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: 22MAC131 (Common to ECE, EEE & ME)**			
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	No. of hours	Blooms cognitive Levels
Module-1: Curve fitting & Statistical methods		
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**	**Apply**
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**	**Apply**
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 convolution theorem.*	**L: 04** **T: 04**	**Apply**
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**	**Apply**
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**	**Apply**

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

CO 1:	Make use of correlation and regression analysis to fit a suitable mathematical model for the statistical data.
CO 2:	Use Laplace transform to find the transformation for 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:	Make use of Fourier transform and Z-transform to illustrate discrete / continuous function arising in wave and heat propagation, signals and systems

Reference Books:

1. E. Kreyszig: "Advanced Engineering Mathematics", John Wiley & Sons, 10"Ed.(Reprint), 2016.
2. B. S. Grewal: "Higher Engineering Mathematics", Khanna Publishers, 44^{th} 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" 11^{th} Edition, Tata McGraw-Hill, 2010.
7. Srimanta Pal & Subodh C Bhunia: "Engineering Mathematics", Oxford University Press, 3 Reprint, 2016.
8. Gupta C. B., Singh S. R. and Mukesh Kumar: "Engineering Mathematics for Semester I & II", Mc-Graw Hill Education (India) Pvt. Ltd., 2015.

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

Assessment Process (for both CIA and SEA)

Professional Core Course (PCC)

Course with Credits	Evaluation Type	Maximum Marks	Minimum Passing Marks	Evaluation details
PCC 3 Credits	**Total CIA theory + Practical**	**50**	**20**	**---**
	CIA-IA Tests	25	10	Average of two Internal Assessment tests each of 50 marks, scale down the marks scored to 25 marks.
	CIA-CCAs	25	10	(i) Practical activities / problems solving exercises -15 marks. (ii) Average of two Assignments each of 10 marks, scale down the marks scored to 10 marks.
	Total CIA theory	**50**	**20**	
	SEA	50	20	SEA exam is a theory exam, conducted for 100 marks, scaled down to 50 marks
	CIA+SEA	**100**	**40**	
	The maximum marks to be secured in CIA to appear for SEA shall be 10(40% of maximum marks-25) in theory component and 10(40% of maximum marks-25) in CIA-CCAs. experiential learning component of the PCC shall be for CIA only, However, In SEA, the questions from the experiential learning shall be included in their respective module only.			

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:22ECE132**

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	
22ECE132.1	Apply the concepts of source transformation, mesh analysis, and node analysis to solve and analyze the electrical circuits.
22ECE132.2	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.
22ECE132.3	Evaluate the initial and final conditions in passive circuits and apply them for the RL, RC, and RLC electrical networks.
22ECE132.4	Apply and analyze the various electrical networks using Laplace transform.
22ECE132.5	Solve the given network using specified two port network parameters. Also, apply and analyze the concept of series and parallel resonance for RLC networks.
22ECE132.6	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.

I Professional Core Course (PCC)

PCC	CIA	SEA	CIA (50)			SEA Conduction: 100 M Reduced to: 50 M
				I	II	
Conduction	50	50	Written Test	50	50	Five questions with each of 20 marks (with internal choice). Student should answer one full question from each module
				Average of two tests – 25 Marks		
			Assignment	15		
			AAT	10		
					Total – 50 marks	**Total – 50 marks**

i) CIA: 50%

IA Test: 2 IA tests - Each of 50 Marks	Average of 2 tests – scaled down to 25 M
Assignment – Two assignments – one for 10 marks and another for 5 marks	15 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 Name: Data Structures using C		**Course Code: 22ECE133**
L: T:P: J	**2:0:2:0**	**CIE Marks:** 50
Credits:	**3**	**SEE Marks:** 50
Hours/Week (Total)	**4**	**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	**No. of Hrs**	**Bloom's Taxonomy Levels/CO Mapping**
Introduction and Overview: Introduction, Basic Terminology, Elementary Data Organization, Data Structures, Data Structure Operations, Abstract Data Types (ADT), ADT of Array, Stack, Queue. Algorithms: Complexity, Time-Space Trade off, Algorithms Notation, Complexity of Algorithms and other asymptotic notations for complexity of algorithms.	**8**	**Understand CO1**
Module–2: LINEAR DATA STRUCTURES		
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.	**8**	**Apply CO2**
Module–3: LINEAR DATA STRUCTURES -STACKS & QUEUES		
Stacks: Introduction, Stacks, Array representation of Stacks, linked representation of Stacks, Arithmetic expressions; Postfix and prefix notations, Quick sort, an application of stacks. **Queues**: Queues, linked representation of queues, dequeue	**8**	**Apply CO3**
Module–4: NON-LINEAR DATA STRUCTURES – TREES		

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.	**8**	**Apply CO4**
Module–5: GRAPHS, SORTING & SEARCHING		
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) **Sorting & Searching:** Introduction, sorting, insertion sort, selection sort, merge sort, searching and data modification.	**8**	**Apply CO5**

