characterization techniques used for evaluating semiconductor devices.	1,2,5,8,9	1,2
4.	Expound IC fabrication process integration, packaging technologies, and design considerations for VLSI systems.	1,2,5,8,9	1,2

Course Contents:

MODULE-1	**Teaching Hours**
Introduction: Electronic-Grade Silicon, Czochralski Crystal Growing, Silicon Shaping, Process Considerations. Environment for VLSI technology: clean room and safety requirements, Wafer cleaning process. Epitaxy: Introduction, Vapour-Phase Epitaxy, Molecular Beam Epitaxy. Oxidation: Wet and dry oxidation process	**10 Hours**
MODULE-2	
Chemical Vapour deposition techniques: CVD techniques for deposition of materials: PECVD, APCVD, and LPCVD. Metallization: Metallization Applications, Metallization Choices, Physical Vapor Deposition (evaporation and sputtering techniques).	**11 Hours**
MODULE-3	
Impurity incorporation: Models of diffusion in Solids, Fick's laws for Diffusion, measurement Techniques. Ion implantation: Introduction, Implantation Equipment, Annealing. Reactive Plasma Etching: Introduction, Plasma Anisotropic Etch Mechanisms, Lithography: Introduction, Optical Lithography, Electron Lithography, X-ray Lithography, Ion Lithography.	**11 Hours**

MODULE-4	
Thin film Characterization: Overview of thin film characterization, Imaging techniques: Scanning electron microscopy (SEM), AFMVLSI Process Integration: Introduction, Fundamental Considerations for IC Processing, NMOS IC technology, CMOS IC Technology, MOS Memory IC Technology, Bipolar IC Technology, IC Fabrication. Packaging of VLSI Devices: Introduction, Package Types, Packaging Design Considerations.	**10 Hours**

Text Books:

1. **S. M. Sze, VLSI Technology, McGraw-Hill, 2nd Edition, 2017**
2. **S.K. Ghandhi**, VLSI Fabrication Principles, John Wiley Inc., New York, 2nd Edition, 2008.

Reference Books:

1. **John A. Venables**, Introduction to Surface and Thin Films Processes, Cambridge University Press, 2010.
2. **Richard C. Jaeger and Travis N. Blalock**," Introduction to Microelectronic Fabrication", 2nd Edition, Pearson, 2012.
3. **T.Vasudeva Reddy, K.Madhava Rao** "Recent Trends in VLSI and Semiconductor Packaging",1st Edition, CRC Press,2025.

EBooks and online course materials/Online Courses and Video Lectures

1. **https://onlinecourses.nptel.ac.in/elearning/preview/noc22_mm29**
2. **https://www.youtube.com/watch?v=_sNDVdRYYbI&list=PLLy_2iUCG87Bny6CcGkCanvlHuXwr4-_W**
3. **http://digimat.in/nptel/courses/video/108107129/L01.html**

Teaching-Learning– Evaluation Scheme:

Sl.No	Teaching and Learning Method	No. of Hours/ Week	No. of Weeks	Hours/ Semester
1	Class Room Teaching &Learning	3	14	42
2	Activity Based Learning(ABL1&ABL2)	-	-	38
3	Evaluation of Learning Process	-	-	10
Total Learning Hours/Semester				**90**

Proposed Assessment Plan (for 50 marks of CIE):

Tool	Remarks	Marks
CIE	Two tests conducted for 50markseachandreducedto15 marks.	30
Activity Details	Details of activities to be conducted 1) Layout Design 2) Flipped Class	20
Total		**50**

Activity Based Learning (38 Hours)

ABL1 (30Hours): Each student selects different kind of circuits for the layout design.		**Hours**
1.	Selection of the circuit to be designed and the software tool required for the same.	8
2.	Analysis of the working of the circuit.	6
3.	Simulate the circuit and design the layout.	10
4.	Conclusion and prepare the report.	6
Total		**30**
ABL2 (8Hours): Flipped class		**Hours**
Step 1: Pre-Class Preparation		1
Step 2: Pre-Class Assessment		1
Step 3: In-Class Engagement		2
Step 4: Collaborative Learning		2
Step 5: Post-Class Assessment		1
Step 6: Reflection and Follow-Up		1
Total Learning Hours/Semester		**38**

Evaluation of Learning Process (7Hours)

Type of Evaluation	**Hours**
Test(1,2and3)	3
Demonstration of activity	4
Semester End Exam	3
Total	**10**

Course articulation matrix

Course Outcomes	**Program Outcomes [POs]**											**Program Specific Outcomes**	
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PS01**	**PSO2**
CO1	3	2										**2**	**2**
CO2	3	2			2			**2**	**2**			**2**	**2**
CO3	3	2			2			**2**	**2**			**2**	**2**
CO4	2	2			2			**2**	**2**			**2**	**2**

MALNAD COLLEGE OF ENGINEERING, HASSAN
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DEPARTMENTOF ELECTRONICS AND COMMUNICATION

Course Title	**DIGITAL CIRCUIT DESIGN WITH VERILOG LABORATORY**		
Course Code	**25EC306**	**(L-T-P)C**	**(0-0-2)1**
Exam	**3Hrs.**	**Hours/Week**	**2Hrs.**
SEE	**50 Marks**	**Total Hours**	**28P+3E=31**

Course Objective: The students will have hands-on experience to design and build combinational circuits and sequential circuits.

Course outcomes:){with mapping shown against the Program Outcomes (POs)}

Upon completion of the course, students shall be able to:

#	Course Outcomes	Mapping To PO's	Mapping To PSO's
1.	Design and implement combinational and sequential logic circuits using ICs	1, 2, 3, 5, 8	2
2.	Design and develop the Verilog description for combinational and sequential circuits	1, 2, 3, 5, 8	2
3.	Document experimental procedures, observations, circuit diagrams, and results systematically in the laboratory record.	9, 11	-

Teaching-Learning–Evaluation Scheme:

Sl. No	Teaching and Learning Method	No. of Hours/Week	No. of Weeks	Hours/ Semester
1	Lab Conduction +Evaluation	2	14	28
2	SEE	-	-	03
Total Learning Hours/Semester				31
ABL : Lab based learning (28Hrs.)				

Sl.No	Experiment Title	Hours
I	**Digital Circuit Experiments**	
1.	Realization of parallel adder/ Subtractor using 7483 chip.	2
2.	MUX and DEMUX for arithmetic circuits and code converter.	2
3.	Realization of One bit comparator, 4 bit and 8 bit magnitude comparator using of 7485	2
4.	Truth table verification of Flip-Flops: (i) JK Type (ii) T type (iii) D type (iv) SR type and (v) JK Master slave.	2
5.	Realization of 3 bit counters as a sequential circuit using IC7476	2+2
6.	Shift left; Shift right, SIPO, SISO, PISO, PIPO operations using IC7495S	2
II	**Verilog Experiments**	
1.	Verilog program for Encoder without priority and with priority	2
2.	Verilog program for Decoder with and without enable.	2
3.	Verilog code for Multiplexer, Demultiplexer, Comparator, Code converters.	2
4.	Verilog code for a) 4-bit parallel adder b)4-bit ALU/8-bit ALU.	2
5.	Verilog codes for SR, D, JK, T-flip-flops.	2
6.	Designing 4-bit Binary counter, BCD counter and any arbitrary sequence counter.	2
Total		**26**

Proposed Assessment Plan(for 50 marks of CIE):

Tool	Remarks	Marks
Internals	Continuous evaluation–10Marks Record writing -20Marks Lab CIE -20Marks	50
Total		**50**

Prescribed Text Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1.	Digital Principles and Applications	Donald P. Leach, Albert Paul Malvino, and Goutam Saha	8th	Tata McGraw-Hill	2014
2.	HDL Programming (VHDL and Verilog)	Nazeih M. Botors	1st	Dream tech publication	2009

Online Courses and Video Lectures:

1. https://nptel.ac.in/courses/117106086
2. https:// nptel.ac.in/courses/106/105/106105165/

Course Articulation Matrix

Course Outcomes	Program Outcomes[POs]												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	1	3	3		2			2					3
CO2	1	3	3		2			2					3
CO3									2		2		-

MALNAD COLLEGE OF ENGINEERING, HASSAN
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DEPARTMENTOF ELECTRONICS AND COMMUNICATION

Course Title	**ANALOG ELECTRONICS AND LINEAR INTEGRATED CIRCUITS LABORATORY**		
Course Code	**25AEC307**	**(L-T-P)C**	**(0-0-2)1**
Exam	**3Hrs.**	**Hours/Week**	**2Hrs.**
SEE	**50 Marks**	**Total Hours**	**28P+2E=30**

Course Objective: Students will have hands on experience to design and build several electronic circuits and study their performance.

