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-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**	**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, 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.
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)

<table>
<tr><th rowspan="2">PCC</th><th rowspan="2">CIA</th><th rowspan="2">SEA</th><th colspan="3">CIA (50)</th><th rowspan="2">SEA
Conduction: 100 M
Reduced to: 50 M</th></tr>
<tr><th></th><th>I</th><th>II</th></tr>
<tr><td rowspan="5">Conduction</td><td rowspan="5">50</td><td rowspan="5">50</td><td rowspan="2">Written Test</td><td>50</td><td>50</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="2">Average of two tests – 25 Marks</td></tr>
<tr><td>Assignment</td><td colspan="2">15</td></tr>
<tr><td>AAT</td><td colspan="2">10</td></tr>
<tr><td colspan="3">Total – 50 marks</td><td>Total – 50 marks</td></tr>
</table>

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)

<table>
<tr><th rowspan="2">PCI</th><th rowspan="2">CIA</th><th rowspan="2">SEA</th><th colspan="3">CIA (50)</th><th colspan="2">SEA
Conduction: 100 M
Reduced to: 50 M</th></tr>
<tr><td></td><td>I</td><td>II</td><td>PART A</td><td>PART B</td></tr>
<tr><td rowspan="4">Conduction</td><td rowspan="4">50</td><td rowspan="4">50</td><td rowspan="2">IA Test</td><td>30</td><td>30</td><td rowspan="3">30 Marks</td><td rowspan="3">70 Marks</td></tr>
<tr><td colspan="2">Average of two tests – 30 M</td></tr>
<tr><td>Continuous Assessment</td><td colspan="2">Weekly Assessment -20 marks</td></tr>
<tr><td colspan="3">Total – 50 Marks</td><td colspan="2">Total – 50 Marks</td></tr>
</table>

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

<table>
<tr><th rowspan="2">PCI</th><th rowspan="2">CIA</th><th rowspan="2">SEA</th><th colspan="3">CIA (50)</th><th rowspan="2">SEA
Conduction: 100 M
Reduced to: 50 M</th></tr>
<tr><th></th><th>I</th><th>II</th></tr>
<tr><td rowspan="5">Conduction</td><td rowspan="5">50</td><td rowspan="5">50</td><td rowspan="2">Written Test</td><td>50</td><td>50</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="2">Average of two tests – 50 marks scaled down to 15 marks</td></tr>
<tr><td>Assignment</td><td colspan="2">Average of 2 Assignments – 10M</td></tr>
<tr><td>Practical</td><td colspan="2">Weekly Assessment – 10 Marks
IA test – 15 Marks
(IA test to be conducted for 50 M and scaled down to 15M)</td></tr>
<tr><td colspan="4">Total – 50 Marks</td><td>Total – 50 Marks</td></tr>
</table>

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:

<table>
<tr><th rowspan="2">PCI</th><th rowspan="2">CIA</th><th rowspan="2">SEA</th><th colspan="3">CIA (50)</th><th rowspan="2">SEA
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Reduced to: 50 M</th></tr>
<tr><th></th><th>I</th><th>II</th></tr>
<tr><td rowspan="3">Conduction</td><td rowspan="3">50</td><td rowspan="3">50</td><td rowspan="2">Written Test</td><td>50</td><td>50</td><td rowspan="3">Five questions with each of 20 marks (with internal choice). Student should answer one full question from each</td></tr>
<tr><td colspan="2">Average of two tests – 50 marks scaled down to 15 marks</td></tr>
<tr><td>Assignment</td><td colspan="2">Average of 2 Assignments – 10M</td></tr>
</table>

			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="4">Conduction</td><td rowspan="4">50</td><td rowspan="4">50</td><td rowspan="3">Theory</td><td>I IA</td><td>II IA</td><td rowspan="3">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><td></td></tr>
<tr><td colspan="4">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, 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. James Stewart : Calculus —Early Transcendental, Cengage Learning India Private Ltd., 2017.
7. B. V. Ramana: "Higher Engineering Mathematics" 11th Edition, Tata McGraw-Hill, 2010.
8. 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/

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, 2nd 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, 2nd 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:

<table>
<tr><th rowspan="2">PCC</th><th rowspan="2">CIA</th><th rowspan="2">SEA</th><th colspan="3">CIA (50)</th><th rowspan="2">SEA
Conduction: 100 M
Reduced to: 50 M</th></tr>
<tr><th></th><th>I</th><th>II</th></tr>
<tr><td rowspan="5">Conduction</td><td rowspan="5">50</td><td rowspan="5">50</td><td rowspan="2">Written Test</td><td>50</td><td>50</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="2">Average of two tests – 25 Marks</td></tr>
<tr><td>Assignment</td><td colspan="2">15</td></tr>
<tr><td>AAT</td><td colspan="2">10</td></tr>
<tr><td colspan="3">Total – 50 marks</td><td>Total – 50 marks</td></tr>
</table>

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:

<table>
<tr><th rowspan="2">PCI</th><th rowspan="2">CIA</th><th rowspan="2">SEA</th><th colspan="3">CIA (50)</th><th rowspan="2">SEA
Conduction: 100 M
Reduced to: 50 M</th></tr>
<tr><th></th><th>I</th><th>II</th></tr>
<tr><td rowspan="4">Conduction</td><td rowspan="4">50</td><td rowspan="4">50</td><td rowspan="2">Written Test</td><td>50</td><td>50</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="2">Average of two tests – 50 marks scaled down to 15 marks</td></tr>
<tr><td>Assignment</td><td colspan="2">Average of 2 Assignments – 10M</td></tr>
<tr><td>Practical</td><td colspan="2">Weekly Assessment – 10 Marks
IA test – 15 Marks
(IA test to be conducted for 50 M and scaled down to 15M)</td></tr>
</table>

			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:

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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
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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		
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** **10**	**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.	**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:

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</table>

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
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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
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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>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="5">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**

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: V

Course Name: Digital Image Processing		**Course Code: 22ECE151**
L: T: P: J	**3 : 0 : 0 : 0**	**CIA Marks:** 50
Credits:	**3**	**SEA Marks:** 50
Hours	**40**	**SEA Duration:** 03 Hours

Course Learning Objectives: The students will be able to

1	Understand the fundamentals of Digital Image Processing.
2	Explain the image enhancement techniques both in the Spatial and Frequency Domain.
3	Explain the Restoration techniques used in Digital image processing.
4	Understand the Color and Morphological Image Processing methods.
5	Understand the techniques for Segmentation and Representation of gray scale Images.