List of Programs

Using C compiler, demonstrate the concepts using following programs:

1. Write a C program to Insert an element in an array and delete an element in the same array
2. Write a C program to sort the array elements using selection sort
3. Write a C program to sort the array elements using bubble sort
4. Write a C program to create of 'n' nodes in singly linked list and display them
5. Write a C program to insert a node at the middle of linked list
6. Write a C program to delete a node in linked list
7. Write a C program to implement the stack in array.
8. Write a C program to Reverse String using STACK
9. Write a C program to implement the queue in array
10. Write a C program to search the number/node in a tree
11. Write a C program to implement Graph

Course Outcomes: After completing the course, the students will be able to	
22ECE133.1	Gain knowledge on the importance of data structures, algorithms and time complexity computations.
22ECE133.2	Apply linear data structures to analyse and obtain solutions
22ECE133.3	Apply non-linear tree data structure to analyse and obtain solutions
22ECE133.4	Apply non-linear graph data structure to analyse and obtain solutions
22ECE133.5	Apply the concepts of sorting and searching to problem solving
22ECE133.6	Analyse real time practical problems and apply appropriate data structures to obtain efficient solutions

Reference Books

1. Data Structures, Seymour Lipschutz, Tata McGraw Hill Education, Revised 1st Edition, 2008.
2. Fundamentals of Data structures in C, Horowitz, Sahni & S.Anderson-Freed, University Press, Second edition, 2008.
3. Introduction to Algorithms, Thomas H. Cormen, C.E. Leiserson, R L.Rivest and C. Stein, Third edition, MIT Press, 2009
4. Data structure and program design in C, R.L. Kruse, B.P. Leary, C.L. Tondo, PHI, 2009(Fourth Impression)
5. Data Structures, Tannenbaum, PHI, 2007(Fifth Impression)

6. An introduction to Data Structures with Applications, Jean Paul Tremblay, Paul G. Sorenson, Second Edition, Tata McGraw-Hill,1991.
7. Data Structures and Algorithm Analysis in C, Mark Allen Weiss, Second Edition, Pearson Education, 1996.

II Professional Core Integrated Lab (PCI) (Programming courses)

PCI	CIA	SEA	CIA (50)			SEA Conduction: 100 M Reduced to: 50 M	
				I	II	**PART A**	**PART B**
Conduction	50	50	IA Test	30	30	30 Marks	70 Marks
				Average of two tests – 30 M			
			Continuous Assessment	Weekly Assessment -20 marks			
					Total – 50 Marks		**Total – 50 Marks**

i) CIA: 50%

IA Test: 2 IA tests - each of 30 Marks	Average of 2 tests – 30 M
Practical Lab record – 10 Marks Performance – 05 Marks Viva – 05 Marks	20 Marks
	Total 50 Marks

ii) SEA : 50%
Question Paper:

Theory part	5 questions to answer each of 6 Marks 2 questions from each module with internal choice Student should answer one full question from each module	6 M x 5 = 30 Marks
Execution part	Write up - 20 Marks Conduction - 40 Marks Viva-Voce - 10 Marks	70 Marks
	Total	**100 Marks** **Reduced to 50 M**

Note:

- No Assignment and AAT

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: 22ECE134		
L: T: P: J	3 : 0: 2 : 0		CIA Marks: 50	
Credits:	4		SEA Marks: 50	
Hours/Week (Total)	5		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.	**10**	**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	**10**	**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.	**10**	**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.	**10**	**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.	**10**	**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	
22ECE134.1	Design and analyze biasing circuits for BJTs amplifier circuits.
22ECE134.2	Design and analyze biasing circuits for FET amplifier circuits
22ECE134.3	Design and analyze FET common source amplifiers with different circuit configurations and biasing conditions.
22ECE134.4	Understand the feedback topologies and approximations in the design of amplifiers
22ECE134.5	Design of circuits using linear ICs for wide range applications such as ADC, DAC, filters and timers.
22ECE134.6	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.

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

PCI	CIA	SEA	CIA (50)			SEA Conduction: 100 M Reduced to: 50 M
				I	II	
Conduction	50	50	Written Test	50	50	Five questions with each of 20 marks (with internal choice). Student should answer one full question from each module
				Average of two tests – 50 marks scaled down to 15 marks		
			Assignment	Average of 2 Assignments – 10M		
			Practical	Weekly Assessment – 10 Marks IA test – 15 Marks (IA test to be conducted for 50 M and scaled down to 15M)		
					Total – 50 Marks	**Total – 50 Marks**

i) CIA: 50%

Theory	**IA Test** (Theory): 2 IA tests - each of 50 Marks – Average of 2 tests scaled down to 15 Marks **Assignment** : 2 Assignments – each of 10 marks	25 Marks
Lab	**Weekly Assessment** – 10 Marks **Practical test (1) -** 15 marks	25 Marks
	Total	**) Marks**

ii) SEA : 50%

Question Paper:

Theory Exam	5 questions to answer, each of 20 Marks questions from each module with internal choice udent 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

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: 22ECE135**

L: T: P: J	**3: 0: 2: 0**	**CIA Marks: 50**
Credits:	**4**	**SEA Marks: 50**
Hours/Week (Total)	**3 Hours/ Week (40 Hours)**	**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, Karnaugh maps using Don't care, Simplifying Maxterm equation up to 4 variables. Quine-McCluskey Minimization Technique. Quine-McCluskey using Don't Care Terms.	**8**	**Apply CO1**
Module-2: Logic Design with MSI Components		
Adders and Subtractors: Binary Parallel Adder and Subtractors, Ripple Carry Adder, Look Ahead Carry Adder Comparators, Decoders, Encoders, Multiplexers.	**8**	**Apply CO2**
Module-3: Flip-Flops and its Applications		
Latches, SR Latch, S'R' Latch, Gated SR latch, Gated D Latch, The Master-Slave Flip-flops (Pulse Triggered flip-flops): SR flip-flops, JK flip flops, 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.	**8**	**Apply CO3**
Module-4: Finite State Machine and Verilog Data flow description		
Mealy and Moore Model, Construction of State Diagram, Structure of Verilog module, Operators, Data Types, Styles of Description. Highlights of Data flow description, Structure of Data flow description.	**8**	**Apply CO4**
Module-5: Verilog Behavioral and Structural description		
Structure, Variable Assignment Statement, Sequential Statements, Loop Statements, Verilog Behavioral Description of Multiplexers Highlights of Structural description, Organization of structural description, Structural description of ripple carry adder.	**8**	**Apply CO5**

Sl.No.	**Lab Experiments**
1	Simplify the given 3/4 variable Boolean expressions. and simulate the design using Verilog dataflow description.
2	Design a Full Adder using two half adders and simulate using verilog structural flow Description
3	Realize 32-bit ALU using Verilog Behavioral description.
4	Realize using Verilog Behavioral description: 8:1 mux, 8:3 Priority encoder
5	Realize using Verilog Behavioral description: 3:8 decoder, 2-bit Comparator
6	Realize using Verilog Behavioral description: Flip-flops: a) JK b) SR c) T d) D and verify the design using FPGA board.
7	Design 4 bit Binary and BCD counters with synchronous and asynchronous reset using Verilog Behavioral description and verify the design using FPGA board
8	Design 8-bit shift register for shift left and right operation using Verilog behavioral Description
9	Develop a Verilog Program to interface a Stepper motor to the FPGA and rotate the motor in the specified direction
10	Interface DAC to generate square and triangular waveform using Verilog program and implement into the FPGA board

Course Outcomes: After completing the course, the students will be able to	
22ECE135.1	Simplify Boolean functions using K-map and Quine-McCluskey minimization technique.
22ECE135.2	Analyze and design for combinational logic circuits.
22ECE135.3	Analyze the concepts of Flip Flops (SR, D, T and JK) and to design the synchronous sequential circuits
22ECE135.4	Design of combinational and sequential circuits using Verilog dataflow descriptions.
22ECE135.5	Design of combinational and sequential circuits using Verilog behavioral and structural descriptions.
22ECE135.6	Design the applications of combinational and sequential circuits

Reference Books

1. Digital Logic Applications and Design, John M Yarbrough, Thomson Learning, 2001
2. Digital Principles and Design, Donald D Givone, McGraw Hill, 2002
3. HDL Programming VHDL and Verilog, Nazeih M Botros, press, 2009
4. Fundamentals of logic design, Charles H Roth Jr., Cengage Learning
5. Verilog HDL-a guide to digital design and synthesis, Sameer Palnitkar2nd edition, Pearson Edition 2003.

Marks Distribution for Assessment:

PCI	**CIA**	**SEA**	**CIA (50)**			**SEA Conduction: 100 M Reduced to: 50 M**
				I	II	
Conduction	50	50	Written Test	50	50	Five questions with each of 20 marks (with internal choice). Student should answer one full question from each
				Average of two tests – 50 marks scaled down to 15 marks		
			Assignment	Average of 2 Assignments – 10M		

			Practical	Weekly Assessment – 10 Marks IA test – 15 Marks (IA test to be conducted for 50 M and scaled down to 15M)	module
				Total – 50 Marks	**Total – 50 Marks**

i) CIA: 50%

Theory	**IA Test** (Theory): 2 IA tests - each of 50 Marks – Average of 2 tests scaled down to 15 Marks **Assignment** : 2 Assignments – each of 10 marks	25 Marks
Lab	**Weekly Assessment** – 10 Marks **Practical test (1)** - 15 marks	25 Marks
	Total	**50 Marks**

ii) SEA : 50%

Question Paper:

Theory Exam	5 questions to answer, each of 20 Marks questions from each module with internal choice udent 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

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

Semester: III

Course Name: Python Programming on Raspberry PI		**Course Code: 22ECE136**
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: Basics of C and C++ language, Students should be familiarized about Python installation and setting Python environment