Course outcomes:){with mapping shown against the Program Outcomes (POs)}

Upon completion of the course, students shall be able to:

#	Course Outcomes	Mapping To PO's	Mapping To PSO's
1.	Implement analog electronics circuits using Electronic components and compare with experimental resultswith theoretical analysis.	1,2,3,4,8,9,11	1,2
2.	Design and test various analog electronic circuits using OP-AMP and compare with experimental results in the Laboratory with theoretical analysis.	1,2,3,4,8,9,11	1,2
3.	Design and test various analog electronic circuits using P-spice software	2,3,4,5,8,9,11	1,2

Teaching-Learning–Evaluation Scheme:

Sl.No	Teaching and Learning Method	No.ofHours/ Week	No.ofWeeks	Hours/ Semester
1	Lab Conduction	2	14	28
2	Evaluation	-	-	02
Total Learning Hours/Semester				30
LBL : Lab based learning (28Hrs.)				

Sl.No	Experiment Title	Hours
1.	Design of a RC-Coupled single stage BJT amplifier and determination of gain versus frequency response.	2
2.	Design and testing of BJT-RC Phase shift oscillator for given audio frequency.	2
3.	Design and testing of FET – Hartley oscillator for Radio frequencies.	2
4.	Design and testing of a Crystal oscillator.	2
5.	Inverting and non-inverting amplifier using Op-Amp.	2
6.	Summer and Subtractor using Op-Amp	2
7.	Integrator and Differentiator using Op amp.	2
8.	Precision Rectifiers.	2
9.	First order Active Butterworth Low Pass and High Pass Filter.	2
10.	Band Pass Filter using Op amp.	2
11.	Band Elimination Filterusing Op amp	2
12.	Pre-emphasis and De-emphasis circuits.	2
13.	Design and test various Analog Electronics Circuits using P-spice software.	2+2
Total		**28**

Proposed Assessment Plan(for50marksof CIE):

Tool	Remarks	Marks
Internals	Continuousevaluation–10Marks Recordwriting -20Marks LabCIE -20Marks	50
Total		**50**

Prescribed TextBook:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1.	Hand Books of Experiments in Electronics and Communication Engineering	S. Poornachandra Rao. B Sasikala,	2nd	Vikas Publication	2008
2.	OP-AMP and Linear ICs	Ramakant A. Gayakwad,	4th	Prentice Hall / Pearson Education	2001

Course Articulation Matrix

Course Outcomes	Program Outcomes[POs]												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	1	3	2	2	-	-	-	1	2	-	2	1	2
CO2	1	3	2	2	-	-	-	2	2	-	2	1	2
CO3	-	2	2	2	3	-	-	2	2	-	2	1	2

MALNAD COLLEGE OF ENGINEERING, HASSAN
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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Course Title	**Sci-lab Programming Laboratory**		
Course Code	**25AEC308**	(L-T-P) C	(0-0-2)1
Exam	3Hrs.	Hours/Week	2Hrs.
SEE	50 Marks	Total Hours	28P+2E=30

Course Objective: To equip students with the skills to utilize Scilab for solving, modeling, and visualizing complex electronics engineering problems

Course Outcomes (COs){with mapping shown against the Program Outcomes (POs)}
Upon completion of the course, students shall be able to:

COs	**Statement**	**POs**	**PSOs**
1.	Able to use Scilab to solve complex electronics problems and perform simulations.	1,2,3,5,8	1,2
2.	Apply mathematical concepts within Scilab for circuit analysis and system modeling.	1,2,3,5,8	1,2
3.	Develop and visualize electronic systems using Scilab's plotting and graphical tools.	1,2,3,5,8	1,2

Teaching-Learning–Evaluation Scheme:

Sl. No	**Teaching and Learning Method**	**No. of Hours/Week**	**No. of Weeks**	**Hours/ Semester**
1	Lab Conduction	2	14	28
2	Evaluation	-	-	02
Total Learning Hours/Semester				30
ABL : Lab based learning(28Hrs.)				

Sl. No	**Experiment Title**	**Hours**
I	Hardware Experiments	
1	Write a Scilab program to calculate the current flowing through a resistor given the voltage across it and its resistance using Ohm's Law (I = V/R).	**2**
2	Write a Scilab program to compute the output voltage of a voltage divider circuit given the input voltage and the values of the two resistors.	**2**
3	Write a Scilab program to convert a resistor's color code to its resistance value.	**2+2**
4	Write a Scilab program to calculate the equivalent resistance of resistors connected in series and parallel.	**2**
5	Write a Scilab program to model and plot the charging and discharging curves of a capacitor in an RC circuit.	**2+2**
6	Write a Scilab program to calculate the time constant of an RL circuit given the values of the resistor and the inductor.	**2+2**
7	Write a Scilab program to compute the resonant frequency of an RLC circuit given the values of the resistor, inductor, and capacitor	**2+2**
8	Write a Scilab program to calculate the required series resistor for an LED given the supply voltage, the LED forward voltage, and the desired current.	**2**

Tool	**Remarks**	**Marks**
Internals	Continuous evaluation–10Marks Record writing -20Marks Lab CIE -20Marks	50
Total		**50**

Textbooks:

1. Perrine Mathieu, Philippe Roux, Scilab, from theory to practice, ISBN: 978-2-8227-0293-5, 2016.
2. Dr. M. Affouf, Scilab by example, ISBN: 978-147920344, 2012.

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MOOC Course:

1. https://www.udemy.com/course/scilab-an-open-source-alternative-of-matlab/
2. https://onlinecourses.swayam2.ac.in/aic20_sp38/preview
   Software Download Link:
3. https://www.scilab.org/

Course Outcomes	Program Outcomes											Program Specific Outcomes	
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PS01**	**PSO2**
CO1	1	2	3		3			2				1	2
CO2	1	2	3		3			2				1	2
CO3	1	2	3		3			2				1	2

MALNAD COLLEGE OF ENGINEERING, HASSAN
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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Course Title	C++ Basic Programming		
Course Code	25AEC309	(L-T-P) C	(0-0-2)1
Exam	3Hrs.	Hours/Week	2Hrs.
SEE	50 Marks	Total Hours	28P+2E=30

Course Objective: The student will have hands on experience on C++ programming concepts.

Course Outcomes (COs) {with mapping shown against the Program Outcomes (POs)} upon completion of the course, the student shall be able to:

COs	Statement	POs	PSOs
1.	To understand the basic concepts of C++ program	1,2	2
2.	Implementing array operation using C++ program	1,3,5,8	2
3.	An ability to create strings and functions	1,3,5,8	2

Teaching-Learning–Evaluation Scheme:

Sl. No	Teaching and Learning Method	No. of Hours/Week	No. of Weeks	Hours/ Semester
1	Lab Conduction	2	14	28
2	Evaluation	-	-	02
Total Learning Hours/Semester				30
ABL : Lab based learning(28Hrs.)				