Module-1: Digital Image Fundamentals	**No. of Hours**	**Blooms Cognitive Levels**
Digital Image Fundamentals: What is Digital Image Processing?, Origins of Digital Image Processing, Examples of fields that use DIP, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Elements of Visual Perception, Image Sensing and Acquisition, Image Sampling and Quantization, Some Basic Relationships Between Pixels, Linear and Nonlinear Operations.	**8**	**Apply CO1**
Module-2: Filtering in the Spatial and Frequency Domain		
Spatial Domain: Some Basic Intensity Transformation Functions, Histogram Processing, Fundamentals of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters **Frequency Domain:** Preliminary Concepts, The Discrete Fourier Transform (DFT) of Two Variables, Properties of the 2-D DFT, Filtering in the Frequency Domain, Image Smoothing and Image Sharpening Using Frequency Domain Filters, Selective Filtering	**8**	**Apply CO2**
Module-3: Restoration		
Restoration: Noise models, Restoration in the Presence of Noise Only using Spatial Filtering and Frequency Domain Filtering, Linear, Position-Invariant Degradations, Estimating the Degradation Function, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering.	**8**	**Understand CO3**
Module-4: Color and Morphological Image Processing		
Color Image Processing: Color Fundamentals, Color Models, Pseudocolor Image Processing. **Morphological Image Processing:** Preliminaries, Erosion and Dilation, Opening and Closing, The Hit-or-Miss Transforms.	**8**	**Understand CO4**
Module-5: Segmentation, Representation and Description		

Segmentation: Point, Line, and Edge Detection, Thresholding, Region-Based Segmentation **Representation and Description**: Representation, Boundary descriptors, Regional Descriptors	**8**	**Understand CO5**

Course Outcomes: After completing the course, the students will be able to	
22ECE151.1	Understand image formation and the role human visual system plays in perception of gray and color image data.
22ECE151.2	Apply image processing techniques in both the spatial and frequency (Fourier) domains.
22ECE151.3	Apply image Restoration techniques in the spatial domain.
22ECE151.4	Apply image processing techniques for Color and Morphological Image Processing.
22ECE151.5	Design image analysis techniques in the form of image segmentation evaluate the methodologies for Representation and Description.
22ECE151.6	Conduct independent study and analysis of Image Enhancement and Restoration techniques for real time applications.

Reference Books

1. Digital Image Processing- Rafel C Gonzalez and Richard E. Woods, PHI 3rd Edition 2010
2. Image Processing- S.Jayaraman, S.Esakkirajan, T.Veerakumar, Tata McGraw Hill 2014.
3. Fundamentals Digital of Digital Image Processing-A. K. Jain, Pearson 2004

Marks Distribution for Assessment:

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Two assignments – Scaled to 10 Marks</td></tr>
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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: V

Course Name: Electromagnetic waves and transmission lines **Course Code:** 22ECE152

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

Pre-Requisites: Vector Calculus

Course Learning Objectives: The students will be able to

1	Understand the applications of Coulomb's law and Gauss law to different charge distributions and the applications of Laplace's and Poisson's Equations to solve real time problems on capacitance of different charge distributions.
2	Understand the physical significance of Biot-Savart's and Ampere's Law for different current distributions
3	Know the physical interpretation of Maxwell' equations and applications for Plane waves for their behavior in different media
4	Acquire knowledge of Poynting Theorem and its application of Power flow.
5	Understand the parameters of microwave transmission line and waveguides.

Module-1: Laws of static electric field	**No. of Hours**	**Blooms Cognitive Levels**
Vector Basics: Vector Algebra, Rectangular coordinate system, vector components and unit vectors, the dot product, the cross product, circular cylindrical coordinates, the spherical coordinate system. **Coulomb's Law, Electric Field Intensity and Flux density** Experimental law of Coulomb, Electric field intensity, Field due to continuous point charge distribution, Field of a line charge, Electric flux density **Gauss's law and Divergence** Gauss's law, Divergence. Maxwell's First equation (Electrostatics), Vector Operator ▼ and divergence theorem[Qualitative Analysis Only]	**8**	**Apply CO1**
Module-2: Energy, Potential, Current and Current density , Poisson's, Laplace's Equations		
Energy, Potential and Conductors: Energy expended in moving a point charge in an electric field, The line integral, Definition of potential difference and potential, The potential field of point charge, Potential gradient. **Current, Current density, Continuity of current.** **Poisson's and Laplace's Equations:** Derivation of Poisson's and Laplace's Equations, Uniqueness theorem, Examples of the solution of Laplace's equation.	**8**	**Apply CO2**
Module-3: Laws of Magneto-static fields and Time varying field		
Steady Magnetic Field: Biot-Savart Law, Ampere's circuital law, Curl, Stokes' theorem[Qualitative Analysis Only], Magnetic flux and magnetic flux density, Scalar and Vector Magnetic Potentials **Faraday' law of Electromagnetic Induction –**Integral form and Point form **Maxwell's equations:**Inconsistency of Ampere's law with continuity equation, displacement current, Maxwell's equations in point form and integral form.	**8**	**Apply CO3**
Module-4: Uniform Plane Wave		

Uniform Plane Wave: Wave Propagation in free space, Derivation of General wave equations from Maxwell's equations, Relation between E and H, Solution of wave equation for free space and good conductor, wave propagation in free space and good conductor (γ, α, β, η) Skin effect or Depth of penetration, Poynting theorem.	**8**	**Apply CO4**
Module-5: Transmission lines		
Transmission Line equations and solutions, Reflection Coefficient and Transmission Coefficient, Standing Wave and Standing Wave Ratio, Calculation of reflection coefficient and standing wave ratio using Smith Chart.	**8**	**Apply CO5**

Course Outcomes: After completing the course, the students will be able to	
22ECE152.1	Evaluate problems on electrostatic force, electric field due to point, linear, volume charges by applying conventional methods. Understanding Gauss law to evaluate Electric fields due to different charge distributions and Volume Charge distribution by using Divergence Theorem
22ECE152.2	Determine potential and energy with respect to point charge. Apply Laplace's equation to determine voltage function, capacitance.
22ECE152.3	Apply Biot-Savart's and Ampere's laws for evaluating Magnetic field for different current configurations, Apply Maxwell's equations for time varying fields.
22ECE152.4	Apply Maxwell's equations for deriving the propagation of EM waves in free space and conductors and Evaluate power associated with EM waves using Poynting theorem.
22ECE152.5	Explain propagation of RF signals through transmission line and transmission line basics.
22ECE152.6	Self-learning through listening and comprehension of audio / video lectures related to electro-magnetic fields and waves domain and understand the effects of E.M. waves with respect to Electromagnetic interference (EMI) and Electromagnetic Compatibility (EMC).