Course Learning Objectives: The students will be able to

1	Learn syntax and semantics in Python
2	Handle Strings, Files, Functions in Python
3	Understand Lists and Dictionaries in Python
4	Understand interface of Sensors with Raspberry Pi
5	Learn interface of display devices with Raspberry Pi

Topics	No. of Hours	Blooms Cognitive Levels/CO Mapping
Module 1: Python Fundamentals, Data types, Operators, Flow Control Loop statements and Exception Handling in Python **Programs:** **1.** Write a python program to find the best of two test average marks out of three test's marks accepted from the user **2.** Develop a Python program to check whether a given number is palindrome or not and also count the number of occurrences of each digit in the input number	**5**	**Understand CO1**
Module 2: Functions: Creation of functions, Passing parameters and return values **Strings:** String Manipulation, String methods **Programs:** **1.** Develop a python program to perform the following code conversions using functions. a) Binary to Decimal b) Octal to Hexadecimal **2.** Write a Python program that accepts a sentence and find the following. a) Number of words and digits b) Number of uppercase letters and lowercase letters	**5**	**Apply CO2**
Module 3: Lists, Tuples and Dictionary in Python **Programs:** 1) Write a python program to implement insertion sort and merge sort using lists 2) Write a program to convert roman numbers in to integer values using dictionaries	**5**	**Apply CO3**
Module 4: Files: Reading, Writing and Organizing files, Regular Expressions in Python	**5**	**Apply**

Programs: 1) Write a python program to accept a file name from the user and perform the following operations. a) Display the first N line of the file b) Find the frequency of occurrence of the word accepted from the user in the file 2) Develop a python program to demonstrate Regular Expression.		**CO4**
Module 5: Introduction to Raspberry Pi architecture, Pin details, Introduction to Interfacing of sensors and output devices **Programs:** 1) Demonstrate the interfacing of IR/PIR sensors to Raspberry Pi. 2) Demonstrate the interfacing of LED to Raspberry Pi. 3) Demonstrate the interfacing of Seven Segment Display device to Raspberry Pi. 4) Demonstrate the interfacing of ultrasonic sensor to Raspberry Pi.	**5**	**Apply CO5**

List of Projects:

1. Develop a Python project to generate QR Code
2. Develop a Python project for countdown timer that takes the number of seconds as input, and countdowns second by second until it displays a message "TimeOut"
3. Develop Smart parking system using Python
4. Automated toll gate system
5. Simple Calculator
6. Quiz Application
7. Generating a strong Password
8. Digital Clock
9. Creating a Desktop Notification Application
10. Sticky notes in Python

Course Outcomes: After completing the course, the students will be able to	
22ECE136.1	Interpret syntax and semantics using flow control statements in Python
22ECE136.2	Demonstrate proficiency in handling Python strings
22ECE136.3	Construct Python program using lists and dictionaries
22ECE136.4	Develop Python program using file system and Regular Expression
22ECE136.5	Apply Python programming techniques to interface sensors and display devices with Raspberry Pi
22ECE136.6	Implement a Python Project using Raspberry Pi concepts

Reference Books

1. Automate the Boring Stuff with Python, Al Sweigart, 2nd Edition 2019, No Starch Press, ISBN-13 978-1593279929.
2. Python Programming Using Problem Solving Approach, Reema Thareja 2nd Edition 2023, Oxford University Press, ISBN-13 978-9354973765.
3. Think Python: How to Think Like a Computer Scientist, Allen B. Downey, 2nd Edition 2015, Green Tea Press, ISBN-13 978-1491939369
4. Internet of Things Programming Projects: Build modern IoT solutions with the Raspberry Pi 3 and Python, Colin Dow, 1st Edition 2018, Packt Publishing Limited, ISBN-13 978-1789134803

Marks Distribution for Assessment:

<table>
<tr><th>PBL</th><th>CIA</th><th>SEA</th><th colspan="3">CIA (50)</th><th>SEA
Conduction: 100 M
Reduced to: 50 M</th></tr>
<tr><td rowspan="5">Conduction</td><td rowspan="5">50</td><td rowspan="5">50</td><td rowspan="3">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>25</td><td>25</td></tr>
<tr><td colspan="2">Average of 2 tests – 25 M</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>

i) CIA: 50%

Theory - 2 IA tests - Each of 25 Marks	25 Marks
Practical **Weekly Assessment -** Lab record/Project – 10 Marks **Lab IA test –** 15 Marks	25 Marks
Total	**50 Marks**

ii) SEA : 50%

Project	Write up – 10 Marks Project report – 25 Marks Presentation & Demonstration - 50 Marks Viva-Voce – 15 Marks	100 Marks Reduced to 50 Marks
	Total	**50 Marks**

B.N.M. Institute of Technology

An Autonomous Institution under VTU

Semester: III		
COURSE: CONSTITUTION OF INDIA AND PROFESSIONAL ETHICS		
Course Code: 22CIP137	**L:T:P:J: 1:0:0:0**	**CIA Marks:** 50
Credits:	**1**	**SEA Marks: 50**
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