Sl.No	Experiment Title	Hours
I	**Hardware Experiments**	
1.	Write a C++ program to sort the elements in ascending and descending order.	2
2.	Write a C++ program to find the sum of all the natural numbers from 1 to n.	2
3.	Write a C++ Program to Check Whether Number is Even or Odd.	2+2
4.	Write a C++ Program to Find Largest Among Three Numbers.	2
5.	Write a C++ Program to Make a Simple Calculator.	2+2
6.	Write a C++ GCD of Two Numbers.	2+2
7.	Write a C++ Program To Find LCM of Two Numbers.	2+2
8.	Write a C++ Program to Check Whether a Number is Palindrome or Not.	2
9.	Write a C++ Program to check Prime Number.	2
10.	Write a C++ Program For Fibonacci Numbers.	2
Total		**28**

Proposed Assessment Plan (for 50 marks of CIE):

Tool	Remarks	Marks
Internals	Continuous evaluation–10Marks Record writing -20Marks Lab CIE -20Marks	50
Total		**50**

TEXT BOOK:

1. Bhushan Trivedi, "Programming with ANSI C++", Oxford Press, Second Edition, 2012.

2. Balagurusamy E, Object Oriented Programming with C++, Tata McGraw Hill _Education Pvt.Ltd , Fourth Edition 2010.

Course Articulation Matrix

Course Outcomes	Program Outcomes												Program Specific Outcomes	
Cos	**PO 1**	**PO 2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PS01**	**PSO2**
CO1	1	2											-	2
CO2	2		3		2			1					-	2
CO3	2		3		2			1					-	2

MALNAD COLLEGE OF ENGINEERING, HASSAN
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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Course Title	IOT APPLICATIONS LABORATORY		
Course Code	25AEC310	(L-T-P) C	(0-0-2)1
Exam	3Hrs.	Hours/Week	2Hrs.
SEE	50 Marks	Total Hours	28P+2E=30

Course Objective: Working with IoT boards for interfacing various sensors to develop IoT applications

Course Outcomes (COs){with mapping shown against the Program Outcomes (POs)}
Upon completion of the course, students shall be able to:

COs	Statement	POs	PSOs
1.	Interface most commonly used sensors and IoT boards.	1, 5	
2.	Select the right sensors, actuators and communication protocols to use in application specific IoT system.	5,8	
3.	Explore the solutions to social problems and potential business opportunities that **IoT** can uncover.	3, 5, 7,8	

Teaching-Learning–Evaluation Scheme:

Sl. No	Teaching and Learning Method	No. of Hours/Week	No. of Weeks	Hours/ Semester
1	Lab Conduction	2	14	28
2	Evaluation	-	-	02
Total Learning Hours/Semester				30
ABL : Lab based learning(28Hrs.)				

Sl. No	Experiment Title	Hours
I	**Hardware Experiments**	
1.	Introduction to Microcontroller based IoT boards(Arduino, Rasberry Pi, TI-MSP-430).	2+2
2.	Working with Arduino using push Button switch, potentiometer, thermistor and other sensors.	2
3.	Using DHT-11 temperature and humidity sensor.	2+2
4.	Connecting 16x2 LCD display to Arduino.	2
5.	Using IR sensor with Arduino and its applications	2+2
6.	Ultrasonic distance measurement and servomotor control using Arduino.	2+2
7.	Joystick based controlling using Arduino.	2+2
8.	Android based Bluetooth Integration to Arduino.	2+2
Total		**28**

Proposed Assessment Plan (for 50 marks of CIE):

Tool	Remarks	Marks
Internals	Continuous evaluation– 10Marks Record writing - 20Marks Lab CIE - 20Marks	50
Total		**50**

TEXT BOOK:

1. **Arshdeep Bahga and Vijay Madisetti**, "Internet of Things - A Hands on Approach", Universities Press, 2015

REFERENCE BOOK:

1. **Olivier Hersent, David Boswarthick, Omar Elloumi**, "The Internet of Things: Key Applications and Protocols", 2nd Edition, Wiley ISBN: 978-1-119-99435-0, 370 pages, January 2012

Course Articulation Matrix

Course Outcomes	Program Outcomes											Program Specific Outcomes	
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PS01**	**PSO2**
CO1	2				2								
CO2													
CO3					2								

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DEPARTMENTOFELECTRONICS AND COMMUNICATION ENGINEERING

IV Semester

Course Title	Fundamentals of Signal Processing		
Course Code	25EC401	(L-T-P) C	(3-0-2)4
Exam	3Hours	Hours/Week	05
SEE	50Marks	Total Hours	42L+28P+40ABL+10E=120

Course Objective: To understand the fundamental concepts of signals and systems in both time and frequency domains, analyze continuous-time and discrete-time linear time-invariant systems using convolution and transform techniques, and implement signal processing operations through simulation tools.

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

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Illustrate the classification of signals, basic operations on signals, interconnection of elements in a system, and properties of system.	1, 2, 5, 8, 9	1,2
2	Apply convolution techniques and solution of differential/difference equation methods to determine the response of linear time-invariant systems.	1, 2, 5, 8, 9	1,2
2	Apply the knowledge of Fourier transforms and Z-transform in signal representation and analysis of linear time-invariant systems.	1, 2, 5, 8, 9	1,2
4	Demonstrate the classification and sketching of signals, convolution, Fourier Transform, and Z-Transform through simulation experiments using appropriate software tools.	1, 2, 5, 8, 9	1,2

MODULE-1 — 11 Hrs.

Introduction: Definitions of a signal and a system, classification of signals, basic Operations on signals, elementary signals, properties of systems.

Self Study: Systems viewed as interconnections of operations.

MODULE-2 — 10 Hrs.

Time-domain representations for LTI systems: Impulse response representation, Concept of Linear Convolution, Convolution Sum and Convolution Integral. Differential and difference equation Representations, System response by solving differential and difference equation.

Block diagram representations: direct form-I, direct form-II representation for differential and difference equations.

Self Study: Properties of impulse response representation.

MODULE-3 — 10 Hrs.

Fourier Representation of Signals: Introduction, Comparison of time and frequency domain, Fourier representation for Four classes of signals, Fourier transform representation for continuous-time non-periodic signals and their properties. The Fourier transform representation of discrete-time non-periodic signals. Inverse Fourier Transform.

Self Study: Properties of Discrete-time Fourier transform.

MODULE-4 — 11 Hrs

Z-Transforms: Introduction, Z – transform and their properties, properties of ROC, inverse Z – transforms. Transform analysis of LTI Systems, Unilateral Z-Transform.

Self Study: Solution of difference equations using unilateral Z-Transform.

PRACTICAL COMPONENT (28 Hours):

Experiments executed using programming languages Scilab / MATLAB

Sl. No	Program List	Hours
1.	Program for generation of Real Signals: periodic, non-periodic, Discrete, continuous signals.	4
2.	Program to operate on continuous-time signals.	2

3.	Program to operate on discrete-time signals.	2
4.	Program on complex signal representation and computing energy and power of signals.	2
5.	Program to perform linear convolution of two given sequences.	2
6.	Program to perform step response of a given system.	2
7.	To find the Fourier Transform of a given signal and plotting its magnitude and phase spectrum.	4
8.	Program to perform frequency domain representations of single tone and multi tone sinusoidal signals.	4
9.	Program to perform stability analysis and causality analysis : Pole-Zero plot, magnitude and phase response from a difference equation using Z-transform.	4
10.	Program to perform frequency response of discrete time system using Fourier Transfrom/Z-Transform.	2
	Total	**28**

Activity Based Learning (40Hours)

ABL (40Hours): Students engage in a hands-on exploration using an interactive simulator.		
1	**Signal Generation and Time-Domain Analysis:** Generate and classify different types of signals (periodic, non-periodic, continuous, and discrete), perform signal transformations such as time shifting, scaling, and amplitude modification, and analyze signal characteristics through energy/power computation, convolution of sequences, and step response evaluation using graphical representations.	**14**
2	**Fourier Transform and Frequency Domain Analysis:** Perform frequency-domain analysis of signals by obtaining and interpreting the Fourier Transform, magnitude spectrum, and phase spectrum of single-tone and multi-tone sinusoidal signals, and identify the constituent frequency components by comparing the spectral characteristics with theoretical expectations.	**13**
3	**Z-Transform and Discrete-Time System Analysis:** Analyze discrete-time systems by obtaining pole-zero plots from difference equations, evaluating system stability and causality, and investigating the relationship between pole-zero locations and the corresponding magnitude, phase, and frequency responses using Fourier Transform and Z-Transform techniques.	**13**
	Total	**40**

Prescribed Text Book:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1.	Signals and Systems, 2ed, An Indian Adaptation	Simon Haykin and Barry Van Veen	2nd **ISBN:** 9789354243158	Wiley India	2021

