B.N.M. Institute of Technology

An Autonomous Institution under VTU, Approved by AICTE

Department of Mathematics

Syllabus

Semester: III			
Course: Fourier Series, Transforms and Statistical Techniques **Course Code: 25MAE131 (Common to ECE & EEE)**			
L:T:P:J	**2:2:0:0**	**CIA**	**: 50**
Credits:	**03**	**SEA**	**: 50**
Hours:	**40**	**SEA Duration**	**: 03 Hours**

Course Learning Objectives: The students will be able to develop the theoretical and practical knowledge of Statistical methods, Laplace transform, Fourier series, Fourier transforms and Z-transforms in a comprehensive manner in various fields of engineering.

Module-1: Curve fitting & Statistical methods	No. of hours	Blooms cognitive Levels
Examples from Engineering field that require curve fitting and statistical methods. **Curve Fitting:** Curve fitting by the method of least squares-fitting the curves of the form: $y = ax+b$, $y = ax^2 + bx + c$ and $y = ax^b$. **Statistical methods:** Introduction to Moments, Skewness, Kurtosis and problems. Karl Pearson's coefficient of correlation and lines of regression. *Experiential Learning component: Problems on curve fitting and statistical methods*	**L: 04** **T: 04**	**L1** **L2** **L3**
Module-2: Laplace Transform		
Examples from Engineering field that require Laplace transforms. Transformation for time domain to frequency domain. Definition and Laplace transforms of elementary functions (statements only). Laplace transform of $e^{at}f(t)$, $t^n f(t)$, $\frac{f(t)}{t}$, $\int_0^t f(t)dt$ and $f^n(t)$ (without proof). Laplace transforms of Periodic functions, unit-step function and unit impulse function. *Experiential Learning component: Finding the Laplace transforms of a function.*	**L: 04** **T: 04**	**L1** **L2** **L3**
Module-3: Inverse Laplace Transform		
Examples from Engineering field that require inverse Laplace transforms. Definition and problems. Inverse Laplace transform using convolution theorem (without proof). Solution of linear differential equations and simultaneous differential equations. Applications to engineering problems. *Experiential Learning component: Problems on LCR Circuit.*	**L: 04** **T: 04**	**L1** **L2** **L3**
Module-4: Fourier Series		
Examples from Engineering field that require Fourier series. Periodic functions, Introduction to Fourier Series, Dirichlet's condition. Fourier series of periodic functions with period 2π and arbitrary period. Half range Fourier sine and cosine series. Practical harmonic analysis over the interval *(0, 2l).* *Experiential Learning component: Finding the Fourier series.*	**L : 04** **T : 04**	**L1** **L2** **L3**
Module-5: Fourier Transforms & Z -Transforms		
Examples from Engineering field that require Fourier Transforms & Z -Transforms. **Fourier Transforms:** Fourier transform and properties-problems, Fourier sine and cosine transforms. Inverse Fourier transforms. **Z-Transforms:** Introduction to Z-transform, Z-transform of standard functions and properties (without proof). Initial value and final value theorems, problems. *Experiential Learning component: Finding the Fourier transforms & Z –Transforms of a function.*	**L : 04** **T : 04**	**L1** **L2** **L3**

Course Outcomes: After completing the course, the students will be able to

CO 1: Apply the knowledge of correlation and regression analysis to fit a suitable mathematical model for the statistical data.

CO 2: Apply Laplace transform technique to find the transformation from time domain to frequency domain.

CO 3: Use inverse Laplace transform in solving differential equations arising in network analysis, control system and other fields of engineering

CO 4: Demonstrate Fourier series to study the behavior of periodic functions and their applications in system communications, digital signal processing and field theory.

CO 5: Apply the knowledge of Fourier transform and Z-transform to illustrate discrete / continuous function arising in wave and heat propagation, signals and systems.

CO - PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	2			2							
CO 2	3	2			2							
CO 3	3	2			2							
CO 4	3	2			2							
CO 5	3	2			2							

Reference Books:

1. E. Kreyszig: “Advanced Engineering Mathematics”, John Wiley & Sons, 10"Ed.(Reprint), 2016.
2. B. S. Grewal: “Higher Engineering Mathematics”, Khanna Publishers, 44th Ed., 2017.
3. H. K. Dass, “ Advanced Engineering Mathematics” S. Chand publication.
4. C. Ray Wylie, Louis C. Barrett : “Advanced Engineering Mathematics", 6" Edition, 2. McGraw-Hill Book Co., New York, 1995.
5. James Stewart : “Calculus —Early Transcendentals”, Cengage Learning India Private Ltd., 2017.
6. B.V. Ramana: "Higher Engineering Mathematics" 11th Edition, Tata McGraw-Hill, 2010.
7. Srimanta Pal & Subodh C Bhunia: “Engineering Mathematics”, Oxford University Press, 3 Reprint, 2016.

Web links and Video Lectures:

1. https://youtu.be/BsVtMnp3vks
2. https://youtu.be/Nz4WB8-gNBg
3. https://youtu.be/6MXMDrs6ZmA
4. https://youtu.be/r18Gi8lSkfM
5. https://youtu.be/cy_KI_FiS7I
6. https://youtu.be/sMYtHaSIXbU

B. N. M. Institute of Technology

An Autonomous Institution under VTU

Dept. of Electronics and Communication Engineering
Choice Based Credit System (CBCS and Outcome Based Education (OBE))

Semester: III

Course Name: Network Analysis		**Course Code:25ECE132**
L: T: P: J	**2: 2: 0 :0**	**CIA Marks:** 50
Credits:	**3**	**SEA Marks:** 50
Hours/Week (Total)	**4**	**SEA Duration:** 03 Hours

Pre-Requisites: Basic Electrical Concepts, Mathematical Preliminaries.

Course Learning Objectives: This course will enable students to:

1	Understand the basic network concepts, source transformation, mesh analysis, nodal analysis in analyzing the electrical circuits.
2	Gain the knowledge of various Network Theorems in analyzing the electrical circuits.
3	Introduce the behavior of networks subjected to transient conditions.
4	Use the applications of Laplace transforms to solve electrical circuits.
5	Study two port network parameters like Z, Y, h and T and their inter-relationships. Also, study the series and parallel resonance.

Module-1: Basic Concepts	**No. of Hours**	**Blooms Cognitive Levels/CO Mapping**
Basic Concepts, Classification of Electrical Networks, Source Transformation**,** Loop and Node analysis with linearly dependent and independent sources for DC and AC networks.	**8**	**Apply CO1**
Module–2: Network Theorems		
Superposition Theorem, Thevenin's and Norton's theorems, Maximum Power transfer theorem, Millman's Theorem. (Applicable only for independent sources only).	**8**	**Apply CO2**
Module–3: Transient Behavior and Initial Conditions		
Behavior of R, L, C components under switching conditions and their representations, evaluation of initial and final conditions in RL, RC and RLC circuits for DC excitations.	**8**	**Apply CO3**
Module–4: Laplace Transform and Its Applications		
Definition of Laplace transform, Laplace transform of Step, Ramp, Impulse functions, Initial and Final value theorem, solution of networks using Laplace transform, waveform Synthesis, solution of simple RL, RC, and RLC circuits for DC excitations using Laplace transforms.	**8**	**Apply CO4**
Module–5: Two Port Network Parameters		
Definition of Z, Y, h and Transmission parameters, modeling with these parameters, Network Analysis using of two port networks, Relationship between Parameters. **Resonance:** Series and parallel resonance, frequency response of series and parallel circuits, Q-factor, Bandwidth.	**8**	**Apply CO5**

Course Outcomes: After completing the course, the students will be able to	
25ECE132.1	Apply the concepts of source transformation, mesh analysis, and node analysis to solve and analyze the electrical circuits.
25ECE132.2	Apply network theorems such as Superposition, Thevenin's, Norton's, Maximum Power Transfer Theorem, and Millman's Theorem to solve and analyze the various electrical networks.
25ECE132.3	Evaluate the initial and final conditions in passive circuits and apply them for the RL, RC, and RLC electrical networks.
25ECE132.4	Apply and analyze the various electrical networks using Laplace transform.
25ECE132.5	Solve the given network using specified two port network parameters. Also, apply and analyze the concept of series and parallel resonance for RLC networks.
25ECE132.6	Apply and analyze the various applications of electrical networks.

Reference Books

1. Network Analysis, M.E. Van Valkenberg, Prentice Hall of India, 3rd Edition, 2010.
2. Networks and Systems, Roy Choudhury, 2nd Edition, New Age International Publications, 2013.
3. Engineering Circuit Analysis, Hayt, Kemmerly and Durbin, 7th Edition, Tata McGraw-Hill Education, 2010.
4. Network Analysis and Synthesis, Ravish R. Singh, 2nd Edition, Tata McGraw-Hill Education, 2013.
5. Circuit Theory (Analysis and Synthesis), A Chakrabarti, Dhanpat Rai and Co, 2013.
6. Circuits, A. Bruce Carlson, 2nd Edition, Thomson Publishers, 2009.