B.N.M. Institute of Technology

An Autonomous Institution under VTU

Semester: III			
COURSE: Soft Skill-1			
Course Code: 22SFT138	**L:T:P:J: 0:0:2:0**		**CIA Marks:** 50
Credits:	**1**		**SEA Marks: 5 0**
Hours:	**24 hrs**		**SEA Duration: 2Hrs**
Course Learning Objectives: The students will be able			
1	To help students understand their strengths and weakness.		
2	To develop analytical and creative ability to solve problems individually or as a team.		
3	To make students industry ready through practice of corporate etiquettes.		
4	To enhance public speaking and presentation skills.		

Module No.	Contents of the Module	Hours	Cos
1	**Module-1 Understanding and Managing Self** Self-Awareness, Self-Management, Anger Management, Time management, Change management. Vision and goal setting - Diff between vision and goal, smart, stretched goal concept, case studies Knowledge, Skill, Attitude Personality analysis using Big 5 personality test Critical Thinking, Problem solving, Creativity and innovation Integrity, ethics, values	8	**1 &2**
2	**Module -2 Corporate etiquettes and Mannerism** Introduction to Etiquette and Mannerism, Personal Etiquette, Grooming etiquettes- professional styling, Body & personality styling, Video Interview Etiquettes, Personal Interview EtiquettesEffective meeting skills. Workplace behavior, Personal interview	6	**3**
3	**Module -3 Public Speaking and presentation skills** Introduction to public speaking, making ideas, illustrating and delivering ideas, overcoming fear of public speaking and developing great delivery. Advanced Business presentation skills, PowerPoint presentation, Group discussion	**6**	**4**
4	**Module -4 Team Work** Interpersonal skills, group work vs team work	**4**	**5**

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

CO1	Understand their strength and weaknesses.
CO2	Develop analytical and creative ability to solve problems.
CO3	Identify themselves as industry ready through the practice of corporate etiquettes.
CO4	Enhance public speaking and presentation skills.
CO5	Build team collaboration by working towards shared goals.

Mapping of Course Outcomes with Programme Outcomes:

COs	PO8	PO9	PO10	PO11
CO1	3	3		
CO2		3		3
CO3	3	3		3
CO4		3	3	
CO5			3	3

MOOC Course:

Communicate with impact - https://www.coursera.org/learn/communicate-with-impact

Leading Diverse Teams - https://www.coursera.org/learn/leading-diverse-teams

Practical component:

1. Mock GD and interview may be conducted at the end of the course to check their confidence. Students can prepare their SWOT analysis and present the same.
2. The students are to be involved in various activities and games such as Just a Minute or Pick and speak to demonstrate each topic.

Class Internal Assessment – 50 Marks

1. **Video Assignment -30Marks**
2. **Weekly Assessment -20Marks**

Rubrics for evaluation: (TOTAL - 30 Marks)

SL no.	Assessment	COs	Marks
1	Creativity	CO 2	5M
2	Approach and flow	CO 2	5M
3	Time Management (duration of video and deadline)	CO 1	5M
4	Individual presentation in the video	CO 4	5M
5	Report- Brief about the topic and Contribution of team members	CO 5	5M
6	Report- Reflections (learnings from the activity)	CO 2 & CO 5	5M

Semester End Assessment – 50 Marks

PPT - 10 Marks

Communication (Clarity and English) - 10 Marks

Body Language - 10 Marks

Viva (Q and A) - 10 Marks

Project Report - 10 Marks

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

B.N.M. Institute of Technology

An Autonomous Institution under VTU, Approved by AICTE

Department of Mathematics

Syllabus

Semester: IV

Course: Complex Analysis, Probability and Random Process

Course Code: 22MAC141 (Common to ECE, EEE & ME)

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**	**Apply**
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, Residue theorem (without proof) *Experiential Learning component: Problems on Cauchy's integral formula*	**L: 04** **T: 04**	**Apply**
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**	**Apply**
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**	**Apply**
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.	**L: 04** **T: 04**	**Apply**

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, Goodness of fit-Chi-square test. *Experiential Learning component: Problems on Markovian processes and, Sampling Theory*		

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

CO5: Use the concepts of random process in dealing with signals in engineering problems.