Reference Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1.	Signals and Systems	Anand Kumar	3rd **ISBN:** 9788120348400	PHI Learning Private Limited	2013
2.	Signals and Systems	D. Ganesh Rao and Satish Tunga	1st **ISBN:** 9788131533628	Cengage India	2017
3.	Signals and Systems: Analysis Using Transform Methods & MATLAB	M. J. Roberts	3rd **ISBN:** 9780078028120, 0078028124	McGraw-Hill	2017

eBooks and Online course material:

1. https://share.google/Fat0przzHf8d07G2t
2. https://www.cedric-richard.fr/assets/files/Signals_and_Systems_2nd_Edition_by_Oppen.pdf

Web links and Video Lectures (e-Resources):

1. https://nptel.ac.in/courses/108104100
2. https://share.google/dnSGIr0LAPjKYB6IA
3. **https://nptel.ac.in/courses/117101055**

Teaching-Learning–Evaluation Scheme:

Sl. No	Teaching and Learning Method	No.of Hours/ Week	No.of Weeks	Hours/ Semester
7.	Class Room Teaching & Learning	3	14	42
8.	Integrated Lab Component	2	14	28
9.	Activity Based Learning (ABL)	-	-	40
10.	Evaluation of Learning Process	-	-	10
Total Learning Hours/Semester				**120**

Proposed Assessment Plan(for50marksofCIE):

Tool	Remarks	Marks
CIE	Two CIEs are conducted for 50 marks each and reduced to 15marks	30
Integrated Lab	• One CIE will be conducted for 20 marks and reduced to 10 marks. • ABL will be evaluated for 20 marks and reduced to 10 marks.	20
Total		**50**

Evaluation of Learning Process(10Hours)

Type of Evaluation	Hours
CIE(1and2)	3
Integrated Lab	4
Semester End Exam	3
Total	**10**

Course Articulation Matrix

Course Outcomes	Program Outcomes[POs]												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	3	3	-	-	2	-	-	2	2	-	-	1	2
CO2	3	3	-	-	2	-	-	2	2	-	-	1	2
CO3	3	3	-	-	2	-	-	2	2	-	-	1	2
CO4	3	3	-	-	2	-	-	2	2	-	-	1	2

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DEPARTMENTOFINFORMATIONSCIENCEANDENGINEERING

Course Title	ELECTROMAGNETICS AND TRANSMISSION LINES		
Course Code	25EC402	(L-T-P) C	(2-2-0)-3
Exam	3 hrs.	Hours/Week	4
SEE	50 Marks	Total Hours	28L + 28E+ 34ABL=90

Course Objective: This course aims to introduce the concepts of electromagnetic field, Maxwell's equations and their applications, propagation of uniform plane waves in different media, and fundamentals of transmission lines.

Course Outcomes: with mapping shown against the Program Outcomes (POs)} Upon completion of the course, students shall be able to:

#	Course Outcomes	Mapping to POs	Mapping to PSOs
1	Understand the fundamental concepts of electrostatics, vector calculus to analyze electric fields, electric flux density, electric potential, and solve electrostatic field problems using Coulomb's law, Gauss' law, Stokes' theorem, and Divergence theorem.	1, 2, 5,8,9	1, 2
2	Apply Biot–Savart's law, Ampere's circuital law, Faraday's law, and Maxwell's equations for electric and magnetic phenomena.	1, 2, 3, 5,8,9	1, 2
3	Analyse electromagnetic wave propagation in different media and evaluate wave behavior, power flow, and reflection characteristics using uniform plane wave theory and Poynting theorem.	1,2,3,5,8, 9	1, 2
4	Evaluate transmission line performance and solve impedance matching problems using Smith chart techniques and transmission line theory.	1, 2, 3,5,8,9	1, 2

MODULE-1	No. of Hrs.
Electrostatics: Introduction to vector algebra, Coulomb's Law, Electric Field Intensity, Electric Flux Density, Electric field due to line charge, sheet charge and volume charge, Stoke's Theorem, Divergence theorem, Gauss' Law, electrical potential at a point, potential difference, potential gradient, Numerical Problems. **Self-study:**Poisson's and Laplace equations.	**14 Hours**
MODULE-2	
Steady Magnetic fields: Biot-Savart's law, Ampere's circuital law, Magnetic flux density, Faraday's law, Displacement Current, Numerical Problems. **Maxwell's equations**: Maxwell's equations in time-varying fields, differential and integral forms of Maxwell's equations, Maxwell's equation for static fields and free space, and proof of Maxwell's equations, Numerical Problems. **Self-study:** Magnetic Scalar and vector potentials	**14 Hours**
MODULE-3	
Electromagnetic Wave Propagation: Uniform plane wave, General solution of uniform plane wave equation, wave propagation in lossy dielectrics, Plane waves in lossless dielectrics, free space and good conductors- skin depth, Power and the Poynting Vector- Poynting theorem, , Numerical Problems. **Self-study:** Reflection of Plane waves at normal incidence	**12 Hours**
MODULE-4	
Transmission lines: Transmission Line Parameters, transmission line equations, lossless and distortion-less lines, Input impedance of open-circuited, short-circuited, and matched lines, VSWR, SWR, Impedance matching principle: quarter wave transformers, single stub tuner, **Self-study:** Slotted Line (Impedance Measurement)	**12 Hours**

Prescribed Textbook:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1.	Elements of Electro-magnetics	Mathew N.O.Sadiku	7th Edition	Oxford University Press	2018

Reference Books:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1	Engineering Electromagnetics	William H. Hayt Jr. and John A. Buck.	7th Edition	Tata McGraw-Hill	2006
2	Network Lines and Fields	John D Ryder	2nd Edition	PHI, New Delhi	2015

E-Books and online course materials:

1. "Electromagnetic Field Theory: A Problem Solving Approach", Markus Zahn, 2008.https://hibp.ecse.rpi.edu/~connor/education/Fields/Zahn/electromagnetic_ field_theory_mod2_tag.pdf
2. docs.google.com/file/d/0B6LN8LD0xzNAcnFoZHdEN1EzLVU/edit?pli=1&resour cekey=0-Y-mrnot4rH37V5ykIWROqA

Online Courses and Video Lectures:

1. Electromagnetic Theory- Prof. Prasanna Kumar IIT Kanpur https://archive.nptel.ac.in/courses/108/104/108104087/
2. Introduction to Electromagnetic Theory Prof. Manoj Harbola https://archive.nptel.ac.in/courses/115/104/115104088/

Teaching -Learning– Evaluation Scheme:

Sl.No	Teaching and Learning Method	No.of Hours/ Week	No.of Weeks	Hours/ Semester
1.	Classroom Teaching & Learning	4	14	56
2.	Activity Based Learning (ABL1&ABL2)			24
3.	Evaluation of Learning Process			10
Total Learning Hours/Semester				**90**

Proposed Assessment Plan (for 50 marks of CIE):

Tool	Remarks	Marks
CIE	Two tests conducted for 50markseachandreducedto15 marks.	30
Activity Details	Details of activities to be conducted 1) Solving Electro static and magnetic problems using software like Scilab/Matlab. 2) Solving electromagnetic wave propagation and Transmission line problems using software like Scilab/Matlab.	20
Total		**50**

Activity-Based Learning (68 Hours)

Activity-Based Learning -1	Hours
ABL1 (28 Hours): Students will understand and analyze electromagnetic concepts such as Coulomb's Law, Electric Field Intensity, Electric Flux Density, Gauss' Law, Stokes' Theorem, Divergence Theorem, Biot–Savart's Law, Ampere's Circuital Law, Magnetic Flux Density, Faraday's Law, and Maxwell's Equations through simulation-based activities demonstrating their engineering applications.	**12**
Activity-Based Learning -2	
ABL2 (30 Hours): Students will apply concepts of electromagnetic wave propagation and transmission lines, including wave propagation in different media, Poynting vector, reflection of plane waves, transmission line equations, VSWR/SWR, impedance matching, quarter-wave transformer, stub tuner, and Smith chart applications using simulation and online analysis tools.	**12**
Total Hours	**24**

Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	3	3			2			2	1			1	1
CO2	2	3			2			2	1			1	1
CO3	2	2	2		2			2	1			1	1
CO4	2	3	2		2			2	1			1	1

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DEPARTMENTOFINFORMATIONSCIENCEANDENGINEERING

Course Title	Principles of Communication Engineering		
Course Code	25EC403	(L-T-P) C	(3-0-0)3
Exam	3Hours	Hours/Week	3
SEE	50Marks	Total Hours	42L+48ABL=90

Course Objective: To understand analog modulation and demodulation process, types of modulation techniques, multiplexing, analyze noise, bandwidth, and transmitting power in communication systems

Course Outcomes: Upon completion of the course, students shall be able to:

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Comprehend analog modulation techniques, their generation, detection, and spectral characteristics.	1, 2, 3,5, 8, 9, 11	1,2
2	Apply sampling, signal reconstruction, and TDM concepts in communication systems.	1, 2, 5, 8, 11	1,2
3	Analyze modulation schemes and noise effects on communication system performance.	1, 2, 3, 5, 8, 9, 11	1,2
4	Asses modulation and multiplexing techniques based on bandwidth, power efficiency, and system performance.	1, 2, 3, 5, 8, 9, 11	1,2

MODULE-1	11Hrs.