Marks Distribution for Assessment:

<table>
<tr><th rowspan="2">PCC</th><th rowspan="2">CIA</th><th rowspan="2">SEA</th><th colspan="4">CIA (50)</th><th>SEA
Conduction: 100 M
Reduced to: 50 M</th></tr>
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<tr><td rowspan="5">Conduction</td><td rowspan="5">50</td><td rowspan="5">50</td><td rowspan="2">Written Test</td><td>30</td><td>30</td><td>30</td><td rowspan="4">Five questions with each of 20 marks (with internal choice). Student should answer one full question from each module</td></tr>
<tr><td colspan="3">Average of three tests – 30 Marks</td></tr>
<tr><td>Assignment</td><td colspan="3">10</td></tr>
<tr><td>AAT</td><td colspan="3">10</td></tr>
<tr><td colspan="4">Total – 50 marks</td><td>Total – 50 marks</td></tr>
</table>

Additional Assessment Tools (AAT) – Quiz, Presentations,Term Paper, Open ended experiments, Mini Projects, Two-minute video on latest topic, Short MOOC courses

i) CIA: 50%

IA Test: 3 IA tests - Each of 30 Marks	Average of 3 tests -30 Marks
Assignment – Two assignments – one for 5 marks and another for 5 marks	10 Marks
Additional Assessment Tools (AAT) – Oral /Online Quizzes	10 Marks
Presentations, Group discussions, Case studies, Term Paper, Open ended experiments, Mini industrial/social/rural Projects, Two-minute video on latest topic, Short MOOC courses, Practical Orientation on Design thinking, creativity & Innovation, Participatory & Industry integrated learning, Practical activities, Problem solving exercises, Participation in seminars/academic events/symposia and any other activity	
Total	**50 Marks**

ii) SEA: 50%

Theory Exam	5 questions to answer each of 20 Marks 2 questions from each module with internal choice Student should answer one full question from each module	20 M x 5 = **100 M** **reduced to 50 M**
	Total	**50 Marks**

B.N.M. Institute of Technology

An Autonomous Institution under VTU

B.E. (Electronics and Communication Engineering) Choice Based Credit System (CBCS and Outcome Based Education (OBE) Semester: III		
COURSE: C Programming for Data Structures in Electronics		
Course Code: 25ECE133	**L: T:P: J: 2:0:2:0**	**CIE Marks:** 50
Credits:	**3**	**SEE Marks:** 50
Hours:	**40 hours**	**SEE Duration: 03** Hours
Pre-Requisites: Basic C Programming knowledge		

Course Learning Objectives: The students will be able to	
1	Understand the role of data structures and time complexity analysis in algorithms.
2	Analyze the linear data structures arrays and linked lists with the operations performed.
3	Illustrate the concept of linear data structures stacks and queues with the operations performed.
4	Illustrate the working of non-linear tree data structure, operations performed and applications
5	Demonstrate the non-linear data structure – graphs and their applications along with sorting and searching algorithms. Also, apply the above data structures suitably to solve practical problems.

Module-1: INTRODUCTION TO DATA STRUCTURES & ALGORITHMS		
Teaching component: **Introduction and Overview**: Introduction, Basic Terminology, Elementary Data Organization, Data Structures, Data Structure Operations, Abstract Data Types (ADT), ADT of Array, Stack, Queue. sorting, insertion sort, selection sort, merge sort. Algorithms: Complexity, Time-Space Trade off, Algorithms Notation, Complexity of Algorithms and other asymptotic notations for complexity of algorithms. Data structures applications in electronics	**No. of Hrs** **8**	**Bloom's Taxonomy Levels** **L1, L2,L3**

Module–2: LINEAR DATA STRUCTURES		
Teaching component: **Arrays:** Introduction, Linear Arrays, Representation of Linear Arrays in memory, Traversing Linear Arrays, Inserting and Deleting, Sorting; Bubble Sort, Two dimensional Arrays. **Linked Lists**: Introduction, linked lists, Representation of Linked lists in memory, traversing a linked list, searching linked list, memory allocation, garbage collection.	**No. of Hrs** **8**	**Bloom's Taxonomy Levels** **L1, L2, L3**

Module–3: LINEAR DATA STRUCTURES -STACKS & QUEUES		
Teaching component: **Stacks**: Introduction, Stacks, Array representation of Stacks, linked representation of Stacks, Arithmetic	**No. of Hrs**	**Bloom's Taxonomy Levels**

expressions; Postfix and prefix notations, Quick sort, application of stacks. **Queues**: Queues, linked representation of queues, dequeue	**8**	**L1, L2, L3**
Module–4: NON-LINEAR DATA STRUCTURES – TREES, SORTING & SEARCHING		
Teaching component: **Trees:** Introduction, Binary trees, representing binary trees in memory, traversing binary trees, binary search trees, searching and inserting in binary search trees, deleting in a binary search tree, AVL search trees.	**No. of Hrs** **8**	**Bloom's Taxonomy Levels** **L1, L2, L3**
Module–5: GRAPHS AND ALGORITHMS		
Teaching component: **Graphs and their applications:** Introduction, Graph theory Terminology, linked representation of a graph, operation on graphs, traversing of graphs (Breadth-First Search, Depth first search) **Algorithms:** Prim's and Kruskal's algorithm, Bellman-Ford algorithm	**No. of Hrs** **8**	**Bloom's Taxonomy Levels** **L1, L2, L3**

Course Outcomes: After completing the course, the students will be able to	
25ECE133.1	Illustrate the importance of data structures, algorithms and time complexity computations.
25ECE133.2	Apply linear data structures to analyse and obtain solutions
25ECE133.3	Build stack and queue structures using array and linked representations.
25ECE133.4	Apply non-linear tree data structure to analyse and obtain solutions
25ECE133.5	Apply non-linear graph data structure to analyse and obtain solutions
25ECE133.6	Analyse real time practical problems and apply appropriate data structures to obtain efficient solutions

Reference Books

1. Seymour Lipschutz, "Data Structures", Tata McGraw Hill Education, Revised 1st Edition, 2008.
2. Horowitz, Sahni & S.Anderson-Freed, "Fundamentals of Data structures in C", University Press, Second edition, 2008.
3. Thomas H. Cormen, C.E. Leiserson, R L.Rivest and C. Stein, Introduction to Algorithms , Third edition, MIT Press, 2009
4. R.L. Kruse, B.P. Leary, C.L. Tondo, "Data structure and program design in C", PHI, 2009(Fourth Impression)
5. Tannenbaum, "Data Structures", PHI, 2007(Fifth Impression)
6. Jean Paul Tremblay, Paul G. Sorenson," An introduction to Data Structures with Applications, Second Edition, Tata McGraw-Hill,1991.
7. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", Second Edition, Pearson Education, 1996.

List of Programs

Using C compiler, demonstrate the concepts using following programs:

1. Write a C program to insert a new frequency channel ID in a sorted array of active channels. When a call or data session ends, the system must delete the associated channel or user ID from the active list to free resources for others.
2. Write a C program to detect the top N highest amplitudes from a sampled signal- a common requirement in signal analysis (like ECG, vibration, or sound wave monitoring) (example on selection sort)
3. Write a C program to sort the array elements using bubble sort
4. Write a C program to implement FIR filtering (y[n] = x[n]*h[0] + x[n-1]*h[1] + ...) using array convolution.
5. Write a C program to create and manage a variable-sized sensor data and display it. (singly linked list)
6. Write a C program to allocate dynamic embedded devices to store sensor data in between. (insertion in the middle of linked list)
7. Write a C program to deallocate dynamic embedded devices (delete a node in linked list)
8. Write a C program to simulate the Undo feature using a stack, suitable for an oscilloscope application where each waveform capture can be stored and reverted.
9. Write a C program to simulate a real-time sensor data buffer using a circular queue.
10. Write a C program to Store electronic components (by ID or frequency) in a searchable structure.
11. Write a C program to represent connections in a digital or analog circuit as a graph.

Marks Marks Distribution for Assessment:

CIA (50)	**Component**	**Description**	**Marks**
	Written Test	● Total Number of Test: 2 ● Each Theory test will be conducted for 30 marks ● Average of 2 tests = 30 Marks	30
	Lab Assignment	Lab records - 05 marks Performance day wise – 05 Marks	10
	Laboratory Internal Test	Conduction – 05 Marks Viva – 05 Marks	10
		Total Marks	**50**
SEA (50)	**Component**	**Description**	**Marks**
	Laboratory Exam	SEA to be conducted for 100 marks and scaled down to 50 Marks, • 5 theory questions from each module each 6M	5x6 =30 70

		• Conduction - 60 Marks • Viva-Voce - 10 Marks (One program to be executed)	
		Total marks for the Course	**100**

Additional Assessment Tools (AAT) – Quiz, Presentations,Term Paper, Open ended experiments, Mini Projects, Two-minute video on latest topic, Short MOOC courses

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B.N.M. Institute of Technology

An Autonomous Institution under VTU
Dept. of Electronics and Communication Engineering
Choice Based Credit System (CBCS and Outcome Based Education (OBE))

Semester: III

Course Name: Analog Electronics Circuits **Course Code: 25ECE134**

L: T: P: J	**3 : 0: 2 : 0**	**CIA Marks:** 50
Credits:	**4**	**SEA Marks:** 50
Hours	**40**	**SEA Duration:** 03 Hours

Pre-Requisites: Physics and Electronics fundamentals

Course Learning Objectives: The students will be able to

1	Explain various BJT parameters, connections and configurations.,
2	Design and demonstrate the transistor amplifiers.
3	Explain various types of FET biasing and demonstrate the use of FET amplifiers.
4	Analyze Power amplifier circuits in different modes of operation.
5	Design op-amp for linear and non-linear applications

Module-1: BJT Biasing, Small Signal Operation and Modelling	**No. of Hours**	**Blooms Cognitive Levels**
Teaching component: Biasing in BJT amplifier circuits: The Classical Discrete circuit bias (Voltage-divider bias), Biasing using a collector to base feedback resistor. Small signal operation and Models: Collector current and transconductance, Base current and input resistance, Emitter current and input resistance, voltage gain, The hybrid Π model, and The T model.	**8**	**Apply CO1**
Module-2: : MOSFETs Biasing, Small signal operation and Modelling		
MOSFETs: Biasing in MOS amplifier circuits: Fixing VGS, Fixing VG, Drain to Gate feedback resistor. Small signal operation and modeling: The DC bias point, signal current in drain, voltage gain, small signal equivalent circuit models, transconductance, The T equivalent circuit model	**8**	**Apply CO2**
Module-3: MOSFET Amplifier		
MOSFET Amplifier configuration: Basic configurations, characterizing amplifiers, CS amplifier with and without source resistance RS. MOSFET internal capacitances and High frequency model: The gate capacitive effect, Junction capacitances, High frequency model. Frequency response of the CS amplifier: The three frequency bands, high frequency response, Low frequency response.	**8**	**Apply CO3**
Module-4: Feedback Amplifier, Output Stages and Power Amplifiers		
Feedback Amplifier: General feedback structure, Properties of negative feedback, The Four Basic Feedback Topologies, The series-shunt, series-series, shunt-shunt, and shunt-series amplifiers (Qualitative Analysis). Output Stages and Power Amplifiers: Introduction, Classification of output stages, Class A output stage, Class B output stage: Transfer Characteristics, Power Dissipation, Power Conversion efficiency, Class AB output stage.	**8**	**Apply CO4**