Reference Books:

1. E. Kreyszig: "Advanced Engineering Mathematics", John Wiley & Sons, 10^{th} Edition(Reprint), 2016.
2. B. S. Grewal: Higher Engineering Mathematics, Khanna Publishers, 44^{th} 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", 6^{th} Edition, 2. McGraw-Hill Book Co., New York, 1995.
6. James Stewart : Calculus —Early Transcendental, Cengage Learning India Private Ltd., 2017.
7. B. V. Ramana: "Higher Engineering Mathematics" 11^{th} Edition, Tata McGraw-Hill, 2010.
8. Srimanta Pal & Subodh C. Bhunia: "Engineering Mathematics", Oxford University Press, 3^{rd} 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/

Assessment Process (for both CIA and SEA)
Professional Core Course (PCC)

Course with Credits	Evaluation Type	Maximum Marks	Minimum Passing Marks	Evaluation details
PCC 3 Credits	**Total CIA theory + Practical**	**50**	**20**	**---**
	CIA-IA Tests	25	10	Average of two Internal Assessment tests each of 50 marks, scale down the marks scored to 25 marks.
	CIA-CCAs	25	10	(i) Practical activities / problems solving exercises -15 marks. (ii) Average of two Assignments each of 10 marks, scale down the marks scored to 10 marks.
	Total CIA theory	**50**	**20**	
	SEA	50	20	SEA exam is a theory exam, conducted for 100 marks, scaled down to 50 marks
	CIA+SEA	**100**	**40**	
	The maximum marks to be secured in CIA to appear for SEA shall be 10(40% of maximum marks-25) in theory component and 10(40% of maximum marks-25) in CIA-CCAs. experiential learning component of the PCC shall be for CIA only, However, In SEA, the questions from the experiential learning shall be included in their respective module only.			

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: Digital Signal Processing (Professional Core Course) **Course Code: 22ECE142**

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	
22ECE142.1	Classify the signals as continuous/discrete, periodic/aperiodic, even/odd, energy/power, and deterministic/random signals.
22ECE142.2	Determine the linearity, causality, time-invariance, and stability properties of continuous & discrete-time systems and compute convolution.
22ECE142.3	Represent signals in the frequency domain using Z-Transforms, DTFT, and compute the DFT of signals.
22ECE142.4	Develop and realize the transfer function of IIR filters
22ECE142.5	Develop and realize the transfer function of FIR filters.
22ECE142.6	Interpret the signals and systems used in the different areas of application.

Reference Books

1. “Signals and Systems”, Simon Haykin and Barry Van Veen, Wiley India, 2^{nd} Edition, 2018.
2. “Digital signal processing – Principles Algorithms & Applications”, Proakis & Monalakis, 4th Edition, Pearson Education, New Delhi, 2007. ISBN: 81-317-1000-9.
3. “Fundamentals of Signals & Systems”, Michael Roberts, Tata McGraw-Hill, 2^{nd} edition, 2010, ISBN 978-0-07-070221-9.
4. “Digital Signal processing - Fundamentals and Applications”, Li Tan, Jean Jiang, Academic Press, 2013, ISBN: 978-0-12-415893.
5. “Digital Signal Processing, A Computer Based Approach”, Sanjit K Mitra, 4th Edition, McGraw Hill Education, 2013.
6. “Signals and Systems”, Dr. D. Ganesh Rao and Satish Tunga, Cengage India Private Limited, 2017, ISBN: 978-81-315-3362-8
7. “Digital Signal Processing”, Dr. D. Ganesh Rao and Vineeth P Gejji, Cengage India Private Limited, 2017, ISBN: 9386858231

Marks Distribution for Assessment:

PCC	CIA	SEA	CIA (50)			SEA Conduction: 100 M Reduced to: 50 M
				I	II	
Conduction	50	50	Written Test	50	50	Five questions with each of 20 marks (with internal choice). Student should answer one full question from each module
				Average of two tests – 25 Marks		
			Assignment	15		
			AAT	10		
			Total – 50 marks			**Total – 50 marks**

i) CIA: 50%

IA Test: 2 IA tests - Each of 50 Marks	Average of 2 tests – scaled down to 25 M
Assignment – Two assignments – one for 10 marks and another for 5 marks	15 Marks
Additional Assessment Tools (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	10 Marks
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 Institutionunder VTU
Dept. of Electronics and Communication Engineering
Choice Based Credit System (CBCS and Outcome Based Education (OBE))

Semester: IV

Course Name:Control Systems **Course Code:22ECE143**

L:T:P:J	**1: 2: 2:0**	**CIAMarks:**50
Credits:	**3**	**SEAMarks:**50
Hours/Week (Total)	**5**	**SEADuration:**03Hours

Pre-Requisites: Basic Electrical, Mathematical Preliminaries

CourseLearning Objectives:Thestudentswillbeable 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

Module-1: Introduction to Control Systems	**No. of Hours**	**BloomsCognitiveLevels**
Introduction to Control Systems: Definitions, Classification of control systems open loop and closed loop, linear and nonlinear, time variant and time invariant, continuous and discrete time systems. Block diagram of a typical open loop and closed loop control system. The transfer function concept, transfer function of simple electrical networks. Mathematical Modeling and Representation mechanical translational, rotational systems and electrical system. Analogous Systems.	**8**	**Apply CO1**
Module–2: Block diagram algebra and Signal Flow graph		
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.	**8**	**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.	**8**	**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	**8**	**Apply CO4**
Module–5: Frequency Domain Analysis		
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.	**8**	**Apply CO5**

Practical Experiments	
Sl. No	**Experiments**
1	Effect of feedback on DC servo motor
2	Determination of transfer function of electric/ mechanical System
3	Time Response of First order system
4	Time response of Second order system
5	Stability Analysis Based on Pole Position
6	To reduce steady state error of a system using MATLAB.
7	Create root locus for a given transfer function using MATLAB.
8	To observe effect of the PID parameters on the closed loop dynamics using MATLAB.
9	Stability Analysis of system using Bode Plot
10	To obtain Nyquist Plot for a given transfer function of the system using MATLAB and comment on the stability.