Analog Modulation-I: Time and Frequency domain description, Generation and Detection of AM waves, DSBSC Modulation: Time and Frequency domain description, Generation and coherent Detection. Single sideband modulation: Time and Frequency Domain description.

MODULE-2	10 Hrs.

Analog Modulation-II: Generation and Detection VSB techniques, comparison of modulation techniques, Frequency division multiplexing. Single-tone Frequency Modulation, Angle Modulation, Generation of FM wave–Direct and Indirect methods, demodulation of FM – balanced discriminator method.

MODULE-3	11 Hrs.

Noise in Modulation systems: Types of Noise, Noise figure, Noise equivalent noise temperature, Signal to noise ratios, Baseband systems, double-sideband systems, single-sideband systems, Amplitude modulation systems, coherent demodulation of AM signals, envelope demodulation of AM signals, square-law demodulation of AM signals, estimator for signal-to-noise ratios, Noise in angle modulation, performance enhancement through the use of De-emphasis, noise in FM

MODULE-4	10Hrs

Sampling Process: Sampling theorem, Quadrature sampling of band pass signals, reconstruction of a message from its samples, signal distortion in sampling, practical aspects of sampling and signal recovery, TDM.

Prescribed Text Book:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1.	An introduction to Analog and Digital communications	Simon Haykin	2nd	John Wiley	**Jan 2012 978-8126536535**
2	Digital Communication	Simon Haykin	Special Edition	John Wiley	September 2018

Reference Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1.	Digital and analog communication systems	K Sam Shanmugam	Student edition	John Wiley& Sons.	1985

E-Books and online course materials:

- https://gctjaipur.wordpress.com/wp-content/uploads/2015/08/an-introduction-to-analog-and-digital-communications-2nd-edition.pdf
- https://gctjaipur.wordpress.com/wp-content/uploads/2015/08/an-introduction-to-analog-and-digital-communications-2nd-edition.pdf

Online Courses and Video Lectures:

- **https://www.youtube.com/watch?v=Cc20NYokagU&list=PLc3zKsWdO93e2I625YDlXi0LlbBth1QpB**
- **https://www.youtube.com/watch?v=Z0Ylnk8zXRo&list=PLgwJf8NK-2e5PngHbdEadEun5XPvnn00N**
- **https://www.youtube.com/watch?v=3i6vtb9EZfI&list=PLgwJf8NK-2e766VdglamL0KzDicK5uqfT**
- **https://www.youtube.com/watch?v=VZ23yvTNjGI&list=PLgwJf8NK-2e6k8KpggtSzksKWhRg6jyjb**

Teaching-Learning–Evaluation Scheme:

Sl.No	Teaching and Learning Method	No.of Hours/ Week	No.of Weeks	Hours/ Semester
1.	Classroom Teaching & Learning	3	14	42
2.	Activity Based Learning (ABL1&ABL2)	-	-	38
3.	Evaluation of Learning Process	-	-	10
Total Learning Hours/Semester				**90**

Proposed Assessment Plan(for 50 marks of CIE):

Tool	Remarks	Marks
CIE	Two tests conducted for 50markseachandreducedto15 marks.	30
Activity Details	**Activity 1:**Design and simulation of Analog modulation and demodulation (such as AM, DSBSC, SSB and VSB) and implementation of Sampling process using open source software Simulator or any relevant Open Source tools ***(10 Marks)*** **Activity 2:** Preparation of document of activity-1 and submission of the same. ***(10 Marks)***	20
Total		**50**

Activity Based Learning(38Hours)

ABL1(15Hours): Students will learn differentmodulation and demodulation process and can use open source platform to simulate or using instructions to implement and analyzes their performances in communication system. Also understands the effect of noise and importance of sampling in communication system.		**Hours**
11.	Generation and Detection of AM	2
12.	DSBSC Modulation and demodulation	2
13.	Single Side Band (SSB) modulation and demodulation	2
14.	VSB Generation & Detection	2
15.	FM Generation & Detection	2
16.	Generation of FDM signal	2
17.	Direct FM generation and detection	2
18.	Indirect FM generation and detection	2
19.	Design of De-emphasis circuit	2
20.	Generation TDM signal	2
Total		**20**
ABL2(18Hours): Preparation of document of activity-1 along with literature survey and submission of detail document in the form of report.		**18**
Total Learning Hours/Semester		**38**

Evaluation of Learning Process(10Hours)

Type of Evaluation	**Hours**
Test(1,2and3)	3
Evaluation of activity	4
Semester End Exam	3
Total	**10**

Course Articulation Matrix

Course Outcomes	**ProgramOutcomes[POs]**											**PSO's**	
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	3	2	1		1			2			1	3	2
CO2	3	2			1			1			1	3	2
CO3	2	2	1		1			1	1		1	2	1
CO4	3	2	1		1			2	1		1	2	1

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Course Title :	ARM EMBEDDED SYSTEMS		
Course Code	25EC404	(L-T-P) C	(3-0-0) 3
Exam	3 Hours	Hours/Week	3
SEE	50 Marks	Total Hours	42L+10+38ABL=90

Course Objective: students will be able to understand the programming model architecture of arm-based microcontroller to program the processor

Course Outcomes: At the end of the course, students shall be able to:

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Depict the organization, architecture, bus technology, memory and operation of the ARM Processors.	1,5,8,11	1
2	Employ the knowledge of the Instruction set of ARM processors to develop basic Assembly Language Programs.	1,2,3,5,8,11	1,2
3	Analyze cache memory, memory hierarchy, LPC2148 architecture, and peripheral operation in ARM-based embedded systems.	1,3,5,8,9,10,11	1,2
4	Examine the architecture, registers, instruction set, and operating modes of ARM Cortex-M3 processors for embedded system implementation.	1,5,8,9,10,11	1,2

MODULE-1 **No. of Hrs.10**

ARM Embedded Systems: Introduction, RISC design philosophy, ARM design philosophy, Embedded system hardware – AMBA bus protocol, ARM bus technology, Memory, Peripherals, Embedded system software – Initialization (BOOT) code, Operating System,

ARM Processor Fundamentals: ARM core dataflow model, registers, current program status register, Pipeline comparison between ARM7 and ARM9, Exceptions, Interrupts and Vector Table, Core extensions.

(Self-study: Applications)

MODULE-2 **No. of Hrs.11**

Introduction to the ARM Instruction set: Introduction, Data processing instructions, Load - Store instruction, Software interrupt instructions, Program status register instructions, Loading constants, Conditional Execution.Assembly level programming.

Introduction to the THUMB instruction set: Introduction, THUMB register usage, ARM – THUMB interworking, other branch instructions, Data processing instructions,

(Self-study: Software interrupt instructions)

MODULE-3 **No. of Hrs.10**

Caches: The memory Hierarchy and caches memory-caches and memory management units, Cache architecture basic architecture of caches memory, basic operation of cache controller.

LPC2148 ARM CPU: Salient features of LPC 2148, Pin Description of 2148 CPU, Architectural Overview. LPC 2148 – Peripherals: Description of General-Purpose Input/output Ports (GPIO) & Pin control Block. Features, Pin description, register description & operation of DAC.