Module-5: Op-Amp Circuits, 555 Timer and its applications		
Teaching component: Instrumentation Amplifier, DAC-weighted resistor and R-2R ladder, ADC- Successive approximation type, Small Signal half wave rectifier, Active Filters, First order low-pass and high-pass Butterworth filters, Band-pass filters, Band reject filters. 555 Timer and its Applications: Monostable and Astable Multivibrators.	**8**	**Apply CO5**

Lab Experiments (Lab sessions + 1 Lab Test)	
Sl. No	Experiments
1	Design and set up the BJT common emitter voltage amplifier without feedback and determine the gain-bandwidth product, input and output impedances.
2	Design and set up the FET common source voltage amplifier without feedback and determine the gain-bandwidth product, input, and output impedances.
3	Experiment to determine the Power efficiency of class C amplifier
4	Design Second Order Butterworth low pass filter using opamp
5	Design of Op- Amp as a comparator circuit
6	R-2R DAC
7	Simulation Experiment: Narrow Band-pass Filter
8	Simulation Experiment: Active second-order Butterworth high pass filters
9	Simulation Experiment: Monostable & Astable Multivibrator using 555 Timer
10	Simulation Experiment: Narrow band-reject filter

Course Outcomes: After completing the course, the students will be able to	
25ECE134.1	Design and analyze biasing circuits for BJTs amplifier circuits.
25ECE134.2	Design and analyze biasing circuits for FET amplifier circuits
25ECE134.3	Design and analyze FET common source amplifiers with different circuit configurations and biasing conditions.
25ECE134.4	Understand the feedback topologies and approximations in the design of amplifiers
25ECE134.5	Design of circuits using linear ICs for wide range applications such as ADC, DAC, filters and timers.
25ECE134.6	Design real-life application based on discrete Analog and linear IC circuits

Reference Books

1. Microelectronic Circuits, Theory and Applications, Adel S Sedra, Kenneth C Smith, 6th Edition, Oxford, 2015. ISBN:978-0-19-808913-1
2. Op-Amps and Linear Integrated Circuits, Ramakant A Gayakwad, 4th Edition, Pearson Education, 2018. ISBN: 978-93-325-4991-3.
3. Integrated Electronics: Analog and Digital Circuits and Systems, Jacob Millman, Christos C. Halkias, McGraw-Hill, 2015.
4. Electronic Devices and Circuit, Boylestad & Nashelsky, Eleventh Edition, Pearson, January 2015
5. Electronic Principles, Albert Malvino, David J Bates, 7th Edition, McGraw Hill Education (India) Private Limited, 2017, ISBN:978-0-07-063424-4.

Marks Distribution for Assessment:

II b. Professional Core with Integrated Lab (PCI) – Course with Lab

<table>
<tr><th rowspan="2">PCI</th><th rowspan="2">CIA</th><th rowspan="2">SEA</th><th colspan="4">CIA (50)</th><th rowspan="2">SEA
Conduction: 100 M
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<tr><td rowspan="4">Conduction</td><td rowspan="4">50</td><td rowspan="4">50</td><td rowspan="3">Theory</td><td>30</td><td>30</td><td>30</td><td rowspan="3">Five questions with each of 20 marks (with internal choice). Student should answer one full question from each module</td></tr>
<tr><td colspan="3">Average of 3 tests - 15 marks</td></tr>
<tr><td colspan="3">AAT - 10 Marks</td></tr>
<tr><td>Practical</td><td colspan="3">Weekly Assessment – 10 Marks
IA test – 15 Marks</td></tr>
<tr><td colspan="4">Total – 50 Marks</td><td>Total – 50 Marks</td></tr>
</table>

B.N.M. Institute of Technology

An Autonomous Institution under VTU, Approved by AICTE

Dept. of Electronics and Communication Engineering

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

Semester: III		
Course Name: Digital System Design Using Verilog		**Course Code: 25ECE135**
L: T: P: J	**3: 0: 2: 0**	**CIA Marks: 50**
Credits:	**4**	**SEA Marks: 50**
Hours	**40**	**SEA Duration: 03 Hours**

Pre-Requisites: Digital Circuits

Course Learning Objectives: The students will be able to

1	Simplifying Boolean expression using K-map techniques and Quine-McCluskey minimization techniques
2	Designing and analyzing combinational logic circuits
3	Design methods and analysis of sequential logic circuits
4	Design of digital systems using Verilog HDL-data flow models
5	Design of digital systems using Verilog HDL behavioral and structural models

Module-1: Principles of Combinational Logic	**No. of Hours**	**Blooms Cognitive Levels/CO Mapping**
Definition of combinational logic, Canonical forms, Generation of switching equations from truth tables, Karnaugh maps- up to 4 variables, Incompletely Specified Functions, Simplifying Maxterm equations, Quine-McCluskey Minimization Technique. Quine-McCluskey using Don't Care Terms. Lab: Simplify the given 3/4 variable Boolean expressions. and simulate the design using Verilog dataflow description.	**10**	**Apply CO1**
Module-2: Logic Design with MSI Components		
Binary Adders and Subtractors, Binary Subtracters, Carry Lookahead Adder, Comparators, Decoders, Logic Design using Decoders, Decoders with a enable input, Encoders, Multiplexers, Logic Design with Multiplexers. Lab: i. Design a Full Adder using two half adders and simulate using verilog structural Description. ii. Realize 32-bit ALU using Verilog Behavioral description. iii. Realize using Verilog Behavioral description: 3:8 decoder, 2-bit Comparator. iv. Realize using Verilog Behavioral description: 8:1 mux, 8:3 Priority encoder using FPGA board.	**10**	**Apply CO2**
Module-3: Flip-Flops and its Applications		
The Basic Bistable Element, Latches, SR Latch, An application of the SR Latch: A Switch Debouncer, S'R' Latch, Gated SR latch, Gated D Latch, The Master-Slave Flip-flops (Pulse Triggered flip-flops): MSSR flip-flops, MSJK flip flops, Setup and Hold time, Edge triggered flip flops, The positive edge triggered D flip flop, Negative edge triggered D flip flops, Asynchronous inputs, Additional types of edge triggered flip flops, Characteristic equations, Registers, Binary Ripple Counters, Synchronous Binary Counters, Design of Synchronous mod-n Counter using clocked JK and D flip-flops.	**10**	**Apply CO3**

Lab: i. Realize using Verilog Behavioral description: Flip-flops: a) JK b) SR c) T d) D and verify the design using FPGA board. ii.Design 8-bit shift register for shift left and right operation using Verilog behavioral Description.		
Module-4: Finite State Machine and Verilog Data flow description		
Mealy and Moore Model, Construction of State Diagrams, Up-down decade counter, Sequence detectors (non overlapped sequence only). **Note: Following topics are applicable to Verilog only.** Structure of Verilog module, Operators, Data Types, Styles of Description, Behavioral Descriptions, Structural Description, Data flow Description, Highlights of Data flow description, Structure of Data flow description, Half adder, Multiplexer, 2X2 Array Multiplier, D latch, 2-bit Magnitude Comparator. Lab: Develop a Verilog Program to interface a Stepper motor to the FPGA and rotate the motor in the specified direction.	**10**	**Apply CO4**
Module-5: Verilog Behavioral and Structural description		
Half adder, Sequential statements, if statement, case statement, Edge triggered JKFF, 3 bit binary counter. Structural Descriptions, Organization of structural description, Half adder, 2x1 Multiplexer with active low enable, 2x4 decoder with tristate output, Full adder, SR Latch, 3 bit RCA. Lab: i. Design 4 bit Binary and BCD counters with synchronous and asynchronous reset using Verilog Behavioral description and verify the design using FPGA board. ii. Interface DAC to generate square and triangular waveform using Verilog program and implement into the FPGA board.	**10**	**Apply CO5**

Course Outcomes: After completing the course, the students will be able to	
25ECE135.1	Apply Karnaugh maps and the Quine-McCluskey minimization technique to simplify Boolean functions.
25ECE135.2	Apply binary arithmetic and combinational logic principles to design circuits using adders, subtractors, comparators, decoders, encoders, and multiplexers.
25ECE135.3	Design Flip-Flops (SR, D, T, and JK) and synchronous sequential circuits based on their operation.
25ECE135.4	Design and develop Verilog dataflow descriptions for combinational (HA, Mux, Multiplier, Comparator) and sequential (D Latch) circuits.
25ECE135.5	Develop Verilog behavioral and structural descriptions for combinational (HA, FA, RCA, Dec, Mux) and sequential (SR Latch, Counter) circuits.
25ECE135.6	Analyze the behavior and functionality of combinational and sequential digital circuits to evaluate their performance and logical correctness.

Reference Books

1. Digital Logic Applications and Design, John M Yarbrough, Thomson Learning, 2016
2. Digital Principles and Design, Donald D Givone, McGraw Hill, 2017
3. HDL Programming VHDL and Verilog, Nazeih M Botros, press, 2009
4. Quick Start Guide to Verilog, Brock J. LaMeres, 2024
5. Digital Systems, Ronald J Tocci, 12th edition, 2022
6. Digital Design, Morris Mano, 6th edition, Pearson Education, 2018

Marks Distribution for Assessment:

II b. Professional Core with Integrated Lab (PCI) – Course with Lab

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<tr><th></th><th>I</th><th>II</th><th>III</th></tr>
<tr><td rowspan="4">Conduction</td><td rowspan="4">50</td><td rowspan="4">50</td><td rowspan="3">Theory</td><td>30</td><td>30</td><td>30</td><td rowspan="3">Five questions with each of 20 marks (with internal choice). Student should answer one full question from each module</td></tr>
<tr><td colspan="3">Average of 3 tests - 15 marks</td></tr>
<tr><td colspan="3">AAT - 10 Marks</td></tr>
<tr><td>Practical</td><td colspan="3">Weekly Assessment – 10 Marks
IA test – 15 Marks</td></tr>
<tr><td colspan="4">Total – 50 Marks</td><td>Total – 50 Marks</td></tr>
</table>

BNM Institute of Technology

An Autonomous Institution under VTU
Dept. of Electronics and Communication Engineering
Choice Based Credit System (CBCS and Outcome Based Education (OBE)

Semester: III

Course Name: Introduction to AI and ML
Course Code: 25ECE136

L: T: P: J	**0 : 0 : 2 : 2**	**CIA Marks:** 50
Credits:	**2**	**SEA Marks:** 50
Hours/Week (Total)	**4**	**SEA Duration:** 03 Hours

Pre-Requisites: Basic knowledge of Linear Algebra, Basic Probability & Statistics, Basic programming concepts

Course Learning Objectives: The students will be able to

1	Understand the fundamental concepts of Artificial Intelligence and Machine Learning and their relevance to Electronics and Communication Engineering applications.
2	Apply Python-based tools and libraries (NumPy, Pandas, Matplotlib, Scikit-learn) for data handling, visualization, and preprocessing.
3	Develop supervised learning models and unsupervised learning techniques such as classification and regression for solving engineering problems.
4	Analyze machine learning models using appropriate performance evaluation metrics and improve model performance.
5	Design basic AI-based solutions for real-world ECE applications such as IoT systems, smart sensors, and signal processing.