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

22ECE143.1	Develop the mathematical model of mechanical, electrical systems and transfer function for a given control system
22ECE143.2	Develop transfer function using block diagram reduction and signal flow graph techniques.
22ECE143.3	Determine the time domain specifications for first and second order system
22ECE143.4	Determine the stability of a system in time domain using Routh-Hurwitz criterion and Root locus technique.
22ECE143.5	Determine the stability of a system in the frequency domain using Polar, Nyquest and bode plots.
22ECE143.6	Explain the method of conserving energy using closed loop control system.

ReferenceBooks

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./ 8thEdition/ 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:

PCI	**CIA**	**SEA**	**CIA (50)**			**SEA Conduction: 100 M Reduced to: 50 M**
				I	II	
Conduction	50	50	Written Test	50	50	Five questions with each of 20 marks (with internal choice). Student should answer one full question from each module
				Average of two tests – 50 marks scaled down to 15 marks		
			Assignment	Average of 2 Assignments – 10M		
			Practical	Weekly Assessment – 10 Marks IA test – 15 Marks (IA test to be conducted for 50 M and scaled down to 15M)		

			Total – 50 Marks	**Total – 50 Marks**

i) CIA: 50%

Theory	**IA Test** (Theory): 2 IA tests - each of 50 Marks – Average of 2 tests scaled down to 15 Marks **Assignment** : 2 Assignments – each of 10 marks	25 Marks
Lab	**Weekly Assessment** – 10 Marks **Practical test (1)** - 15 marks	25 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
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: 22ECE144**
L:T:P:J	**3:0:2:0**	**CIE Marks : 50**
Credits:	**4**	**SEE Marks : 50**
Hours/Week(Total)	**5**	**SEE 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**
Overview of the Cortex-M3, Architecture of ARM Cortex M3, Various Units in the architecture, Debugging support, General Purpose Registers, Special Registers, Exceptions/ Interrupts, The Built-In Nested Vectored Interrupt Controller, Stack operation, Operation Modes.	**10**	**Understand 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.	**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, Programming in C, Programming in assembly	**10**	**Apply CO3**
Module–4: Memory Systems of Cortex-M3		
Memory System Features Overview, 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	**10**	**Understand 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 Pend able Service Call	**10**	**Understand CO5**

List of Lab Experiments
1. ALP to find the sum of first 10 integer numbers.
2. ALP to multiply two 16 bit binary numbers.

3. ALP to find the number of 0's and 1's in a 32 bit data
4. ALP to find determine whether the given 16 bit is even or odd
5. ALP to store data in the RAM
6. ALP to reverse the string
7. Interface a simple Switch and display its status through Relay, Buzzer and LED.
8. Interface a Stepper motor and rotate it in clockwise and anti-clockwise direction.
9. Interface a DAC and generate Triangular and Square waveforms.
10. Display the Hex digits 0 to F on a 7-segment LED interface, with an appropriate delay in between.
11. Interface keypad & display the Key Pressed on LCD
12. Toggle the LED when an external interrupt occurs
Revision
Lab Assessment & evaluation

Course Outcomes: After completing the course, the students will be able to	
22ECE144.1	Understand the architectural features of 32-bit microcontroller ARM Cortex M3.
22ECE144.2	Apply the knowledge of instruction set of ARM Cortex M3 for programming
22ECE144.3	Apply the knowledge of embedded C Programming for ARM Cortex M3 for different applications.
22ECE144.4	Understand the memory map & Bus interface unit of ARM Cortex M3
22ECE144.5	Understand the exceptions of ARM Cortex M3.
22ECE144.6	Design a Embedded system using ARM CortexM3 for Societal needs, Health care, Home application

Reference Books
1. "The Definitive Guide to the ARM® Cortex-M3", Joseph Yiu, Second Edition, 2009.
2. "Discovering the STM32 Microcontroller", Geoffrey Brown, Publisher: Indiana University, 2016.