(Self-study: the relationship between cache and main memory)

MODULE-4 **No. of Hrs.11**

ARM Cortex-M3 Processor: Introduction, What Is the ARM Cortex-M3 Processor? Instruction Set Development, The Thumb-2 Technology and Instruction Set Architecture, Cortex-M3 Processor Applications.

Overview of the Cortex-M3: Fundamentals, Registers, R0–R12: General-Purpose Registers, R13: Stack Pointers, R14: The Link Register, R15: The Program Counter, Special Registers, Operation Modes.

(Self-study: Background of ARM and ARM Architecture)

Prescribed Text Books:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1	ARM System Developers Guide"	Andrew N Sloss, Dominic System and Chris Wright	1st Edition	Elsevier, Morgan Kaufmann publisher	2008

Reference Books:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1	ARM System on chip Architecture	**Furber S**	2nd edition	Addison Wiley	2008
2	Embedded System	**Rajkamal**	2nd edition	Tata McGraw-Hill Publishers	2008

EBooks and online course materials:

1. https://www.geeksforgeeks.org/arm-processor-and-its-features/

Online Courses and Video Lectures:

1. https://www.youtube.com/watch?v=3OmyM4-zuQw

Teaching -Learning– Evaluation Scheme:

Sl. No	Teaching and Learning Method	No. of Hours/ Week	No. of Weeks	Hours/ Semester
1	Class Room Teaching & Learning	3	14	42
2	Evaluation of Learning Process	-	-	10
3	Activity Based Learning (ABL)	-	-	38
	Total Learning Hours/Semester			**90**

Proposed Assessment Plan (for 50 marks of CIE):

Tool	Remarks	Marks
CIE	Two tests conducted for 50markseachandreducedto15 marks.	30
Activity Details	Details of activities to be conducted Mini-Project using ARM Processor: A group of four members A brief report has to be submitted along with demonstration to the concerned faculty member.	20
Total		**50**

Evaluation of Learning Process (7 Hours)

Type of Evaluation	Hours
Test(1,2and3)	3
Presentation	**4**
Semester End Exam	**3**
Total	10

Course Articulation Matrix

Course Outcomes	Program Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	3				2			1			1	2	
CO2	3	2	2		2			2			1	2	1
CO3	3		2		2			2	1	1	1	2	1
CO4	3				2			2	1	1	1	2	1

MALNADCOLLEGEOFENGINEERING,HASSAN
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DEPARTMENTOFINFORMATIONSCIENCEANDENGINEERING

Course Title	Microwave and RADAR Communication		
Course Code	25EC405	(L-T-P) C	(3-0-0)3
Exam	3Hours	Hours/Week	3
SEE	50Marks	Total Hours	42L+48ABL=90

Course Objective: The objective to understand the principles and applications of microwave devices and systems used in RF communication, radar, navigation, and space communication.

Course Outcomes: Upon completion of the course, students shall be able to:

#	Course Outcomes	Mapping to PO's	Mapping toPSO's
1	Comprehend microwave transmission lines, waveguides, and their propagation characteristics.	1, 2, 3,5, 8, 11	1,2
2	Illustrate the operation and applications of microwave tubes and semiconductor microwave devices.	1, 2, 8, 11	1,2
3	Apply radar principles, radar equations, Doppler effect, and tracking techniques to analyze radar system performance.	1, 2, 3, 5, 8, 9, 11	1,2
4	Analyze the operation, performance, and applications of Pulse, CW Doppler, and MTI radar systems.	1, 2, 3, 5, 8, 9, 11	1,2

MODULE-1	11Hrs.

Fundamentals of Microwaves: Microwave frequency spectrum, IEEE and OSHA(Occupational Safety And Health Administration)standards and band designations, advantages and disadvantages of microwave signals,

Rectangular waveguide: Cut off wavelength, cut offfrequency, characteristic wave impedance, group and phase velocities (Definitions, formulae and Simplenumerical) structure, advantages, disadvantages and applications of rectangular waveguide, Rectangular waveguide modes: TE, TM, TEM,dominant mode,

MODULE-2	10 Hrs.

Microwave Tubes: Microwave frequency spectrum ,Microwave tube oscillators and amplifiers: Reflex klystron, magnetron, backward wave oscillator, Travelling wave tube,

Microwave diodes: Varactor diode, Gunn diode, tunnel diode, PIN diode, IMPATT diode, TRAPATT diode, BARITT diode (Construction, working principle and applications)

MODULE-3	11 Hrs.

RADAR Fundamentals: Basic block diagram of RADAR system, Doppler effect, Definitions: Radar range, pulse width, Pulse Repetition Frequency (PRF), duty cycle, RADAR range equation derivation (simple numerical), significance of RADAR range, factors affecting RADAR range,

Antenna Scanning :Types of scanning, Working principle of Horizontal, vertical, helical and spiral, Antenna Tracking types - Working principle of sequential, conical and mono pulse, RADAR displays.

MODULE-4	10Hrs

RADAR systems: CW Doppler RADAR, CW-FM RADAR, MTI RADAR (Block diagram, operation and applications)

Working principle of RADAR applications: Vehicle speed detection, Self-driving cars, Vehicle parking assistance system, Air traffic control system, Weather surveillance RADAR, RADAR Beacons

Prescribed Text Book:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1.	Microwave Engineering	D. M. Pozar	4th	John Wiley Publication	2013 ISBN:978-8126541904
2	Foundation for Microwave Engineering	R. E. Collins	2nd	John WileyPublication	2007 ISBN: 978-8126515288
3	Microwave and RADAR Engineering	V. C. Kshirsagar		Synergy knowledgeware, Mumbai.	ISBN: 978-93-833-5228-9

Reference Books:

Sl.No	Book Title	Authors	Edition	Publisher	Year
1.	Fundamentals of Microwave and RADAR Engineering	K.K. Sharma	Student edition	S.Chand and Company New Delhi.	ISBN:9788121935371
2	Electronic Communication Systems	KENNAEDY DAVIS	4th	TMH	ISBN: 0-07-4636782-0

E-Books and online course materials:

- https://cchgeu.ru/upload/iblock/030/5jx80vlz570v5r41oay519alhspk4mtt/Pozar_Microwave_Engineering.pdf
- https://radfiz.org.ua/share/sheva_s8_DEK/SECONDARY/%E4%C5%D2%D6/%E4%C5%D2%D6/%CE%D7%DE%20%D4%C5%C8%CE%A6%CB%C1/%CC%A6%D4/Collin.%20Foundations%20for%20Microwave%20Engineering.pdf

Online Courses and Video Lectures:

- https://onlinecourses.nptel.ac.in/noc24_ee115/preview
- https://home.sandiego.edu/~ekim/e194rfs01/
- https://youtu.be/uPXLJfmrCUA?si=OQzaEtDiZeMjrnqV
- https://youtu.be/EoWDC4FJK7Q?si=bSJ8Fz8Vb6NsbqG4
- https://youtu.be/pGbY59Q9smo?si=QrVy6HUM83g87tdU
- https://portal.coepvlab.ac.in/vlab/auth/home?dept=2&lab=2

Teaching-Learning–Evaluation Scheme:

Sl. No	Teaching and Learning Method	No. of Hours/ Week	No. of Weeks	Hours/ Semester
1.	Classroom Teaching & Learning	3	14	42
2.	Activity Based Learning (ABL1&ABL2)	-	-	38
3.	Evaluation of Learning Process	-	-	10
Total Learning Hours/Semester				**90**

Proposed Assessment Plan(for 50 marks of CIE):

Tool	Remarks	Marks
CIE	Two tests conducted for 50 marks each and reduced to15 marks.	30
Activity Details	**Activity 1:**Prepare a power point presentation, microwave waveguide simulations using freeware/Open source software's, conduct a Library / Internet based survey; Prepare a poster**. (*10 Marks)*** **Activity 2:** Preparation of document of activity-1 and submission of the same. ***(10 Marks)***	20
Total		**50**

Activity Based Learning (38Hours)