Module-1: Introduction & Machine Learning Basics	**No. of Hours**	**Blooms Cognitive Levels**
What is AI & Machine Learning?, Types of ML (supervised, unsupervised), Applications in ECE, Python ML ecosystem (NumPy, Pandas, Scikit-learn), End-to-end ML project overview, Loading and exploring datasets	**5**	**Apply CO1**
Module-2: Data Preprocessing & Visualization		
Data cleaning and handling missing values, Feature scaling and transformation Train-test split, Data visualization (basic plots), Feature selection basics	**5**	**Apply CO2**
Module-3: Supervised Learning: Classification Algorithms		
Classification concepts, **Algorithms:** KNN (conceptual link), Logistic Regression, Decision Trees (intro), **Performance evaluation:** Accuracy, Confusion matrix, Precision & Recall, Overfitting & Underfitting, Regularization basics	**5**	**Apply CO3**
Module-4: Supervised Learning: Regression Algorithms		
Linear Regression, Polynomial Regression, **Regression Evaluation Metrics:** Mean Absolute Error (MAE): Mean Squared Error (MSE): Root Mean Squared Error (RMSE): Huber Loss, R2 – Score	**5**	**Apply CO4**
Module-5: Unsupervised Learning & Applications		
Clustering: K-Means, Dimensionality Reduction: PCA, Introduction to Neural Networks, AI applications in: IoT, Smart sensors, Signal processing	**5**	**Apply CO5 & CO6**

1. A sensor system in an IoT-based smart environment collects data such as temperature, humidity, and light intensity at regular intervals. The dataset is stored in a CSV file. Write a Python program using Pandas to: Load the dataset from a CSV file, display the first and last few records, identify the number of rows and columns, display column names and data types, generate summary statistics (mean, median, standard deviation), and check for missing values in each column.
2. An engineer wants to analyze sensor data collected from an embedded system to understand trends and relationships between variables such as temperature, humidity, and voltage. Write a Python program using Matplotlib to: Plot a **bar chart** showing average sensor readings, a **scatter plot** to analyze the relationship between two variables (e.g., temperature vs humidity), a **histogram** to observe the distribution of a selected parameter, label axes and provide appropriate titles for each graph.
3. A real-world dataset collected from sensors often contains missing values and inconsistent scales, which affect machine learning model performance. Write a Python program to: Identify missing values in the dataset, handle missing values using appropriate techniques: remove rows/columns or replace with mean/median, normalize or standardize the dataset using scaling techniques, compare the dataset before and after preprocessing.
4. A smart monitoring system collects sensor data such as temperature, humidity, and gas levels to classify environmental conditions (e.g., Normal / Warning / Critical). Write a Python program to: Load the dataset, split into training and testing sets, implement **K-Nearest Neighbors (KNN)** classifier, predict class labels for test data, evaluate performance using accuracy and confusion matrix.
5. An electronic circuit monitoring system record parameters like voltage, current, and temperature to detect faults (Fault / No Fault). Write a Python program to: Apply **Logistic Regression,** train and test the model, compute accuracy, precision, recall and interpret results.
6. A communication system needs to classify signal quality (Good / Moderate / Poor) based on features such as SNR, bandwidth, and noise level. Write a Python program to: Implement a **Decision Tree classifier,** train the model and visualize decision rules (optional), evaluate using confusion matrix and accuracy.
7. An ECE system records time vs signal amplitude data and needs to predict future signal values. Write a Python program to: Implement **Linear Regression,** extend to **Polynomial Regression, c**ompare model performance and plot regression curves.
8. A machine learning model trained on sensor data shows different performance on training and testing datasets. Write a Python program to: Train a regression/classification model, identify **overfitting/underfitting,** apply basic **regularization,** compare performance before and after optimization.
9. A dataset containing signal features needs to be grouped into clusters based on similarity. Write a Python program to: Apply **K-Means clustering,** choose appropriate number of clusters, visualize clusters and interpret results.
10. High-dimensional sensor data needs to be simplified and used for classification using a basic neural network. Write a Python program to: Apply **PCA** to reduce dimensionality, train a **basic neural network (MLP),** compare results before and after PCA.

Course Outcomes: After completing the course, the students will be able to	
25ECE136.1	Understand Machine Learning concepts and workflow. (L2)
25ECE136.2	Apply data handling and visualization techniques using Python tools. (L3)
25ECE136.3	Implement classification algorithms for ECE applications. (L3)
25ECE136.4	Apply regression and neural network models for prediction tasks. (L3)
25ECE136.5	Implement clustering and dimensionality reduction techniques for real-world problems. (L3)
25ECE136.6	Design and develop AI-based projects for real-world ECE problems. (L4)

Reference Books:

1. Aurélien Géron, "*Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow*", 3rd Edition (2022), O'Reilly Media, ISBN: 978-1-098-12597-4.
2. Tom M Mitchell, "*Machine Learning", McGraw Hill*", 1997, 1st Edition (1997), ISBN: 0070428077
3. Andreas C. Müller and Sarah Guido, *"Introduction to Machine Learning with Python",* O'Reilly Media, 1st Edition 2016, ISBN: 1449369413
4. Stuart J. Russell, Peter Norvig, "*Artificial Intelligence: A Modern Approach*", Pearson Education, Fourth edition (2022), ISBN: 9356063575
5. Andriy Burkov*, "The Hundred-Page Machine Learning Book",* Ingram short title, Hard Cover edition, ISBN: 978-1999579517

Marks Distribution for Assessment:

<table>
<tr><th rowspan="2">PCL</th><th rowspan="2">CIA</th><th rowspan="2">SEA</th><th colspan="3">CIA (50)</th><th>SEA
Conduction: 100 M
Reduced to: 50 M</th></tr>
<tr><td></td><td>I</td><td>II</td><td></td></tr>
<tr><td rowspan="4">Conduction</td><td rowspan="4">50</td><td rowspan="4">50</td><td rowspan="2">Theory</td><td>25</td><td>25</td><td rowspan="3">Project
Assessed for 100 marks reduced to 50 marks</td></tr>
<tr><td colspan="2">Average of two tests – 25 marks</td></tr>
<tr><td>Practical</td><td colspan="2">Weekly Assessment (Record/Project)-10 Marks
Lab IA test-15 Marks</td></tr>
<tr><td colspan="3">Total – 50 Marks</td><td>Total – 50 Marks</td></tr>
</table>

B.N.M. Institute of Technology

An Autonomous Institution under VTU

Semester: III		
COURSE: CONSTITUTION OF INDIA AND PROFESSIONAL ETHICS		
Course Code: 25CIP137	**L:T:P:J: 1:0:0:0**	**CIA Marks:** 50
Credits:	**1**	**SEA Marks: 5 0**
Hours:	**15 hrs**	**SEA Duration: 2Hrs**

Course Learning Objectives: The students will be able to

1	know the fundamental political codes, structure, procedures, powers, and duties of Indian government institutions, fundamental rights, directive principles, and the duties of citizens
2	know the Indian top civil service positions and the exams conducted by UPSC and SPSC for the same
3	Understand engineering ethics and their responsibilities; identify their individual roles and ethical responsibilities towards society.

MODULE 1: Introduction to Indian Constitution	**RBT**	**Hrs**
The Necessity of the Constitution, Introduction to Indian Constitution, The Making of the Constitution, Role of Constituent Assembly, Preamble and Salient features of the Constitution of India, Fundamental Rights and its Restriction and limitations in different complex situations, Directive Principles of State Policy, Fundamental Duties.	**1,2,3**	**3**
MODULE 2: System of Government, Central Government, State Government	**RBT**	**Hrs**
System of Government-Parliamentary System, Federal System. Central Government-Basic details, Powers and Functions of Union Executive. Parliament- LS and RS (Composition, Duration, Membership and Presiding officers of Parliament and their functions). Leaders in Parliament (Leader of the House and Leader of the Opposition). Sessions of Parliament (Summoning, Adjournment, Adjournment Sine Die, Prorogation, Dissolution). Quorum of House, Language in Parliament, Joint sitting of two Houses. State Government-Basic details, Powers and Functions of State Executive. State Legislature (Composition, Duration, Membership and Presiding officers of Parliament and their functions).	**1,2,3**	**3**
MODULE 3: Judiciary, Amendments and Emergency Provisions	**RBT**	**Hrs**
Supreme Court, High Court, Judicial Review, Judicial Activism. Methods in Constitutional Amendments (How and Why). Types of Emergencies and its Consequences, Recent Amendments to the Constitution.	**1,2,3**	**3**
MODULE 4: Elections, Constitutional and Non Constitutional Bodies	**RBT**	**Hrs**
Elections- Election Commission of India, Electoral Process. Constitutional Bodies- Election Commission, Union Public Service Commission, State Public Service Commission, Goods and Service Tax Council. Non Constitutional Bodies- Central Information Commission, State Information Commission.	**1,2,3**	**3**

MODULE 5: Professional Ethics	RBT	Hrs
Scope & Aims of Engineering & Professional Ethics, Positive and Negative Faces of Engineering Ethics, Responsibilities in Engineering, the impediments to Responsibility. Trust and Reliability in Engineering, Risks, Safety and liability in Engineering, Clash of Ethics, IPRs (Intellectual Property Rights)	**1,2,3**	**3**

Course outcome: On completion of this course, students will be able to,
CO1: Have constitutional knowledge and legal literacy.
CO2: Have knowledge on All India Services and State Civil Services.
CO3: Understand Engineering and Professional Ethics and responsibilities of Engineers.