Reference Books

1. Engineering Electromagnetics by W.H. Hayt and J.A. Buck, Tata McGraw Hill, 2014, ISBN-978-93-392-0327-6, 8th Edition.
2. Microwave Devices and Circuits by Samuel Y.Liao, PHI, 3rd Edition
3. Electromagnetic Waves and Radiating systems, E. C. Jordan and K.G. Balman,PHI 2nd Edition
4. Elements of Electromagnetics, Matthew N.O., Sadiku, Oxford university press 4th Edition.
5. Electromagnetics, Joseph Edminister, Schaum Outline Series, McGraw Hill,2nd Edition

Marks Distribution for Assessment:

PCC	**CIA**	**SEA**	**CIA (50)**				**SEA Conduction: 100 M Reduced to: 50 M**
				I	II	III	
Conduction	50	50	Written Test	30	30	30	Five questions with each of 20 marks (with internal choice). Student should answer one full question from each module
				Average of three tests – 30 Marks			
			Assignment	Two assignments – Scaled to 10 Marks			
			AAT	10 Marks			
						Total – 50 marks	**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: V

Course Name: Computer Networks and Security Course Code: 22ECE153

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

Pre-Requisites:

Course Learning Objectives: The students will be able to

1	Understand the layering architecture of OSI reference model and TCP/IP protocol suite.
2	Understand the protocols associated with each layer.
3	Learn the different networking architectures and their representations.
4	Explain transport layer and application layer protocols.
5	Explain network security services, mechanisms, Transport Level Security and IP Security.

Module-1: Data communication and Physical Layer	**No. of Hours**	**Blooms Cognitive Levels**
Data communication: Components, Data representation, Data flow. Networks: Network criteria, Physical Structures, Network types: LAN, WAN, Switching, The Internet. TCP/IP Protocol Suite, Layered Architecture, Layers in the TCP/IP Protocol Suite, Description of each Layer, Encapsulation and De-capsulation, Addressing, Multiplexing and De-multiplexing, OSI versus TCP/IP.	**8**	**Apply CO1**
Module-2: Data-Link Layer		
Data-Link Layer: Nodes and Links, Services, Two Categories of links, Sublayers, Link Layer addressing: Types of addresses, ARP. Data Link Control (DLC) services: Framing, Flow and Error Control, Data Link Layer Protocols: Simple Protocol, Stop and Wait protocol **Wired and Wireless LANs:** Ethernet Protocol, Standard Ethernet, Introduction to wireless LANs, Characteristics, Access Control	**8**	**Apply CO2**
Module-3: Network Layer		
Network Layer: Introduction, Network Layer services: Packetizing, Routing and Forwarding, Packet Switching: Datagram Approach, Virtual Circuit Approach. IPV4 Addresses: Address Space, Classful Addressing, Classless Addressing, DHCP, Network Address Resolution **Network Layer Protocols:** Internet Protocol(IP) **Routing Algorithms:** Distance Vector Routing, Link State Routing	**8**	**Apply CO3**
Module-4: Transport Layer and Application Layer		
Transport Layer: Introduction, Transport Layer Services, Connectionless and Connection-oriented Protocols **Transport-Layer Protocols in the Internet:** User Datagram Protocol: User Datagram, UDP Services Transmission Control Protocol: TCP Services, TCP Features, Segment,	**8**	**Understand CO4**

Connection, State Transition diagram, Flow control, Error control, TCP congestion control **Application Layer:** Introduction, Services, Application - layer paradigms.		
Module-5: Network Security		
Network Security: Need for Security, Security Approaches, Principles of Security, Types of Attacks, Viruses and Related Threats, Need for Firewalls, Firewall Characteristics, Types of Firewalls, overview of IP security. **Transport Level Security**: Web security consideration, Transport Layer Security (TLS).	**8**	**Understand CO5**

Lab Experiments
1. Program to implement three nodes point – to – point network with duplex links between them.
2. Program to implement transmission of ping messages/trace route over a network topology consisting of 6 nodes and find the number of packets dropped due to congestion.
3. Program to implement an Ethernet LAN using n nodes and set multiple traffic nodes and plot congestion window for different source / destination.
4. Program to construct simple LAN and understand the concept and operation of Address Resolution Protocol (ARP) using CISCO Packet Tracer.
5. Program for simulation of distance vector routing algorithm.
6. Program for simulation of link state routing algorithm.
7. Program to analyze the performance of various configurations and protocols in LAN using CISCO Packet Tracer.
8. Program to construct a Wireless LAN and make the PCs communicate wirelessly using CISCO Packet Tracer.
9. Program to install and configure network interface card. Identify IP address of a work station, class of the address and configure the IP address on a work station. To share the hardware resources on a network.
Revision
Lab assessment & evaluation

Course Outcomes: After completing the course, the students will be able to	
22ECE153.1	Apply the concepts of networking to create networks thoroughly.
22ECE153.2	Apply the Data Link layer services and protocols to networks.
22ECE153.3	Apply the Network layer services and protocols to networks.
22ECE153.4	Explain the Transport layer services and protocols.
22ECE153.5	Explain security concerns in networks, Transport level security and IP security.
22ECE153.6	Discuss and analyze the various applications that can be implemented on networks.

References

1. Forouzan, “Data Communications and Networking”, 5th Edition, McGraw Hill, 2013, ISBN: 1-25-906475-3.
2. William Stallings, “Cryptography and Network Security Principles and Practice”, Pearson Education Inc., 5th Edition, 2014, ISBN: 978-81-317- 6166-32.
3. Atul Kahate, “Cryptography and Network Security”, TMH, 4th Edition, 2019, ISBN-13: 978-9353163303, ISBN-10: 9353163307.
4. Andrew Tannenbaum, “Computer Networks”, Prentice Hall, 2003, ISBN: 0-13-066102-3.

Marks Distribution for Assessment:

<table>
<tr><th rowspan="2">PCL</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>
<tr><th></th><th>I</th><th>II</th><th>III</th></tr>
<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 scaled down to 20 marks</td></tr>
<tr><td>Assignment</td><td colspan="3">Average of 2 Assignments – 10M</td></tr>
<tr><td>Practical</td><td colspan="3">Weekly Assessment – 10 Marks
IA test – 10 Marks</td></tr>
<tr><td colspan="4">Total – 50 Marks</td><td>Total – 50 Marks</td></tr>
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B.N.M. Institute of Technology

An Autonomous Institution under VTU, Approved by AICTE

B.E. (Electronics and Communication Engineering)

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

Semester: V

Course Name: Embedded Systems and RTOS		**Course Code: 22ECE154**
L: T: P: J	**3: 0 : 2 : 0**	**CIA Marks: 50**
Credits:	**4**	**SEA Marks: 50**
Hours	**40**	**SEA Duration: 03 Hours**

Pre-Requisites:

1. Knowledge of microprocessor/microcontroller hardware.
2. Programming concept in assembly and Embedded C.
3. Basic knowledge of Python programming, understanding of GPIO pins on Raspberry Pi.
4. Familiarity with Raspberry Pi's RPi. GPIO library for GPIO control.