ABL1(15Hours): Students will learn the importance of microwave and RADAR communication and can able to prepare power point presentation, poster presentation and conduct survey beyond the syllabus.		**Hours**
21.	Prepare a power point presentation on various types of microwave antennas.	2
22.	Prepare report on Comparative performance of microwave semiconductor devices/microwave tubes.	2
23.	To perform microwave waveguide simulations using freeware/Open source software's	2
24.	Conduct a Library / Internet based survey of RADAR displays and submit detail report of it.	2
25.	Prepare a poster on microwave radiation hazards and its protective measures	2
26.	To Illustrate the working principle of the following a. Microwave Tubes	2
27.	EM wave propagation, prepare /download an animation and share with the class	2
28.	Conduct internet based survey on modes of propagation.	2
29.	Conduct internet based survey on different antennas used for RADAR communication.	2
Total		**20**
ABL2(18Hours): Preparation of document of activity-1 along with literature survey and submission of detail document in the form of report.		**18**
Total Learning Hours/Semester		**38**

Evaluation of Learning Process(10Hours)

Type of Evaluation	**Hours**
Test(1,2and3)	3
Evaluation of activity	4
Semester End Exam	3
Total	**10**

Course Articulation Matrix

Course Outcomes	**Program Outcomes[POs]**											**PSO's**	
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	3	2	1		1			2			1	3	2
CO2	3	2	1					2			1	2	2
CO3	2	2	1		1			2	1		1	2	2
CO4	3	2	1		1			1	1		1	2	1

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DEPARTMENTOFINFORMATIONSCIENCEANDENGINEERING

Course Title	COMMUNICATION LABORATORY		
Course Code	25EC406	(L-T-P)C	(0-0-2)1
Exam	3Hrs.	Hours/Week	2Hrs.
SEE	50 Marks	Total Hours	28P+2E=30

Course Objective: To understand and analyze analog, digital, RF, and microwave communication systems through hardware and SCI-Lab experiments involving modulation, demodulation, signal analysis, and measurement of communication system parameters.

Course outcomes:){with mapping shown against the Program Outcomes (POs)}Upon completion of the course, students shall be able to:

#	Course Outcomes	Mapping To PO's	Mapping To PSO's
4.	Conduct experiments to demonstrate the concepts related to Analog and Digital communication system.	2,3,8,9,11	1, 2
5.	Conduct microwave experiments to measure losses, power, wavelength, VSWR, coupling coefficient, gain and directivity using microwave bench.	2,8,9,11	1, 2
6.	Demonstrate various modulation techniques used in communication systems using SCI-Lab.	2,5,8,9,11	1, 2

Teaching-Learning–Evaluation Scheme:

Sl. No	Teaching and Learning Method	No. of Hours/Week	No. of Weeks	Hours/ Semester
1.	Lab Conduction	2	14	28
2.	Evaluation	-	-	02
Total Learning Hours/Semester				30
ABL : Lab based learning (28Hrs.)				

Sl.No	Experiment Title	Hours
I	**Hardware Experiments**	
1.	Amplitude Modulation and Demodulation.	2
2.	Frequency Modulation and Demodulation.	2
3.	Class-C Tuned RF amplifier.	2
4.	Measurement of radiation pattern of a Horn Antenna.	2
5.	Measurement of frequency wavelength and VSWR using Microwave test bench.	2
6.	Determination of Characteristic of Directional Couplerusing Microwave test bench.	2
7.	The mode curves of Reflex Klystron using Microwave test bench.	2
II	**Using SCI-Lab**	
1.	Amplitude Modulation and Demodulation.	2
2.	Frequency Modulation and Demodulation.	2
3.	Phase Modulation and Demodulation.	2
4.	Balanced Modulator and SSB generation.	2
5.	Pulse Code Modulation and Demodulation	2
6.	Pulse Width Modulation and Demodulation	2
7.	Pulse Amplitude modulation and Demodulation	2
	Total Hours	**28**

Proposed Assessment Plan(for50marksof CIE):

Tool	Remarks	Marks
Internals	Continuous evaluation–10Marks Record writing -20Marks Lab CIE -20Marks	50
Total		**50**

Prescribed Text Books:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1.	An introduction to Analog and Digital communications,	Simon Haykin,	2nd	John Wiley	2009
2.	Microwave Devices and Circuits	SAMUEL Y. LIAO	3rd	Pearson	2003

Online Courses and Video Lectures:

1. https://www.youtube.com/watch?v=Tcsev2bqwPA
2. https://www.youtube.com/watch?v=Icl-NjKQULI
3. http://referenceglobe.com/kpsslp/support/upload_videos/microwave-devices-and-circuits-samuel-liao_1588230228.pdf.

Course Articulation Matrix:

Course Outcomes	Program Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO1 1**	**PSO 1**	**PSO 2**
CO1	1	3	2	2	-	-	-	2	2	-	2	1	2
CO2	1	3	2	2	-	-	-	2	2	-	2	1	2
CO3	-	2	-	-	3	-	-	-	2	-	2	1	2

MALNAD COLLEGE OF ENGINEERING, HASSAN
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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Course Title	**ARM EMBEDDED SYSTEMS LABORATORY**		
Course Code	**25AEC407**	**(L-T-P) C**	**(0-0-2) 1**
Exam	**3 Hours**	**Hours/Week**	**2 Hrs.**
SEE	**50 Marks**	**Total Hours**	**28P+2E=30**

Course Objective: This laboratory course enables students to get practical experience in writing ALP and C programs for ARM processor.

Course Outcomes: At the end of the course, students shall be able to:

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Apply ARM assembly language programming concepts to develop and execute programs for arithmetic, logical, and data manipulation operations.	1,2,5,8,9	1,2
2	Design and implement ARM-based embedded interfacing applications using peripherals such as UART, DAC, motors, interrupts, and displays.	1,2,3,5,8,9	1,2
3	Demonstrate professional skills through laboratory experimentation, teamwork, documentation, and effective communication of results.	1,8,9,11	1,2

Teaching -Learning– Evaluation Scheme:

Sl. No	Teaching and Learning Method	No. of Hours/ Week	No. of Weeks	Hours/ Semester
1	Lab conduction	2	14	28
2	Evaluation	-	-	02
	Total Learning Hours/Semester			**30**

ABL: Lab based learning (28 Hrs.)	
PART-A: Conduct the following experiments by writing Assembly Language Program (ALP) using ARM-7 using an evaluation board/simulator and the required software tool: 1. Write an ALP to find the sum of first 10 integer numbers. 2. Write an ALP to add an array of 16-bit numbers and store the 32-bit result in internal RAM. 3. Write an ALP to find sum of two 64-bit numbers. 4. Write an ALP to multiply two 32-bit binary numbers. 5. Write an ALP to find factorial of a number. 6. Write an ALP to find the largest/smallest number in an array of 32 numbers. 7. Write an ALP to arrange a series of 32-bit numbers in ascending/descending order. 8. Write an ALP to count the number of ones and zeros in two consecutive memory locations. 9. Write an ALP to Scan a series of 32-bit numbers to find how many are negative. 10. Write an ALP generate fibonacci series.	**10 Hrs.**
PART-B: Conduct the following experiments on an ARM 7 using evaluation version of Embedded 'C' & Keil Uvision-4 tool/compiler. 1. Display message using Internal UART.	**18 Hrs.**

2. Interface and Control a DC Motor. 3. Interface a Stepper motor and rotate it in clockwise and anti-clockwise direction. 4. Demonstrate the use of an external interrupt to toggle an LED On/Off. 5. Interface a DAC and generate Triangle and Square waveforms. 6. Display the Hex digits 0 to F with 7-segment counter, with a suitable delay in between.	
TOTAL	**28**

Proposed Assessment Plan (for 50 marks of CIE):

Tool	Remarks	Marks
CIE	Continuous evaluation Record writing Lab CIE	10 20 20
Total		**50**

Prescribed Text Books:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1	ARM System Developers Guide"	Andrew N Sloss, Dominic System and Chris Wright	1st Edition	Elsevier, Morgan Kaufmann publisher	2008

Reference Books:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1	ARM System on chip Architecture	**Furber S**	2nd edition	Addison Wiley	2008
2	Embedded System	**Rajkamal**	2nd edition	Tata McGraw-Hill Publishers	2008

E Books and online course materials:

1. https://www.geeksforgeeks.org/arm-processor-and-its-features/

Online Courses and Video Lectures:

1. https://www.youtube.com/watch?v=3OmyM4-zuQw

Course Outcomes	Program Outcomes											Program Specific Outcomes	
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PSO2
CO1	3	2			3			2	1			3	1
CO2	3	2	2		3			2	1			3	1
CO3	3							2	1		1	2	1

MALNAD COLLEGE OF ENGINEERING, HASSAN
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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Programmable Logic Controllers

Course Code :25AEC408	**(L-T-P)C: (0-1-2)1**
Exam Hours : 3	Hours / Week: 2
SEE :**50 Marks**	Total hours: 26L+4ABL=30

Course Objective: This course will enable student to:

- To understand the need for automation in the industry with basic controller mechanisms involved.
- To study programming concepts to achieve the desired goal or to define the various steps involved in the automation.
- To understand programming involved with basic subroutine functions.
- To make use of the internal hardware circuits of automation circuit to control the devices during various states by monitoring the timers and counters.
- To handle the data of the I/O devices to interface the data with the controller and auxiliary devices.