Reference Books

Suggested Learning Resources:

1.**Title of the Book - Indian Polity**
Name of the Author - M Lakshmikanth
Name of the Publisher-Mc Graw Hill Education
Edition and Year- 2019

2.**Title of the Book - Engineering Ethics**
Name of the Authors - M. Govindarajan, S.Natarajan, V.S. Senthilkumar
Name of the Publisher- Prentice-Hall
Edition and Year-2004

3. Durga Das Basu (DD Basu): "Introduction to the Constitution on India", (Students Edition.) Prentice –Hall EEE, 19th / 20th Edn., (Latest Edition) or 2008.

4. Shubham Singles, Charles E. Haries, and Et al : "Constitution of India and Professional Ethics" byCengage Learning India Private Limited, Latest Edition – 2018.

5. M.Govindarajan, S.Natarajan, V.S.Senthilkumar, "Engineering Ethics", Prentice –Hall of IndiaPvt. Ltd. New Delhi, 2004

6. M.V.Pylee, "An Introduction to Constitution of India", Vikas Publishing, 2002.

7. Latest Publications of **NHRC - Indian Institute of Human Rights**, New Delhi.

Web Links and Video Lectures

www.unacademy.com/lesson/future-perfect-tense/YQ9NSNQZ https://successesacademy

Question paper pattern for SEA and CIA.

- The SEA question paper will be set for 50 marks and the pattern of the question paper will be objective type (MCQ).
- The CIA question paper will be set for 50 marks and the pattern of the question paper will be objective type (MCQ).

Final Marks = CIA + SEA = 50+50 = 100 Marks

Class Internal Assessment

IA1	Objective type questions 50Marks	Average of 2 IA will be taken 50Marks
IA2	Objective type questions 50Marks	
	Total CIA	**50 Marks**

Semester End Assessment

Semester end Exam	Objective type questions 50Marks	50 Marks
	Total SEA	**50 Marks**

Final Marks = CIA + SEA = 50+50 = 100 Marks

BNM Institute of Technology

Syllabus for Soft Skills
SEMESTER – III
Year 2026-27

Subject Name	Quantitative Aptitude and Logical Reasoning	**Daily/Weekly Assessment Marks**	Max 50 Min 20
Subject Code	25SFT138		
Duration & Number of Contact Hours/Day	One-week continuous classes 6 hrs per day	**Final Assessment Marks**	Max 50 Min 20
Total Number of Contact Hours	30	**Credits**	1

1.Understanding Corporate Communication: (2hrs)	Define corporate communication and its importance. Identify key stakeholders in corporate. Understand workplace etiquette: communication tone, addressing colleagues, and handling conflicts. Resume Writing.
2.Cross Culture Sensitivity: (2hrs)	Knowledge, awareness and acceptance of other cultures/caste/creed. Being of oneness and understanding the work environment.
3. Effective Communication and Interpersonal Skills (2hrs)	Skills we use daily when we communicate and interact with other people, both individually and in groups. Active listening, right response and clear message. Conduct mock presentations on technical topics relevant to engineering.
4. Collaboration and Team Communication: (2hrs)	Participate in team-based activities and projects to practice collaboration. Understanding types of Leadership and inculcating leadership skills
5. Written Communication (2hrs)	Passage / Email writing Identify your goal. Before you write an email, ask yourself what you want the recipient to do after they've read it. Writing technical documentation and reviews
6. Goal Setting & Mind Mapping (2hrs)	Development of an action plan designed to motivate and guide a person or group toward a goal. Gives one's life direction and boosts your motivation and self-confidence. Developing career Action plans

Quantitative Aptitude	**Speed Math** : Number System, Multiple and factors, Divisibility Rules HCF & LCM, Squares and Cubes, BODMAS & Tables, Approximation, Decimals, Fractions, Surds & Indices
	Profit & Loss - Concepts of SP, CP, Profit, Loss, Gain or Loss %. Marked Price & Discount problems, Successive Selling Tye, Discount
	Percentages – Percent to Decimal or Fraction Conversion, Inverse Case – Value From Percentage, relative Percentage, Successive Selling type, Dishonest Dealings, partnerships
	Averages - Understanding Averages, relevance, meaning, properties of average, deviation method, weighted average, & solving problems.
Logical Aptitude	**Logical Aptitude** – Syllogism, Venn diagram method, three statement syllogism, deductive and inductive reasoning, introduction to puzzle and games organizing information, parts of an argument, common flaws, arguments and

	assumptions.
	Coding & Decoding – Letter Coding, Number coding, symbol coding, **Crypt arithmetic** – basic concepts, addition, subtraction, multiplication of coded alphabets, types of cryptarithmetic Concept of EJOTY, Opposite Letter, Reversing thealphabets. Jumbling of Letter, Finding Codes of Derivatives.
	Image Analysis - Paper cutting & Folding, Mirror & Water Image, Cubes andDice, Analogy, Find the odd one out, Rule Detection. Cubes and dice
	Series Completion - Basics of Next no, Missing no and Wrong no and problemson that. Solving various types of Letter series and understanding different types.
	Odd Man Out - Following certain patterns and groups. Identifying the errors/odd one in the group.
	Visual sequence, visual analogy and classification, single & multiple comparisons, linear sequencing
	Logical Puzzles - K-level thinking, Arithmetic Puzzles and stick puzzles

13/08

Department of Mathematics

Syllabus

Semester: IV

Course: Complex Analysis, Probability and Random Process
Course Code: 25MAE141 (Common to ECE & EEE)

L:T:P:J	**2:2:0:0**	**CIA :50**
Credits:	**03**	**SEA : 50**
Hours:	**40**	**SEA Duration: 03 Hours**

Course Learning Objectives: The students will be able to

1 Provide an insight into applications of complex variables and conformal mapping arising in potential theory, quantum mechanics, heat conduction and field theory.

2 Develop the knowledge of probability, joint probability distribution and Random process occurring in digital signal processing, design engineering and microwave engineering.

Module-1: Complex Analysis	No. of hours	Blooms cognitive Levels
Examples from Engineering that require complex analysis. Review of function of a complex variable, limits, continuity and differentiability. Analytic functions. Cauchy-Riemann equations in Cartesian and polar forms. Consequences of Cauchy-Riemann equations (only statement), construction of analytic function using Milne-Thomson method. *Experiential Learning component: Problems on construction of analytic functions*	**L: 04** **T: 04**	**L1** **L2** **L3**
Module-2: Conformal Mapping & Complex Integration		
Examples from Engineering that require Conformal Mapping & Complex Integration. **Conformal mapping:** Introduction, discussion of transformations: $w = e^z$, $w = z^2$, $w = z + \frac{1}{z}(z \neq 0)$. Bilinear transformations. **Complex integration:** Introduction to complex integration, Cauchy's theorem and Cauchy's integral formula. Poles and residues, Taylor series, Laurent series and Residue theorem (without proof) *Experiential Learning component: Problems on Cauchy's integral formula*	**L: 04** **T: 04**	**L1** **L2** **L3**
Module-3: Probability Distributions & Joint probability distribution		
Examples from Engineering that require Probability and Joint probability distribution. **Probability Distributions:** Review of basic probability theory. Discrete and continuous Random variables, probability mass/density functions (definitions only). Binomial, Poisson, exponential and normal distributions (without proof). **Joint probability distribution:** Joint Probability distribution for two discrete random variables, expectation, covariance and correlation. *Experiential Learning component: Problems on Binomial, Poisson, Exponential and Normal distributions*	**L: 04** **T: 04**	**L1** **L2** **L3**
Module-4: Random Process		
Examples from Engineering that require random process. Introduction, classification of random process, methods of description of a random process, stationary, auto-correlation function, Ergodicity, Spectral representation, Weiner-Kinchine theorem, Poisson process, pure birth process, birth and death process with a constant rate, death process with a linear rate. *Experiential Learning component: Problems on Poisson process, pure birth process, birth and death process*	**L: 04** **T: 04**	**L1** **L2** **L3**

Module-5: Markov Chain & Sampling Theory		
Examples from Engineering that require Markov Chain and Sampling Theory. **Markov Chain**: Introduction to Stochastic process, Probability vectors, Stochastic matrices, Regular stochastic matrices, Markov Chains, Higher transition probabilities, Stationary distribution of Regular Markov chains and absorbing states, Markovian processes. **Sampling Theory**: Introduction to sampling theory, Testing of hypothesis, level of significance, confidence limits, test of significance of mean and difference of means for large samples-z-test, test of significance of small samples-Student's t- distribution. *Experiential Learning component: Problems on Markovian processes and, Sampling Theory*	**L: 04** **T: 04**	**L1** **L2** **L3**

Course Outcomes: After completing the course, the students will be able to

CO1: Use the concepts of analytic function and complex potentials to solve the problems arising in electromagnetic field theory.

CO2: Utilize conformal mapping and complex integral arising in aerofoil theory, fluid flow visualization and image processing.

CO3: Apply discrete and continuous probability and joint probability distributions in analyzing the probability models arising in engineering field.

CO4: Use the concepts of random process in dealing with signals in engineering problems.

CO5: Use Markov chain in prediction of future events and demonstrate the validity of testing the hypothesis.

CO - PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	2			2							
CO 2	3	2			2							
CO 3	3	2			2							
CO 4	3	2			2							
CO 5	3	2			2							

Reference Books:

1. E. Kreyszig: "Advanced Engineering Mathematics", John Wiley & Sons, 10th Edition(Reprint), 2016.
2. B. S. Grewal: Higher Engineering Mathematics, Khanna Publishers, 44th Edition, 2017.
3. S. D. Sharma : "Operations Research", KedarNath Ram Nath & Co. Meerut, 2014.
4. T. Veerarajan : "Probability, Statistics and Random processes", McGraw Hill Education (India) Private Limited, Third edition, Nineteenth reprint 2017.
5. C. Ray Wylie, Louis C. Barrett : "Advanced Engineering Mathematics", 6th Edition, 2. McGraw-Hill Book Co., New York, 1995.
6. B. V. Ramana: "Higher Engineering Mathematics" 11th Edition, Tata McGraw-Hill, 2010.
7. Srimanta Pal & Subodh C. Bhunia: "Engineering Mathematics", Oxford University Press, 3rd Reprint, 2016.