Course Learning Objectives: The students will be able to

1	Understand the basic hardware components and their selection method based on the characteristics and attributes of an embedded system
2	Develop an embedded system using hardware software co-design approaches
3	Understanding Advanced Architecture and Processor- Memory Organization
4	Understanding the Raspberry Pi Architecture
5	Apply the scheduling techniques for the given real time operating system
6	Design an Embedded system for Societal needs, Health care, Home application

	No. of Hours	**Blooms Cognitive Levels/CO Mapping**
Module-1: Embedded System Components and its Design Concepts		
Introduction, Embedded Vs General computing system, Classification of Embedded systems Characteristics, and Quality Attributes of Embedded Systems, Operational and non-operational quality attributes, Embedded Firmware Design Approaches, Embedded Firmware Development Languages, Fundamental Issues in Hardware Software Co-Design, Computational Model in Embedded Design, Introduction to Unified Modelling Language, Hardware Software Trade Offs.	**8**	**Understand CO1**
Module-2: Embedded Product Development Life Cycle & Trends in Embedded Industry		
Objectives of EDLC, Different Phases of EDLC, EDLC Approaches(Modeling the EDLC), Processor Trends in Embedded Systems, Embedded OS Trends, Development Language Trends, Open Standard, Frameworks and Alliances, Bottlenecks, Development Platform Trends, Cloud, Internet of Things and Embedded Systems- The next big thing.	**8**	**APPLY CO2**
Module-3: Advanced Architecture and Processor- Memory Organization		
Processor- Memory Organization, Introduction to Advanced processor Architectures, Processor Organization, Instruction level Parallelism, Intel x86 Architecture, HARC, Memory Types & Addresses, Memory Addresses, Memory Hierarchy & Cache, Performance Metrics, Selection of Processor & Memory Devices.	**8**	**Understand CO3**

Module-4: Raspberry Pi Architecture		
Introduction to Raspberry Pi, Features of Raspberry Pi, Introduction to Raspberry Pi architecture, Pin Details, Memory, Raspberry Pi Applications, Raspberry Pi based Motor Speed Control, Auto Intensity Control using Raspberry Pi, Interfacing Raspberry Pi to sensors and output devices: LED, Buzzer, DHT11 sensors, Ultrasonic sensors, Exploring Sound with Raspberry Pi	**8**	**APPLY CO4**
Module-5: Real Time Operating Systems		
Introduction, Operating System basics, Types of operating systems, Task, process and threads excluding programs, Thread preemption, multi-processing and multitasking, Task scheduling excluding programs.	**8**	**APPLY CO5**

List of Experiments	
1	Interface LED/ bulb, switch and buzzer using Raspberry Pi
2	Interface LDR/ DHT11 sensors to Raspberry Pi and visualize it on Blynk application
3	Interface 16 X 2 LCD to Raspberry Pi without using library and using library
4	Interface RFID RC522 to Raspberry Pi
5	Interface Servo motor or DC motor to Raspberry Pi
6	Program for creating child threads
7	Programs to build multithreaded applications
8	Program for FIFO scheduling
9	Program for round robin scheduling
10	Program for Priority Based scheduling
11	Lab Assessment

Course Outcomes: After completing the course, the students will be able to	
22ECE154.1	Understand the basic hardware components and their selection method based on the characteristics and attributes of an embedded system
22ECE154.2	Develop an embedded system using hardware software co-design approaches
22ECE154.3	Understand Advanced Architecture and Processor- Memory Organization
22ECE154.4	Understanding the Raspberry Pi Architecture
22ECE154.5	Apply the scheduling techniques for the given real time operating system
22ECE154.6	Design an Embedded system for Societal needs, Health care, home application

Reference Books

1. "Introduction to Embedded Systems", Shibu K V, Tata McGraw Hill Education Private Limited, 2nd Edition, 2017.
2. Embedded System: Architecture, Programming and Design by Raj Kamal, TMH Publication, 3rd Edition, 2003.
3. Derek Molloy "Exploring Raspberry PI Interfacing to the Real World with Embedded Linux", Wiley 2016
4. Embedded Software Primer, David Simon, Pearson Education, 2002.
5. Real Times Systems Theory and Practice by Rajib Mall, Pearson Education, 2006.
6. Embedded Real-time Systems Programming, Sri Ram Iyer and Pankaj Gupta, TMH, 2017.
7. The Linux Programming Interface, Michael Kerrisk, No Starch Press, 2010.

Web links and Video Lectures:

1. https://www.raspberrypi.org/learn/
2. https://www.coursera.org/specializations/real-time-embedded-systems

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
Conduction: 100 M
Reduced to: 50 M</th></tr>
<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="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="4">Total – 50 Marks</td><td>Total – 50 Marks</td></tr>
</table>

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: V

Course Name: Artificial Intelligence and Machine Learning Applications		**Course Code: 22ECE155**
L: T: P: J	**0: 0 : 2 : 2**	**CIA Marks: 50**
Credits:	**2**	**SEA Marks: 50**
Hours	**25**	**SEA Duration: 03 Hours**

Pre-Requisites: Linear Algebra Fundamentals and basics of MATLAB

Course Learning Objectives: The students will be able to

1	Introduce some concepts and techniques that are core to Artificial Intelligence and Machine Learning.
2	Understand Intelligent Systems, and problem solving.
3	Understand K-means clustering algorithms
4	Acquire knowledge of Classification and Regression Techniques
5	Identify and apply Machine Learning algorithms to solve real world problems

Module 1 – Artificial Intelligence	**No. of Hours**	**Blooms Cognitive Levels/CO Mapping**
Artificial Intelligence: History, Intelligent systems, foundation and sub area of AI, applications, current trend and development of AI, Problem solving state space search and control strategies, introducing machine learning with MATLAB **Program:** 1. Write a MATLAB script to import an excel file by a.) Manual Method b.) Programmatic Method using in-built command as a table variable and display the summary of table	**5**	**Apply CO1**
Module 2: Machine Learning		
Machine Learning: Introduction to Machine Learning. Different types of learning: Supervised, Unsupervised and Reinforcement learning, Feature Selection **Program:** 1. Write a MATLAB script to load the titanic dataset (Ref1) and use suitable functions to select the best features for predicting the survival status of a given passenger.	**5**	**Apply CO2**
Module 3: Clustering Algorithms		
Introduction to Clustering algorithms, K Means clustering algorithm **Program:** 1. Write a MATLAB script to perform data clustering. a.) Hard Clustering Algorithm b.) Soft Clustering Algorithm	**5**	**Apply CO3**

Module 4: Classification		
Introduction to Classification, Evaluation Metrics, MATLAB Implementation. **Program:** 1. Write a MATLAB script to develop a classifier model to predict the survival status of a passenger using titanic dataset	**5**	**Apply CO4**
Module 5: Regression		
Introduction to Regression, Evaluation Metrics, MATLAB Implementation. **Program:** 1. Write a MATLAB script to implement a Regression Model on a given Dataset	**5**	**Apply CO5**
Mini Project: One mini project to be completed in 12 lab sessions including its evaluation.		
Sample Mini Projects 1. Image Segmentation. 2. Sign Language Recognition System. 3. Game Playing Project. 4. Handwritten Character Recognition. 5. Bitcoin Price Predictor. 6. Music Genre Classification. 7. Wine Quality Test. 8. Titanic Survival Prediction Project.		