Marks Distribution for Assessment:

PCI	**CIA**	**SEA**	**CIA (50)**			**SEA Conduction: 100 M Reduced to: 50 M**
				I	II	
Conduction	50	50	Written Test	50	50	Five questions with each of 20 marks (with internal choice). Student should answer one full question from each module
				Average of two tests – 50 marks scaled down to 15 marks		
			Assignment	Average of 2 Assignments – 10M		
			Practical	Weekly Assessment – 10 Marks IA test – 15 Marks (IA test to be conducted for 50 M and scaled down to 15M)		
					Total – 50 Marks	**Total – 50 Marks**

i) CIA: 50%

Theory	**IA Test** (Theory): 2 IA tests - each of 50 Marks – Average of 2 tests scaled down to 15 Marks **Assignment** : 2 Assignments – each of 10 marks	25 Marks

Lab	**Weekly Assessment** – 10 Marks **Practical test (1)** - 15 marks	25 Marks
	Total	**50 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
Dept. of Electronics and Communication Engineering
Choice Based Credit System (CBCS and Outcome Based Education (OBE))

Semester: IV		
Course Name: Analog and Digital Communication (Integrated Laboratory) **Course Code: 22ECE145**		
L: T: P: J	**3:0:2:0**	**CIA Marks:** 50
Credits:	**4**	**SEA Marks:** 50
Hours/Week (Total)	**50 hours**	**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	No. of Hours	Blooms Cognitive Levels
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.	**10**	**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.	**10**	**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.	**10**	**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: Gram-Schmidt orthogonalization procedure, Baseband pulse, Pulse Shaping and Matched Filter Detection, Intersymbol interference (qualitative analysis), Eye pattern.	**10**	**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.	**10**	**Apply CO5**

Course Outcomes: After completing the course, the students will be able to	
22ECE145.1	Derive the time-domain and frequency domain representation of Amplitude modulation.
22ECE145.2	Derive the time-domain and frequency domain representation of Frequency modulation.
22ECE145.3	Compute the performance of pulse modulation schemes with quantization noise.
22ECE145.4	Apply the concepts of waveform coding for Base-band Transmission of digital signals.
22ECE145.5	Compute the performance of digital modulation schemes over the noisy channel.
22ECE145.6	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:

PCI	**CIA**	**SEA**	**CIA (50)**			**SEA Conduction: 100 M Reduced to: 50 M**
				I	II	
Conduction	50	50	Written Test	50	50	Five questions with each of 20 marks (with internal choice). Student should answer one full question from each module
				Average of two tests – 50 marks scaled down to 15 marks		
			Assignment	Average of 2 Assignments – 10M		
			Practical	Weekly Assessment – 10 Marks IA test – 15 Marks (IA test to be conducted for 50 M and scaled down to 15M)		
					Total – 50 Marks	**Total – 50 Marks**

i) CIA: 50%

Theory	**IA Test** (Theory): 2 IA tests - each of 50 Marks – Average of 2 tests scaled down to 15 Marks **Assignment** : 2 Assignments – each of 10 marks	25 Marks
Lab	**Weekly Assessment** – 10 Marks **Practical test (1)** - 15 marks	25 Marks
	Total	**50 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
Dept. of Electronics and Communication Engineering
Choice Based Credit System (CBCS and Outcome Based Education (OBE))

Semester: 4		
Course Name: Signal Processing Applications of MATLAB (Theory + Lab + Mini Project) **Course Code: 22ECE146**		
L: T: P: J	**0: 0: 2: 2**	**CIA Marks:** 50
Credits:	**2**	**SEA Marks:** 50
Hours/Week (Total)	**12 Lab sessions + 12 sessions for project**	**SEA Duration:** 03 Hours
Pre-Requisites: Signals and Systems and DSP Fundamentals		

Course Learning Objectives: The students will be able 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 and test the filter with a speech/audio file. Plot the spectrum of audio signal before and after filtering	**2**	**Apply CO4**
8. Design and implementation of Low pass FIR filter to meet the desired specifications and test the filter with a speech/audio file. Plot the spectrum of audio signal before and after filtering	**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	
22ECE146.1	Demonstrate sampling theorem and plot elementary waveforms in continuous and discrete time domains.
22ECE146.2	Analyze and plot the signals using DFT and convolution.
22ECE146.3	Perform basic operations on images.
22ECE146.4	Apply filtering techniques on audio/speech signals.
22ECE146.5	Build a system to verify the properties of a given system using SIMULINK.
22ECE146.6	Develop a real time application in speech/audio/image processing.

Reference Books

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

Marks Distribution for Assessment:

<table>
<tr><th rowspan="2">PBL</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 rowspan="3">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="4">Conduction</td><td rowspan="4">50</td><td rowspan="4">50</td><td>30</td><td>30</td></tr>
<tr><td colspan="2">Average of two tests – 30 marks</td></tr>
<tr><td>Lab</td><td colspan="2">Weekly Assessment
(Record/Project) – 10 Marks
Lab IA test – 10 Marks</td></tr>
<tr><td colspan="3">Total – 50 Marks</td><td>Total – 50 Marks</td></tr>
</table>

i) CIA: 50%

Theory	**IA Test** (Theory): 2 IA tests - each of 30 Marks	Average of 2 tests 30 Marks
Lab	**Weekly Assessment** – Lab Record/Project - 10 Marks **Lab IA test (1)** - 10 marks	20 Marks
	Total	**50 Marks**

ii) SEA: 50%

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