Web links and Video Lectures:

1. https://nptel.ac.in/courses/111106141
2. https://www.digimat.in/nptel/courses/video/111107119/L29.html
3. https://archive.nptel.ac.in/courses/122/107/122107036/
4. https://archive.nptel.ac.in/courses/105/105/105105045/
5. https://archive.nptel.ac.in/courses/111/102/111102014/
6. https://archive.nptel.ac.in/courses/111/103/111103159/

B.N.M. Institute of Technology

An Autonomous Institution under VTU, Approved by AICTE

Dept. of Electronics and Communication Engineering

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

Semester: IV

Course Name: Digital Signal Processing		**Course Code:** 25ECE142
L: T: P: J	3 : 2 : 0 : 0	**CIA Marks:** 50
Credits:	4	**SEA Marks:** 50
Hours/Week (Total)	5hrs/week (50)	**SEA Duration:** 03 Hours

Course Learning Objectives: The students will be able to

1	To discuss continuous and discrete-time signals and systems, their properties, representations, and methods that are necessary for the analysis of continuous and discrete-time signals and systems.
2	To develop the mathematical and computational skills needed in application areas like communication, signal processing, and control, which will be taught in other courses.
3	Understand the concept of Z-transforms, frequency domain sampling, and Discrete Fourier Transform (DFT).
4	Design digital FIR filters and IIR filters.

Module-1:	**No. of Hours**	**Blooms Cognitive Levels**
Introduction and Classification of Signals: Definition of signal and Classification of signals **Basic Operations on signals**: Amplitude scaling, addition, multiplication, Differentiation, and Integration of signals. Time scaling, time shift, and time reversal. **Elementary signals/functions:** Exponential, sinusoidal, step, impulse, ramp functions, triangular, and rectangular pulse.	**10**	**Apply CO1**
Module-2:		
System and its properties: Definition of system, Linear-nonlinear, Time variant-invariant, causal-noncausal, static-dynamic, Stable and Unstable Systems. **Impulse response representation of LTI Systems:** Convolution Sum & Convolution Integral (combination of Unit Step and Exponential). **Properties of Impulse response representation for LTI systems.**	**10**	**Apply CO2**
Module-3:		
Z-Transforms: Definition, Basic problems, Region of Convergence, Inverse Z Transform (Partial Fraction Method only). **Fourier Representation of aperiodic Signals:** Introduction to DTFT, Definition, and basic problems, Properties (Linearity, Time Shift, Frequency Shift, Differentiation in the Frequency Domain).	**10**	**Apply CO3**

Module-4:		
IIR Filters: Introduction to IIR filters, Bilinear Transformations, Design of Analog and Digital Butterworth filters (low-pass and high-pass). Realization of IIR filter structure (Direct form I & form II, Cascade, Parallel).	**10**	**Apply CO4**
Module-5:		
FIR Filters: Introduction to FIR filters, Frequency response of ideal digital low pass filter, high pass filter, Windowing design of FIR filters using Rectangular, Hanning, Hamming, Blackmann & Bartlett windows. FIR filter realization using Direct form and linear phase structure.	**10**	**Apply CO5**

Course Outcomes: After completing the course, the students will be able to	
25ECE142.1	Classify the signals as continuous/discrete, periodic/aperiodic, even/odd, energy/power, and deterministic/random signals.
25ECE142.2	Determine the linearity, causality, time-invariance, and stability properties of continuous & discrete-time systems and compute convolution.
25ECE142.3	Represent signals in the frequency domain using Z-Transforms, DTFT, and compute the DFT of signals.
25ECE142.4	Develop and realize the transfer function of IIR filters
25ECE142.5	Develop and realize the transfer function of FIR filters.
25ECE142.6	Interpret the signals and systems used in the different areas of application.

Textbooks

1. Simon Haykins and Barry Van Veen, “Signals and Systems”, 2nd Edition, 2018, Wiley India. ISBN 9971-51-239-4.
2. Proakis & Monalakis, “Digital signal processing – Principles Algorithms & Applications”, 4th Edition, Pearson Education, New Delhi, 2007. ISBN: 81-317-1000-9.

Reference Books

1. Michael Roberts, “Fundamentals of Signals & Systems”, 2nd edition, Tata McGraw-Hill, 2010, ISBN 978-0-07-070221-9.
2. Li Tan, Jean Jiang, “Digital Signal processing - Fundamentals and Applications”, Academic Press, 2013, ISBN: 978-0-12-415893.
3. Sanjit K Mitra, “Digital Signal Processing, A Computer Based Approach”, 4th Edition, McGraw Hill Education, 2013.
4. Dr. D. Ganesh Rao and Satish Tunga, “Signals and Systems”, Cengage India Private Limited, 2017, ISBN: 978-81-315-3362-8
5. Dr. D. Ganesh Rao and Vineeth P Gejji, “Digital Signal Processing” Cengage India Private Limited, 2017, ISBN: 9386858231

Marks Distribution for Assessment

<table>
<tr><th rowspan="2">PCC</th><th rowspan="2">CIA</th><th rowspan="2">SEA</th><th colspan="4">CIA (50)</th><th rowspan="2">SEA
Conduction: 100 M
Reduced to: 50 M</th></tr>
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<tr><td colspan="3">Average of three tests – 30 Marks</td></tr>
<tr><td>Assignment</td><td colspan="3">10 Marks</td></tr>
<tr><td>AAT</td><td colspan="3">10 Marks</td></tr>
<tr><td colspan="4">Total – 50 marks</td><td>Total – 50 marks</td></tr>
</table>

AAT: Oral /Online Quizzes, Presentations, Group discussions, Case studies, Term Paper, Open ended experiments, Mini industrial/social/rural Projects, Two-minute video on latest topic, Short MOOC courses, Practical Orientation on Design thinking, creativity & Innovation, Participatory & Industry integrated learning, Practical activities, Problem solving exercises, Participation in seminars/academic events/symposia and any other activity

BNM Institute of Technology

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

Semester: IV

Course Name: AI-Driven Control Engineering		**Course Code:25ECE143**
L:T:P:J	**2 : 2 : 2 : 0**	**CIA Marks:**50
Credits:	**4**	**SEA Marks:**50
Hours/Week (Total)	**50**	**SEA Duration:**03Hours

Pre-Requisites: Basic Electrical, Mathematical Preliminaries, Basics of AI

Course Learning Ob0jectives:The students will be able to

1	Understand the terminologies of control systems and mathematical modelling of electrical and mechanical system.
2	Determine the transfer function from block diagram and signal flow graph
3	Find time response from Transfer Functions
4	Analyze the stability of a system in time and frequency domain
5.	Understand the use artificial intelligence in control system.

Module-1: Introduction to Control Systems and Fuzzy Logic control System	**No. of Hours**	**Blooms Cognitive Levels**
Introduction to Control Systems: Definitions, Classification of control systems open loop and closed loop, linear and nonlinear, time variant and time invariant. The transfer function of simple electrical networks. Mathematical Modeling and Representation mechanical translational, rotational systems and electrical system. Analogous Systems. Definition of intelligent systems, soft computing & Hard computing, Soft computing Tools, Fuzzy Logic Control **1.** Determination of transfer function of electric/ mechanical System. **2.** Program to control gain Using Fuzzy Logic	**10**	**Apply CO1**
Module–2: Block diagram algebra, Signal Flow graph		
Block Diagram Reduction, Signal Flow Graphs, Mason's Gain Formula (No Proof), Conversion from electrical circuit to SFG and Block diagram to SFG. **3.** Determine the transfer function for given closed loop system in block diagram representation. **4.** Time Response of First and Second order system.	**10**	**Apply CO2**
Module–3: Time Response of Feedback Control Systems:		
Time Response of Feedback Control Systems: Standard test signals, step response of first and second order systems, time domain specifications. Type and order of the system, Steady state error and static error constants. Concepts for P, PD, PI and PID Controllers, AI based PID controller. **5.** To observe effect of the PID parameters on the closed loop dynamics. **6.** Tuning of PID Controllers Using Reinforcement Learning **7.** To reduce steady state error of a system.	**10**	**Apply CO3**
Module–4: Time Domain Analysis		
Stability Analysis: Concept of stability, R H criterion, applications of R H criterion with limitations. **Root locus technique:** Introduction to root locus concepts, Construction rules, Analysis of stability by root locus plot AI in Lead–Lag Compensation design, tune, and optimize lead–lag compensators for complex system	**10**	**Apply CO4**

8. Stability Analysis Based on Pole Position. **9.** Effect of Loop Gain of negative feedback system on stability. **10.** Create root locus for a given transfer function		
Module–5: Frequency Domain Analysis and Intelligent Control System		
Frequency domain analysis: Correlation between frequency response and transient response. Frequency domain specifications, concept of phase margin and gain margin, Introduction to frequency domain plots. Polar plots, Bode and inverse bode plots. Genetic Algorithm (GA, Genetic Programming (GP), Hybrid Systems, AI based Compensation networks 10. Stability Analysis of system using Bode Plot. 11. Program to train a neural network to approximate the control action for a simple system.	**10**	**Apply CO5**

Practical Experiments	
Sl. No	**Simulation Experiments using MATLAB/Equivalent software**
1	Determination of transfer function of electric/ mechanical System.
2	Program to control gain Using Fuzzy Logic
3	Determine the transfer function for given closed loop system in block diagram representation.
4	Time Response of First and Second order system.
5	To observe effect of the PID parameters on the closed loop dynamics.
6	To reduce steady state error of a system.
7	Stability Analysis Based on Pole Position.
8	Effect of Loop Gain of negative feedback system on stability.
9	Create root locus for a given transfer function.
10	Stability Analysis of system using Bode Plot.
11.	Program to train a neural network to approximate the control action for a simple system.

Course Outcomes: After completing the course, the students will be able to

25ECE143.1	Develop the mathematical model of mechanical, electrical systems and transfer function for a given control system
25ECE143.2	Develop transfer function using block diagram reduction and signal flow graph techniques.
25ECE143.3	Determine the time domain specifications for first and second order system
25ECE143.4	Determine the stability of a system in time domain using Routh-Hurwitz criterion and Root locus technique
25ECE143.5	Determine the stability of a system in the frequency domain using Polar and bode plots and illustrate the use artificial intelligence in control system.
25ECE143.6	Explain the method of conserving energy using closed loop control system.