Course Outcomes: After completing the course, the students will be able to	
22ECE155.1	Implement data importing and reading using MATLAB
22ECE155.2	Implement Feature Selection and Prediction using MATLAB
22ECE155.3	Design Clustering Algorithms for a given Problem Statement and a Dataset
22ECE155.4	Design a suitable Classification Algorithm for a given Problem Statement and a Dataset
22ECE155.5	Design a suitable Regression Algorithm for a given Problem Statement and a Dataset
22ECE155.6	Apply Machine Learning algorithms to solve real-world problems.

Reference Books

1. Saroj Kaushik, Artificial Intelligence, Cengage Learning, 2022, 2nd Edition, Cengage Learning India, ISBN: 9789355730428
2. Giuseppe Ciaburro, MATLAB for Machine Learning, Packt Publishing, 2017, ISBN: 978-1-78839-843-5, 2017
3. Elaine Rich, Kevin Knight, Artificial Intelligence, Tata McGraw Hill Education, 3rd edition, 2017
4. Oliver Theobald, Machine Learning for Absolute Beginners, 3rd Edition, 2021.

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>
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Project report – 25 Marks

Presentation & Demonstration - 50 Marks
Viva-Voce – 15 Marks
Project
Assessed for 100 marks.
reduced to 50 Marks</td></tr>
<tr><td>20(T) + 20 (E)</td><td>20(T) + 20 (E)</td></tr>
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<tr><td>Continuous Assessment</td><td colspan="2">Weekly Assessment (Record/Project) 5+5= 10 M</td></tr>
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</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: V

Course Name: Smart Technologies **Course Code:** 22ECE1561

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

Pre-Requisites: Basic Engineering Science

Course Learning Objectives: The students will be able to

1	Introducing fundamentals of sensing and exploration of various sensors widely used for real life application.
2	To familiarize the characteristics, working principle and application of special purpose transducers
3	Obtain knowledge on sensors, sensors with microcontrollers and their applications.
4	To develop skillset to implement IoT systems for wearable applications.

Module-1: An Introduction to Smart Technologies	**No. of Hours**	**Blooms cognitive Levels**
Introduction, Sensor Requirement in Smart Systems, Sensor Technologies for Smart systems, General concepts and terminology of Sensor systems, Transducers classification-sensors and actuators, General input-output configurations, Static and dynamic characteristics of measurement system.	**8**	**Understand CO1**
Module-2: Smart Sensors and Applications		
Integrated and Smart sensors, IEEE 1451 standard & Transducer Electronic Datasheets (TEDs), Overview of various smart sensors: Digital temperature sensor (DS1621, TMP36GZ), Humidity sensor (DHT11, DHT22, FC28), IR sensor (FC51), Gas sensor (MQ2, MQ8), Pressure sensors (BMP180), Accelerometers (ADXL335)	**8**	**Apply CO2**
Module-3: Sensors with Microcontroller		
Introduction, Separate Vs Integrated Signal Conditioning, Digital Conversion, Online Tool for Evaluating a Sensor Interface Design, MCU Control, MCUs for Sensor Interface, Sensor Integration, Application Examples.	**8**	**Apply CO3**
Module-4: Bio-Medical and Automotive sensors		
Electrical Potentials and Propagation of Nerve Signals, Electrodes, EMG, ECG, EEG, Blood pressure, Engine temperature, Airflow, Combustion, Torque, Accelerometers, Gas composition sensors – Liquid level sensors	**8**	**Apply CO4**
Module-5: Smart Devices Case Study		
Wearable devices use cases- Smart watches, Android wear, Smart glasses/ Google Glass, fitness trackers, health care devices, sports, smart clothing, defence and security. Wearables: Challenges and Opportunities, Future and Research Roadmap	**8**	**Understand CO5**

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

22ECE1561.1	Understand the working principle and behavior of sensors
22ECE1561.2	Understand the working principle of special purpose sensors and the need for developing smart sensors

22ECE1561.3	Able to understand how microcontroller is implemented in sensor technologies.
22ECE1561.4	Relate and realize the importance automotive sensors and bio medical sensors
22ECE1561.5	Design and develop IoT end points for wearable applications.
22ECE1561.6	Able to design and perform experiments on the sensors and develop the projects based on the customer needs.

Reference Books

1. Jacob Fraden, "Handbook of Modern Sensors: Physics, Designs, and Applications", 5th Edition, Springer, 2016.
2. Frank, Randy, "Understanding smart sensors", Artech House integrated microsystems series, 3rd Edition, 2013.
3. John Turner, Automotive Sensors, 2012, Momentum Press, USA.
4. J. G. Webster, Medical Instrumentation; Application and Design, 2010, 4th Edition, John Wiley, USA.
5. John G Webster, Measurement, Instrumentation and Sensors Handbook, 2014, CRC Press, USA.
6. M. Mardonova and Y. Choi, "Review of Wearable Device Technology and Its Applications to the Mining Industry," Energies, vol. 11, p. 547, 2018.