Course Outcomes (COs) {with mapping shown against the Program Outcomes (POs)} upon completion of the course, the student shall be able to:

COs	**Statement**	**POs**
1.	Describe the PLC and how to construct PLC ladder diagrams.	1, 2
2.	Illustrate an application with programming.	1, 2,5
3.	Apply PLC functions to timing and counting applications.	1,2
4.	Analyze the analog operation of PLC and demonstrate the robot applications with PLC.	1,2

Module-1
Introduction:Programmablelogiccontroller(PLC),roleinautomation(SCADA),advantagesand disadvantages, hardware, internal architecture, sourcing and sinking **(Textbook1:1.1to1.4)** **I/O devices and Processing:** list of input and output devices, examples of applications. I/O processing, input/output units, signal conditioning, remote connections, networks, processing inputs I/O addresses. **(TextBook1:2.1to2.3and4.1to4.7).**
Module-2
Programming: Ladder programming- ladder diagrams, logic functions, latching, multiple outputs, entering programs, functional blocks, program examples like location of stop and emergency switches. (**TextBook1:5.1to5.7).**
Module-3
Programming Methods: Instruction Lists- Ladder programs and Instruction lists, Branch codes, Programming Examples- Signal lamp-valve operation task. Sequential Function Charts- Branching and convergence. **(TextBook1:6.1to6.3).**
Module-4
Internal Relays:ladderprograms,battery-backedrelays,one-shotoperation,setandreset,mastercontrol relay (**TextBook1:7.1to7.6).** **Timersandcounters:**Typesoftimers,ONandOFF-delaytimers,pulsetimers,formsofcounter, programming, up and down counters. **(TexBook1:9.1to9.6).**

Virtual Lab link: https://plc-coep.vlabs.ac.in/

Text books:

1. Programmable Logic controllers-W Bolton, 5th edition/6th edition, Elsevier- newness, 2009/2015.
2. Programmable logic controllers - principles and applications"-John W. Webb, Ronald A Reiss, Pearson education, 5th edition, 2007.

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Course Outcomes	Program Outcomes												Program Specific Outcomes	
Cos	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS01**	**PSO2**
CO1	2	2												
CO2	2	3			3									
CO3	2	2												
CO4	2	2												

Activity Number	Activity Name	Description	Marks	POs
1	**Conduction of Experiment**	Implementation of logic gates, DOL Starter, On- Delay and Off-Delay timer**(2 hours).**	**10**	**2,5,9**
2	**Conduction of Experiment**	Implementation of Up-Down Counter, PLC Arithmetic Instructions, PID Controller(**2 hours).**	**10**	**2,5,9**

MALNAD COLLEGE OF ENGINEERING, HASSAN
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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Course Title	Statistics with R Lab for machine learning		
Course Code	25AEC409	(L-T-P) C	(0-0-2)1
Exam	3Hrs	Hours/Week	2Hrs
SEE	50 Marks	Total Hours	28P+2E=30

Course Objective: Students will be able to use appropriate data structures for solving problems.

Course outcomes: with mapping shown against the Program Outcomes (POs)} Upon completion of the course, students shall be able to:

COs	Statement	POs	Mapping to PSO's
4.	Write the program for the mathematical procedure connected with probability, hypothesis testing, co-relation and regression.	1,2,5	-
5.	Execute the program and provide perfect output.	1,2,5	-

Teaching-Learning–Evaluation Scheme:

Sl. No	Teaching and Learning Method	No. of Hours/Week	No. of Weeks	Hours/ Semester
1	Lab Conduction	2	14	28
2	Evaluation	-	-	02
Total Learning Hours/Semester				30
ABL : Lab based learning(28Hrs.)				

Sl. No	Experiment Title	Hours
I	Hardware Experiments	
1.	To predict the conditional probabilities using Bayes theorem.	2
2.	To predict the probability of discrete random variable- Binomial.	2
3.	To predict the probability of discrete random variable- Poisson.	2+2
4.	To predict the probability of discrete random variable- Hyper geometric.	2
5.	To predict the probability of continuous random variable in an interval (Uniform random variable, exponential variable).	2+2
6.	To predict the probability of continuous random variable in an interval (Normal random variable).	2+2
7.	To predict the probability of application connected with Markov process in long run.	2+2
8.	To compute the confidence interval for mean and standard deviation.	2
9.	Hypothesis testing on application problem connected with mean, variance, proportions when sample size is large.	2
10.	Hypothesis testing on application problem connected with mean, variance, proportions when sample size is less (student's T distribution, chi square distribution)	2
Total		28

Proposed Assessment Plan (for 50 marks of CIE):

Tool	Remarks	Marks
Internals	Continuous evaluation Record writing Lab CIE	30 10 10
Total		**50**

Course Articulation Matrix

Course Outcomes	Program Outcomes											Program Specific Outcomes	
Cos	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PSO2
CO1	**3**	**2**			**1**								
CO2	**3**	**2**			**1**								

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Course Title	LAB VIEW PROGRAMMING		
Course Code	25AEC410	(L-T-P) C	(0-0-2)1
Exam	3Hrs.	Hours/Week	2Hrs.
SEE	50 Marks	Total Hours	28P+2E=30

Course Objective:

- Aware of various front panel controls and indicators.
- Connect and manipulate nodes and wires in the block diagram.
- Locate various tool bars and pull-down menus for the purpose of implementing specific functions.
- Locate and utilize the context help window.
- Familiar with Lab VIEW and different applications using it.

Course Outcomes (COs){with mapping shown against the Program Outcomes (POs)}
Upon completion of the course, students shall be able to:

COs	Statement	POs	COs
1.	Use LabVIEW to create data acquisition, analysis and display operations	1, 2, 5	
2.	Create user interfaces with charts, graph and buttons	1, 2,5	
3.	Use the programming structures and data types that exist in LabVIEW	1, 2,5	

Teaching-Learning–Evaluation Scheme:

Sl. No	Teaching and Learning Method	No. of Hours/Week	No. of Weeks	Hours/ Semester
1	Lab Conduction	2	14	28
2	Evaluation	-	-	02
Total Learning Hours/Semester				30
ABL : Lab based learning(28Hrs.)				

Sl.No	Experiment Title	Hours
I	**Hardware Experiments**	
1.	Basic arithmetic operations : addition, subtraction, multiplication and division.	2+2
2.	Boolean operations: AND, OR, XOR, NOT and NAND	2
3.	Sum of ‘n’ numbers using ‘for’ loop	2+2
4.	Factorial of a given number using ‘for’ loop	2
5.	Determine square of a given number	2+2
6.	Factorial of a given number using ‘while’ loop	2+2
7.	Sorting even numbers using ‘while’ loop in an array	2+2
8.	Finding the array maximum and array minimum	2+2
Total		**28**

Proposed Assessment Plan (for 50 marks of CIE):

Tool	Remarks	Marks
Internals	Continuous evaluation Record writing Lab CIE	30 10 10
Total		**50**

TEXT BOOKS:

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

Course Articulation Matrix

Course Outcomes	Program Outcomes											Program Specific Outcomes	
Cos	**PO 1**	**PO 2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PS01**	**PSO2**
CO1	2	2			2								
CO2	2	3			2								
CO3	2	2			3								