Reference Books

1. Control Engineering, J. Nagrath & M. Gopal, New Age International Publishers/ 5th edition/ 2005.
2. Automatic Control Systems, Benjamin C. Kuo, John Wiley India Pvt. Ltd./ 8 th Edition/ 2008.
3. Control systems,AAnandKumar,PHIlearningprivatelimited,NewDelhi
4. Control Engineering, D.Ganesh Rao and K.Channavenkatesh Publisher-Sanguine Technical Publishers,2008.

Marks Distribution for Assessment:

<table>
<tr><td rowspan="2"></td><td rowspan="2">CIA</td><td rowspan="2">SEA</td><td colspan="4">CIA (50)</td><td rowspan="2">SEA
Conduction: 100 M
Reduced to: 50 M</td></tr>
<tr><td></td><td>I</td><td>II</td><td>III</td></tr>
<tr><td rowspan="5">Conduction</td><td rowspan="5">50</td><td rowspan="5">50</td><td rowspan="3">Theory</td><td>30</td><td>30</td><td>30</td><td rowspan="4">Five questions with each of 20 marks (with internal choice). Student should answer one full question from each module</td></tr>
<tr><td colspan="3">Average of 3 tests - 15 marks</td></tr>
<tr><td colspan="3">AAT - 10 Marks</td></tr>
<tr><td>Practical</td><td colspan="3">Weekly Assessment – 10 Marks
IA test – 15 Marks</td></tr>
<tr><td colspan="5">Total – 50 Marks</td><td>Total – 50 Marks</td></tr>
</table>

i) CIA: 50%

Theory	**IA Test (Theory): 3 IA tests - each of 30 Marks- Average of 3 tests**	15 Marks
	AAT– **10** Marks Assignment, Oral /Online Quizzes, Presentations, Group discussions, Case studies, Term Paper, Open ended experiments, Two-minute video on latest topic, Practical Orientation on Design thinking, creativity & Innovation, Practical activities, Problem solving exercises, Participation in seminars/academic events/ symposia and any other activity	10 Marks
Practical	**Weekly Assessment**– **10** Marks	25 Marks
	IA test -15 marks	
	Total	**Marks**

ii) SEA : 50%

Question Paper:

Theory Exam	**5** questions to answer, each of 20 Marks **2** questions from each module with internal choice Student should answer one full question from each module	20 M x 5= **100 M** **Reduced to 50 M**
	Total	**50 Marks**

B.N.M. Institute of Technology

An Autonomous Institution under VTU, Approved by AICTE

Dept. of Electronics and Communication Engineering

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

Semester: IV

Course Name: ARM Microcontroller & Its Application **Course Code: 25ECE144**

L: T: P: J	**3: 0: 2: 0**	**CIA Marks: 50**
Credits:	**4**	**SEA Marks: 50**
Hours	**40**	**SEA Duration: 03 Hours**

Pre-Requisites: Basic knowledge of Microcontroller/Microprocessor

Course Learning Objectives: The students will be able to

1	Understand the architectural features of 32-bit microcontroller ARM Cortex M3.
2	Program ARM Cortex M3 using the instructions set and C language for different applications.
3	Describe the memory systems, bus interface unit, exceptions of ARM Cortex M3.

Module-1: ARM-32-bit Microcontroller	**No. of Hours**	**Blooms Cognitive Levels**
Architecture of ARM Cortex M3, Various Units in the architecture, General Purpose Registers, Special Registers, Exceptions/ Interrupts, The Built-In Nested Vectored Interrupt Controller, Stack operation, Operation Modes. Lab: 1a. Write ALP to find the sum of first 10 integer numbers 1b. Write ALP to multiply two 32-bit binary numbers 2. Write ALP to find determine whether the given 32-bit is even or odd	**10**	**Apply CO1**
Module-2: ARM Cortex M3 Instruction Sets and Programming-Part 1		
ARM Cortex M3 Instruction, Assembly basics, General Data-Processing Instructions, Bit Field instructions, IF THEN instructions, Saturation Operations. Lab: 3. Write ALP to set/clear the 3rd bit of a given 32-bit number. 4. Write ALP to check if a 32-bit number in `R0` is negative and perform Sign extension to 32-bit using `IT` and `ORR`.	**10**	**Apply CO2**
Module-3: ARM Cortex M3 Instruction Sets and Programming-Part 2		
Memory Access instructions, Branch control instructions, Combined Compare and Conditional Branch, Typical Development Flow, CMSIS, Programing in C - Toggle an LED. Lab: 5a. Write ALP to store data in the RAM 5b. Write ALP to find the largest number in an array	**10**	**Apply CO3**
Module-4: Memory Systems of Cortex-M3		
Memory Maps, Memory Access Attributes, Bit-Band Operations, The Pipeline, A Detailed Block Diagram, Bus Interfaces on the Cortex-M3, The I-Code Bus, The D-Code Bus, The System Bus, The External PPB, The DAP Bus Lab: 6a. Write ALP to demonstrate bit-band operations in SRAM location using the bit-band alias region. 6b. Write ALP to demonstrate pipelining. 7a. Write embedded C program to interface a simple switch and display its status through Relay, Buzzer and LED. 7b. Write embedded C program to interface a Stepper motor and rotate it in clockwise and anti-clockwise direction.	**10**	**Apply CO4**
Module-5: Exceptions in Cortex M3		

Exception Types, Definitions of Priority, Vector Tables, Interrupt Inputs and Pending Behaviour, Fault Exceptions, Bus Faults, Memory Management Faults, Usage Faults, Hard Faults, Dealing with Faults, Supervisor Call and Pendable Service Call Lab: 8. Display the Hex digits 0 to F on a 7-segment LED interface, with an appropriate delay in between. 9. Interface a DAC and generate Triangular and Square waveforms. 10. Toggle the LED when an external interrupt occurs	**10**	**Apply CO5**

Course Outcomes: After completing the course, the students will be able to	
25ECE144.1	Utilize the knowledge of ARM Cortex-M3 architecture to use general-purpose, special registers, stack and on chip blocks.
25ECE144.2	Develop assembly language programs for embedded applications using instruction set (data-processing, bit-field, if-then, saturation).
25ECE144.3	Apply knowledge of branching, memory access, embedded C and CMSIS framework to create simple embedded applications using ARM Cortex-M3.
25ECE144.4	Employ the principles of memory mapping, access attributes, bit-band operations, pipelining, and bus interfaces to optimize data handling and control.
25ECE144.5	Apply the concepts of interrupt priorities, vector tables, faults, supervisor calls to implement effective exception handling.
25ECE144.6	Design Embedded system using ARM CortexM3 for Societal needs, Health care, Home application.

Reference Books

1. The Definitive Guide to the ARM® Cortex-M3, Second Edition, Joseph You.
2. Discovering the STM32 Microcontroller by Geoffrey Brown, Publisher: Indiana University, Published: 2016.

Marks Distribution for Assessment

<table>
<tr><th rowspan="2">PCI</th><th rowspan="2">CIA</th><th rowspan="2">SEA</th><th colspan="4">CIA (50)</th><th rowspan="2">SEA
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B.N.M. Institute of Technology

An Autonomous Institution under VTU
Dept. of Electronics and Communication Engineering
Choice Based Credit System (CBCS and Outcome Based Education (OBE))

Semester: IV

Course Name: Analog and Digital Communication		**Course Code:** 25ECE145
L: T: P: J	**3:0:2:0**	**CIA Marks:** 50
Credits:	**4**	**SEA Marks:** 50
Hours	**40**	**SEA Duration:** 03 Hours

Pre-Requisites: Fourier Transform, Basics of Signals and systems

Course Learning Objectives: The students will be able to

1	Understand and analyze concepts of Analog Modulation schemes viz; AM, FM techniques.
2	Understand and analyze concepts digitization of signals viz; sampling, quantizing, and encoding.
3	Understand the concept of signal processing of digital data and signal conversion to symbols at the transmitter and receiver.
4	Understand the concepts of waveform coding for Base-band Transmission of digital signals.
5	Understand and analyze the concepts of Digital Modulation schemes and compute performance metrics of bandlimited channel.

Module-1: AMPLITUDE MODULATION		
AMPLITUDE MODULATION: Introduction, Communication Block diagram, Need for Modulation, Amplitude Modulation: Time & Frequency Domain description, switching modulator, Envelop detector. **DOUBLE SIDE BAND-SUPPRESSED CARRIER MODULATION:** Time and Frequency Domain description, Ring modulator Coherent detection, Costas Receiver, Frequency Translation.	**No. of Hours** **8**	**Blooms Cognitive Levels** **Apply CO1**
Module-2: ANGLE MODULATION		
ANGLE MODULATION: Basic definitions, Frequency Modulation: Narrow Band FM, Wide Band FM, the Transmission bandwidth of FM Signals, Generation of FM Signals, Demodulation of FM Signals, FM Stereo Multiplexing, Phase–Locked Loop: Linear model of PLL. Figure of Merit of FM receiver	**8**	**Apply CO2**
Module-3: SAMPLING AND QUANTIZATION		
Introduction, Why Digitize Analog Sources? The Low pass Sampling process, Pulse Amplitude Modulation, Time Division Multiplexing, Pulse-Position Modulation, Generation of PPM Waves, Detection of PPM Waves, Quantization Random Process, Quantization Noise.	**8**	**Apply CO3**
Module-4: BASE-BAND TRANSMISSION OF DIGITAL SIGNALS		
Pulse–Code Modulation: Sampling, Quantization, Encoding, Regeneration, Decoding, Filtering, Multiplexing; Delta Modulation. Base-band transmission of Digital Signals: Baseband pulse, Pulse Shaping and Matched Filter Detection, Intersymbol interference (qualitative analysis), Eye pattern.	**8**	**Apply CO4**

Module-5: DIGITAL MODULATION TECHNIQUES		
Amplitude shift keying, Frequency shift keying, Binary Phase shift keying; Generation and detection with constellation diagram; Performance analysis; Power and Bandwidth; Bit error rate. (qualitative analysis)	**8**	**Apply CO5**

Course Outcomes: After completing the course, the students will be able to	
25ECE145.1	Derive the time-domain and frequency domain representation of Amplitude modulation.
25ECE145.2	Derive the time-domain and frequency domain representation of Frequency modulation.
25ECE145.3	Compute the performance of pulse modulation schemes with quantization noise.
25ECE145.4	Apply the concepts of waveform coding for Base-band Transmission of digital signals.
25ECE145.5	Compute the performance of digital modulation schemes over the noisy channel.
25ECE145.6	Apply and develop the functional blocks of signal processing and communication applications.