Marks Distribution for Assessment:

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<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
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<tr><td colspan="3">Average of three tests – 30 Marks</td></tr>
<tr><td>Assignment</td><td colspan="3">Two assignments – Scaled to 10 Marks</td></tr>
<tr><td>AAT</td><td colspan="3">10 Marks</td></tr>
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</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: V

Course Name: Mobile Communication and Processor		**Course Code: 22ECE1562**
L: T: P: J	**3 : 0 :0 :0**	**CIA Marks:** 50
Credits:	**3**	**SEA Marks:** 50
Hours	**40**	**SEA Duration:** 03 Hours

Pre-Requisites:
Basics of Communication
Basics of Electronics and Processors

Course Learning Objectives: The students will be able to

1	Understand the Concepts of Wireless Communication Systems
2	Understand basic blocks of Mobile Phone
3	Understand Software Architecture of Mobile Phone

Module-1: Evolution of Wireless Communications Technology	**No. of Hours**	**Blooms Ccognitive Levels**
Introduction to wireless communications: Evolution of mobile radio communications, paging system, cordless telephone system, cellular telephone system, Modern wireless communication systems: 2G networks, 3G networks, Bluetooth and personal area networks.	**8**	**Understand CO1**
Module-2: GSM System (2G) Overview		
Introduction, History of GSM, Overview of GSM Network Architecture, PLMN and Network operators, GSM Mobility and Roaming, GSM PLMN Services, GSM Interfaces, GSM Subscriber and Equipment Identity	**8**	**Understand CO2**
Module-3: Anatomy of GSM Mobile Handset		
Introduction of GSM Handset, Functional Blocks Inside a GSM Mobile Phone, Hardware Block diagram of Mobile Phone, Antenna, Analog to Digital Conversion Module, Automatic Frequency Correction module, Loudspeaker, Microphone, Subscriber Identification Module, Application Processing Unit, Camera, LCD Display, Keypad, Connectivity Modules, Battery, Clocking Scheme, Memory.	**8**	**Understand CO3**
Module-4: GSM Mobile Phone Software Design		
Introduction to GSM Mobile Handset Software, Operating System Software, Device Driver Software, GSM System Protocol Software, Speech and Multimedia Application Software	**8**	**Understand CO4**
Module-5: Next Generation Mobile Phones		
Introduction, 3GPP LTE, LTE System Design, IEEE802.16 System, 4G Mobile System, Key Challenges in Designing 4G Mobile System and Research Areas, Cognitive Radio.	**8**	**Understand CO5**

Course Outcomes: After completing the course, the students will be able to	
22ECE1562.1	Understand the different generation wireless communication technology
22ECE1562.2	Understand the basic GSM System operation
22ECE1562.3	Understand the Hardware architecture of mobile phone
22ECE1562.4	Understand the software architecture of mobile phone
22ECE1562.5	Understand the requirements of Next Generation Wireless Communication Technologies
22ECE1562.6	Troubleshoot the hardware and software issue in a basic mobile phone

Reference Books

1. Rappaport T. S., "Wireless Communication: Principles and Practice", Second Edition, Pearson Education, 2009
2. Sajal K. Das, "Mobile Handset Design", Wiley, 2010
3. Luke Wroblewski, "Mobile First-A Book Apart"; First Edition (2011)
4. Tommi Mikkonen, "Programming Mobile Devices: An Introduction for Practitioners", John Wiley & Sons Ltd, 2007.
5. J Scheible and Ville Tulos John, "Mobile Python Rapid Prototyping of Applications on the Mobile Platform" Wiley India Pvt. Ltd, 2008.
6. S. Poslad, "Ubiquitous Computing: Smart Devices, Environments and Interactions," Wiley,2009.
7. Nick Lecrenski, Karli Watson, "Windows Phone 7 Application Development" version 2011
8. Jermaine G. Anderson "Flash Lite Mobile Development" version 2010

Marks Distribution for Assessment:

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<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>

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: V

Course Name: Satellite Communication **Course Code:** 22ECE1563

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

Pre-Requisites: Communication concepts, Mathematical Preliminaries

Course Learning Objectives: The students will be able to

1	Understand the basic principle of satellite orbits and trajectories.
2	Study of electronic systems associated with a satellite and the earth station.
3	Understand the various technologies associated with the satellite communication.
4	Focus on a communication satellite and the national satellite system.
5	Study of satellite applications focusing various domains services such as remote sensing, weather forecasting and navigation.

Module-1:	**No. of Hours**	**Blooms Cognitive Levels**
Satellite Orbits and Trajectories: Definition, Basic Principles, Orbital parameters, Injection velocity and satellite trajectory, Types of Satellite orbits, Orbital perturbations, Satellite stabilization, Orbital effects on satellite's performance, Eclipses, Look angles: Azimuth angle, Elevation angle.	**8**	**Understand CO1**
Module-2:		
Satellite subsystem: Power supply subsystem, Attitude and Orbit control, Tracking, Telemetry and command subsystem, Payload. **Earth Station:** Types of earth station, Architecture, Design considerations, Testing, Earth station Hardware, Satellite tracking.	**8**	**Apply CO2**
Module-3:		
Multiple Access Techniques: Introduction, FDMA (No derivation), SCPC Systems, MCPC Systems, TDMA, CDMA, SDMA. **Satellite Link Design Fundamentals**: Transmission Equation, Satellite Link parameters, Propagation considerations	**8**	**Apply CO3**
Module-4:		
Communication Satellites: Introduction, Related Applications, Frequency Bands, Payloads, Satellite Vs. Terrestrial Networks, Satellite Telephony, Satellite Television, Satellite radio, Regional satellite Systems, National Satellite Systems.	**8**	**Understand CO4**
Module-5:		
Remote Sensing Satellites: Classification of remote sensing systems, orbits, Payloads, Types of images: Image Classification, Interpretation, Applications. **Weather Forecasting Satellites**: Fundamentals, Images, Orbits, Payloads, Applications. **Navigation Satellites**: Development of Satellite Navigation Systems, GPS system, Applications	**8**	**Understand CO5**

Course Outcomes: After completing the course, the students will be able to	
22ECE1563.1	Describe the satellite orbits and trajectories with the definitions of parameters associated with satellites.
22ECE1563.2	Apply the electronic hardware systems associated with the satellite subsystem and earth station.
22ECE1563.3	Compute the satellite link parameters under various propagation conditions with the illustration of multiple access techniques.
22ECE1563.4	Describe the various applications of satellites with the focus on national satellite system.
22ECE1563.5	Describe the fundamentals and applications of remote sensing, weather forecasting and navigation satellites.
22ECE1563.6	Relate contextual knowledge to assess the solutions for real life applications of communication systems.

Reference Books

1. Anil K. Maini, Varsha Agrawal, Satellite Communications, Wiley India Pvt. Ltd., 2015, ISBN: 978-81-265-2071-8.
2. Dennis Roddy, Satellite Communications, 4th Edition, McGraw- Hill International edition, 2006
3. Timothy Pratt, Charles Bostian, Jeremy Allnutt, Satellite Communications, 2nd Edition, Wiley India Pvt. Ltd , 2017, ISBN: 978-81-265-0833-4

Marks Distribution for Assessment:

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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: V

Course Name: Embedded System Design Using Raspberry Pi **Course Code:** 22ECE1564

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

Pre-Requisites: Microprocessor/Microcontroller, Python Basics.

Course Learning Objectives: The students will be able to

1	Gain the knowledge of knowledge of hardware software co-design
2	Understand the firmware approaches design and development and its applications
3	Understand the embedded product development life cycle and its trends in embedded industry.
4	Understand the working principle of Raspberry Pi board and interfacing peripherals.
5	Identify sensor technologies for sensing real world entities and to control Arduino using Raspberry pi

Module-1: Hardware Software Co-Design & Embedded Firmware Design, Development & Its Applications	**No. of Hours**	**Blooms cognitive Levels**
Fundamental Issues in Hardware Software Co-Design, Computational Model in Embedded Design, Introduction to Unified Modelling Language, Hardware Software Trade Offs, Embedded Firmware Design Approaches, Embedded Firmware Development Languages, High Level Language Based Development, Applications: Washing Machine-Application Specific, Automotive: Domain Specific.	**8**	**Understand CO1**
Module-2: Embedded Product Development Life Cycle & Trends in Embedded Industry		
Different Phases of EDLC, EDLC Approaches (Modeling the EDLC), Processor Trends in Embedded Systems, Embedded OS Trends, Development Language Trends, Open Standard, Frameworks and Alliances, Bottlenecks, Development Platform Trends, Cloud, Internet of Things and Embedded Systems- The next big thing.	**8**	**Apply CO2**
Module-3: Introduction to Raspberry Pi and its Applications		
Introduction to Raspberry Pi, Features of Raspberry Pi, Introduction to Raspberry Pi architecture, Pin Details, Memory, Basic Setup for Raspberry Pi, Operating Systems, Raspberry Pi Applications, Controlling Hardware: Connecting an LED, Controlling the Brightness of an LED, Make a Buzzing Sound, Changing the Colour of an RGB LED, Using Lots of LEDs, Controlling GPIO Outputs Using a Web Interface	**8**	**Understand CO3**
Module-4: Implementation of IoT with Raspberry Pi		
Raspberry Pi based Motor Speed Control: Controlling the Speed of DC Motor, Controlling the Direction of DC Motor, Using a Unipolar Stepper Motor, Using a Bipolar Stepper Motor, Raspberry Pi based Using Sensor: Resistive Sensors, Measuring Light, Measuring Temperature Using Digital Sensor, Measuring Distance. Displays: Using a Four Digit LED Display, Displaying Messages on an Alphanumeric LCD	**8**	**Understand CO4**

Module-5: Interfacing Arduino and Peripherals with Raspberry Pi		
Programming an Arduino from Raspberry Pi, Communicating with the Arduino by Using the Serial Monitor, Setting Up PyFirmata to Control an Arduino from a Raspberry Pi Writing Digital Outputs on an Arduino from a Raspberry Pi, Using PyFirmata with TTL Serial, Reading Arduino Digital Inputs Using PyFirmata, Reading Arduino Analog Inputs Using PyFirmata, Analog Outputs (PWM) with PyFirmata, Custom Communication with an Arduino over TTL Serial, I2C, Temperature Dependent Auto Cooling System,	**8**	**Understand CO5**

Course Outcomes: After completing the course, the students will be able to	
22ECE1564.1	Develop the hardware software co-design for an Embedded Systems
22ECE1564.2	Develop the embedded firmware design and its applications
22ECE1564.3	Demonstrate the embedded product development life cycle and its trends in embedded industry.
22ECE1564.4	Design and Development of Raspberry Pi based Embedded applications.
22ECE1564.5	Illustrate different sensor technologies for sensing real world entities and to control the Arduino using Raspberry Pi
22ECE1564.6	Apply and analyze the various applications of Embedded systems.

Reference Books

1. Shibu K V, "Introduction to Embedded Systems", Tata McGraw Hill Education, 2nd Edition, 2000.
2. Simon Monk, "Raspberry Pi Cookbook", O'Reilly Media, Inc,2014.
3. https://archive.nptel.ac.in/courses/106/105/106105166/
4. Raj Kamal, "Internet of Things: Architecture and Design Principles", 1 st Edition, McGraw Hill Education, 2017. (ISBN: 978-9352605224)

Marks Distribution for Assessment:

CIA (50)	**Component**	**Description**	**Marks**
	Written Test	● Total Number of Test: 3 ● Each Theory test will be conducted for 30 marks. ● Average of 3 tests = 30 Marks	30
	Assignment	1 Assignment for 10 marks	10
	AAT	Open ended experiments, Presentations on interfacing peripherals with Raspberry Pi	10
		Total Marks	**50**
SEA (50)	**Component**	**Description**	**Marks**
	Written Exam	Theory exam will be conducted for 100 marks and scaled down to 50 Marks. The question paper will have 10 full questions each of 20 marks. Students have to answer 5 full questions	**50**
		Total marks for the Course	**100**

B N M Institute of Technology

An Autonomous Institution under VTU

Department of Training & Placement

Syllabus

Course Name: Employability Skills (Technical)-1

Class: V Semester **Year of Study: 2024-25**

Course Objectives: This course will enable students to

- ability to understand fundamentals of trending technologies currently used in the industry.
- understand the importance of professional etiquettes.
- to be prepared for group discussions and various modes of interviews.
- to solve company simulated aptitude and technical question papers related to campus recruitments.

Module	Topics to be covered	No of Hours
Introductory Courses	Data Science (Data Analytics & Visualization), Cyber Security, Industrial Automation 4.0, & IOT, AWS, & Cloud Computing	**10 Hours**
Personality & Grooming Training	Dressing & Group Discussion Etiquettes, Interview Skills, Resume Building(should include introduction to Github, Hackerrank, LeetCode, Codechef), Email & Telephone Etiquettes, Social Media Etiquettes, & LinkedIn Profiling.	**6 Hours**
Interview Preparation Training	**Pre-Preparation Formalities** • Training session on Pre-Preparation formalities of Campus Selection should be conducted Job Profiles analysis must be done. • Understanding the salary breakups & other perks, researching about the Company and the work culture through their websites & other digital platforms like Glassdoor & LinkedIn. • Rewriting resumes keeping the job profiles in view.	

	Group Discussion & Personal Interview • Pre-Placement Talk, Mock GD & Personal Interview training sessions for each individual student should be conducted by the Industry Experts and they should brief students on the area of improvements, presentation & behavioral skills required during the campus selection process.	
Assessment Tests	Company Specific Aptitude and Technical Tests	**6 Hours**

Course Outcome: (CO)

By end of the course the students will be able to:

1. analyze the problem and solve it within the allocated time span.
2. apply the professional etiquettes during the recruitment drives.
3. implement the techniques and skills during the group discussions and various interview skills.