Reference Books

1. "Communication Systems", Simon Haykins & Moher, 5th Edition, John Willey, India Pvt. Ltd, 2010, ISBN 978 – 81 – 265 – 2151 – 7.
2. "Digital communications", Simon Haykin, John Wiley India Pvt. Ltd, 2008.
3. "Digital Communication Systems", Simon Haykin, John Wiley & Sons, First Edition, 2014, ISBN 978-0-471-64735-5.
4. "Fundamentals of Communication Systems", John G Proakis and Masoud Salehi, 2014 Edition, Pearson Education, ISBN 978-8-131-70573-5.
5. "Modern Digital and Analog Communication Systems", B. P. Lathi, Oxford University Press., 4th edition.
6. "An Introduction to Analog and Digital Communication", Simon Haykins, John Wiley India Pvt. Ltd., 2008, ISBN 978–81–265–3653–5.
7. "Digital Communications - Fundamentals and Applications", Bernard Sklar and Ray, Pearson Education, Third Edition, 2014, ISBN: 978-81-317-2092-9.

List of Lab Experiments	
Sl. No.	**Experiment**
1	Pulse sampling, Verification of sampling theorem.
2	Time Division Multiplexing and Demultiplexing of two bandlimited signals.
3	BASK generation and detection.
4	BFSK generation and detection.
5	Simulate Amplitude Modulation and Demodulation: Standard AM using MATLAB. (One hour session to be engaged for concept discussion).

6	Simulate Amplitude Modulation and Demodulation: DSBSC using MATLAB. (One hour session to be engaged for concept discussion).
7	Simulate Frequency modulation and demodulation using MATLAB.
8	Simulate Pulse Width modulation and demodulation using MATLAB. (One hour session to be engaged for concept discussion).
9	Simulate Pulse Position modulation and demodulation using MATLAB. (One hour session to be engaged for concept discussion).
10	Simulate Pulse code modulation and demodulation using MATLAB. (One hour session to be engaged for concept discussion).

Marks Distribution for Assessment:

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<tr><td colspan="3">Average of 3 tests - 15 marks</td></tr>
<tr><td>Assignment</td><td colspan="3">AAT - 10 Marks</td></tr>
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<tr><td colspan="4">Total – 50 Marks</td><td>Total – 50 Marks</td></tr>
</table>

BNM Institute of Technology

Dept. of Electronics and Communication Engineering
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)

Semester: IV

Course Name: Signal Processing Applications using MATLAB (Theory +Lab + Mini Project)
CourseCode:25ECE146

L:T:P:J	**0:0: 2:2**	**CIAMarks:**50
Credits:	**2**	**SEAMarks:**50
Hours/Week (Total)	**12 Lab sessions + 12 sessions for project**	**SEADuration:**03Hours

Pre-Requisites: Signals and Systems and DSP Fundamentals

CourseLearning Objectives:Thestudentswillbeable to

1	Simulate continuous time, discrete time signals and verify sampling theorem using MATLAB.
2	Perform computation of DFT and convolution along with the verification of their properties.
3	Perform operations and transformations on Images.
4	Compute and display the filtering operations and compare with the theoretical values.
5	Able to use Simulink platform to verify the properties of a system.

	No. of Hours	**Blooms Cognitive Levels**
1. Plot discrete and continuous time waveforms like rectangular pulse, square wave, triangular pulse, triangular wave, impulse, step, and ramp signal.	**2**	**Apply CO1**
2. Computation of Linear convolution of two given sequences. Prove commutative, distributive, and associative property of convolution.	**2**	**Apply CO1, CO2**
3. **Theory: Discrete Fourier Transform (DFT)**: Frequency domain sampling, The Discrete Fourier Transform, DFT as a linear transformation, Properties of the DFT: Periodicity, Linearity, Multiplication of two DFTs and Circular Convolution. Necessity for efficient computation of DFT, Radix-2 Fast Fourier Transform (FFT) algorithm for DFT computation. Radix-2 FFT algorithm for computation of Inverse Discrete Fourier Transform (IDFT)	**5**	**Apply CO2**
4. Computation of N point DFT of a given sequence and to plot magnitude and phase spectrum.	**2**	**Apply CO2**
5. Introduction to Image processing toolbox. Perform basic image processing operations like add, subtract, complement, and crop.	**2**	**Apply CO3**

6. Perform the following operations on images: image enhancement, and thresholding on a given gray scale image.	**2**	**Apply CO3**
7. Design and implementation of Low pass IIR filter to meet the desired specifications.	**2**	**Apply CO4**
8. Design and implementation of Low pass FIR filter to meet the desired specifications.	**2**	**Apply CO4**
9. Checking Linearity/Non-Linearity of a system using SIMULINK	**2**	**Apply CO5**
10. Checking Time variance/invariance of a system using SIMULINK	**2**	**Apply CO5**

Mini Project

One mini project to be completed in 12 lab sessions including its evaluation.

Sample Mini Projects

1. Light Animation using Arduino and MATLAB.
2. Fruit identification.
3. Vehicle number plate detection.
4. Simulation of power plant.
5. Hybrid electric vehicle modeling.
6. Image processing using MATLAB.
7. Improve speech communication in the car.
8. Remove noise from the voice signal.

Course Outcomes: After completing the course, the students will be able to

25ECE146.1	Demonstrate sampling theorem and plot elementary waveforms in continuous and discrete time domains.
25ECE146.2	Analyze and plot the signals using DFT and convolution.
25ECE146.3	Perform basic operations on images.
25ECE146.4	Apply filtering techniques on audio/speech signals.
25ECE146.5	Build a system toverify the properties of a given system using SIMULINK.
25ECE146.6	Design real time application in speech/audio/image processing.

ReferenceBooks

1. Vinay K Ingle, John G Proakis, Digital Signal Processing using MATLAB, Fourth Edition, Cengage India Private Limited, 2017.
2. John W. Leis, Digital Signal Processing Using MATLAB for Students and Researchers, Wiley, August 2011

Marks Distribution for Assessment:

<table>
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<tr><td rowspan="4">Theory</td><td>I IA</td><td>II IA</td><td rowspan="4">Project Assessed for 100 Marks
Reduced to 50 Marks</td></tr>
<tr><td rowspan="2">Conduction</td><td rowspan="2">50</td><td rowspan="2">50</td><td>25</td><td>25</td></tr>
<tr><td colspan="2">Average of two tests–25 marks</td></tr>
<tr><td>Lab</td><td colspan="2">Weekly Assessment
(Record/Project) – 10 Marks
Lab IAtest – 15 Marks</td></tr>
<tr><td colspan="4">Total– 50Marks</td><td>Total– 50Marks</td></tr>
</table>

i) CIA:50%

Theory	**IATest** (Theory): 2 IAtests -each of 25 Marks	Averageof 2tests 25Marks
Lab	**Weekly Assessment**– Lab Record/Project - 10Marks **Lab IA test(1)**-15 marks	25Marks
	Total	**50Marks**

ii) SEA: 50%

Project	Write-Up – 10 Marks Project Report – 25 Marks Presentation and Demonstration – 50 Marks Viva-Voce – 15 Marks	**100 M Reducedto50M**
	Total	**50Marks**

BNM Institute of Technology

Syllabus for Soft Skills
SEMESTER – IV
Year 2025-26

Subject Name	Quantitative Aptitude and Logical Reasoning	**Daily/Weekly Assessment Marks**	Max 50 Min 20
Subject Code	25SFT148		
Duration & Number of Contact Hours/Day	One-week continuous classes 6 hrs per day	**Final Assessment Marks**	Max 50 Min 20
Total Number of Contact Hours	30	**Credits**	1

Module 1 (Logical Reasoning)	**Ages & Blood Relation** - Generation Tree, Family Tree Problems, Statement Based Questions, Coded Blood Relation Question, Blood Relation Based Puzzles.
	Seating Arrangement - Single or Double rows facing each other or away from each other in the same direction Circular Seating Arrangement · Uni- & Bi-directional problems on · Circular, Square, Rectangular, Hexagonal tables
	Distance & Direction - Distance and Displacement between any two points as well as puzzles based on that, Concept of Shadows.
	Clocks & Calendars - Understanding concepts and basic formula along with solving different types of problems.
	Probability - Single event probability, multi event probability, independent events and dependent events, mutually exclusive events, non-mutually exclusive events, combination method for finding the outcomes.
	Analogies - Drawing similarity between different but sufficiently similar events, situations, or circumstances using tips and tricks, find the odd one out, rule detection,
Module 2 (Quantitative Aptitude)	**Ratio and Proportion** · Simple Ratios, Compound Ratios · Comprehend and Dividend · Direct & Indirect Proportions · Problems on ages,
	Mixtures & Alligation– technique, general representation, the straight-line approach, application of weighted allegation methods in problems involving mixtures, application of allegation on situations other than mixtures problems & Coin problems.
	Data Interpretation – Simple arithmetic, rules for comparing fractions, calculating(approximation)fractions, shortcut ways to find the percentages, Classification of data tables, Bar Graph, Tabular Form, Line Chart, case let Form. Pie Chart, Radar/Web, combination of graphs, combination of graphs and tables. and Missing Data Interpretation.
	Simple interest and Compound Interest - Simple Interest, Basic Difference b/w both the Interests. Mixed interest, CI with a Fractional Rate, to find Installments of both SI and CI.

	- Relative speed, Average speed, Problems on Races when somebody gives a start to other Person. Persons moving opposite & same direction in circular track, problems on train, Boat & Stream,
	Permutation & Combination - Arrangement, law of addition & multiplication, factorial **Speed, Time & Distance** function, concept of step arrangement, permutation of similar things, circular things, find the rank of word in dictionary. Concepts of selections using combination.
	Time & Work - Partial work done problems Work done on Alternate days. Problems related to efficiency. Division of Wages According to Work. Work & wages, pipes & cisterns

12/18