CO-PO/PSO Mapping:

CO No.	Statement	Bloom's Cognitive level	POs
1	analyze the problem and solve it within the allocated time span.	**Apply**	PO1, PO2 & PO12
2	apply the professional etiquettes during the recruitment drives.	**Analyze**	PO1, PO2 & PO12
3	implement the techniques and skills during the group discussions and various interview skills.	**Analyze**	PO1, PO2 & PO12

Assessment processes:

	Components	Description	Marks
CIA (100)	Continues Evaluation	Students to be evaluated on: 1. Mock G.D. 2. Interview- Offline and Online 3. Resume	50
	Written / Online Test	• **Total Tests: 03** ➢ Assessments with 75 minutes duration & 50 marks each ➢ Average score of 50 Marks from 3 tests will be considered for the final score	50
		Total Marks for the Course	100

BNM Institute of Technology

Autonomous Engineering College Under VTU

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

Semester: VI

Course Name: Engineering Project Management and Finance
Course Code: 22ECE161

L: T: P: J	**2 :0 :0:0**	**CIA Marks:** 50
Credits:	**2**	**SEA Marks:** 50
Hours	**25**	**SEA Duration:** 03 Hours

Pre-Requisites:

Course Learning Objectives: The students will be able to

1	To familiarize the students with basic concepts of project management.
2	To understand the Schedule in project management.
3	To understand risk management and perform technical analysis of market and demand.
4	To understand financial estimates and projections in projects.
5	To understand financing of projects.
6	To understand and analyze the cash flows in projects.

Module-1: Project Management	**No. of Hours**	**Blooms Cognitive Levels**
Overview of Project Management: Project Definition, Project related concepts, Need for Project Managers, Essential Elements of Project, Speaking the language of Project Management, Project, People skill in Project Management, Success criteria **Roles and Responsibilities of Project Managers**: The Project Manager's Functions, Process Functions of Project Managers, Characteristics of an Effective Project Manager	**5**	**Understand CO1**
Module-2: Project Planning: The Schedule		
Benefits of Planning and Scheduling, The Planning and Scheduling Process Developing the Work Breakdown Structure, Key Facts About Developing a WBS, The WBS Dictionary, Enterprise Environmental Factors, Estimating Activity Duration and Sequencing Activities, Displaying the Project Schedule, The CPM Network Diagram, Scheduling Software and Combined Schedule Formats	**5**	**Understand CO2**
Module-3: Project Planning: The Risk Management Plan		
Risk Management: Definition, classification of Risk factors, Risk as it relates to project success criteria, Risk identification process, qualitative and quantitative risk analysis, quantitative risk analysis tools Case study: Challenging Engineering and Technology Projects	**5**	**Understand CO3**
Module-4: Financial Estimates and Projections		
Cost of Project, Means of Finance, Estimates of Sales and Production, Cost of Production, Working Capital Requirement and Its Financing	**5**	**Understand CO4**
Module-5: Financing Of Projects		
Capital Structure, Menu of Financing, Internal Accruals, Equity Capital, Preference Capital, Debentures (Or Bonds), Term Loans	**5**	**Understand CO5**

Course Outcomes: After completing the course, the students will be able to	
22ECE161.1	Apply the basic concept of Project Management
22ECE161.2	Understand the process of scheduling in Project Management by Project Managers.
22ECE161.3	Understand risk management and perform market and demand analysis
22ECE161.4	Understand cost of project, means of finance, sales estimates in projects.
22ECE161.5	Understand capital structures, internal accruals, equity capital, debentures and term loans.
22ECE161.6	Understand and analyze project cash flows.

Reference Books

1. Project Management for Engineering and Technology, David L. Goetsch, Pearson, 2015.
2. Project Planning: Analysis, Selection, Implementation and Review – Prasanna Chandra, 7/e TMH, 2011.
3. Project Management and Control – Narendra Singh, HPH, 2003.
4. Project Management: The Managerial Process – Gray & Larson, 4/e, TMH, 2011.
5. Projects: Planning, Analysis, Selection, Financing, Implementation, and Review - Prasanna Chandra, 9/e, 2019, McGraw-Hill Education.
6. Financial Management: Problems and Cases, Khan M. Y.& Jain P. K, TMH, 8/e, 2019.
7. Financial Management, Prasanna Chandra, TMH, 9/e, 2017.

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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: VI		
Course Name : Microwave & Antenna		**Course Code: 22ECE162**
L: T:P: J	**3:0:2:0**	**CIA Marks:** 50
Credits:	**4**	**SEA Marks:** 50
Hours:	**40**	**SEA Duration: 0**3 Hours

Pre-Requisites: Electromagnetic waves and transmission lines fundamentals

Course Learning Objectives: The students will be able to

1	Apply the knowledge of fields and waves to develop concepts of transmission line theory.
2	Describe the basic operation of microwave devices.
3	Describe the radiation from isolated, linear wire antennas and from linear elements near or on a conducting surface.
4	Calculate the fundamental parameters for antennas and the radiation field from an antenna.

Module-1: Microwave Waveguides & S- Parameters		
Microwave Waveguides : Introduction, TE, TM waves Rectangular waveguides (qualitative analysis TE, TM modes), group velocity phase velocity, and wave impedance, Microwave cavities (qualitative analysis), resonant frequency. **S-parameters:** Introduction, properties of S matrix (qualitative analysis)	**No. of Hrs** **8**	**Bloom's Cognitive Levels** Apply CO1
Module–2: Microwave Devices		
Microwave Sources: Klystron Oscillator, Magnetron, TWT amplifiers. **Microwave Passive Devices:** Waveguide Tee's, Directional couplers, circulators, power divider, Faraday Isolator, Phase shifters (Rotatory type), Attenuators (Rotatory type).	**8**	Apply CO2
Module–3: Antenna Basics and Electric Dipoles		
Antenna Basics :Introduction, antenna radiation mechanism, basic Antenna parameters, patterns, beam area, radiation intensity, beam efficiency, Directivity and gain, antenna apertures, effective height, bandwidth, radiation, efficiency, antenna temperature and antenna field zones. **Electric dipoles:** Introduction, short electric dipole (Directivity, radiation resistance).	**8**	Apply CO3
Module–4: Point Sources & Thin linear Antenna		
Point Sources: Introduction, Point Sources, Power Theorem, Arrays of two isotropic point sources, Linear Arrays of n Isotropic Point Sources of equal Amplitude and Spacing. **Thin Linear Antenna**: Directivity and Radiation Resistance	**10**	Apply CO4

Module–5: Antenna Types		
Loop Antenna, Horn Antenna, Parabolic Antenna, Helical Antenna, Yagi- Uda Antenna, Log Periodic Antenna, Reflector antenna , Microstrip Patch Antenna.	**10**	Apply CO5

Practical Experiments	
Sl. No	**Experiments**
1	Measurement of frequency, guide wavelength, power, VSWR and attenuation in microwave test bench.
2	Obtain the Radiation Pattern and Measurement of directivity and gain of microstrip dipole and Yagi antennas.
3	Determination of Coupling and isolation characteristics of microstrip directional coupler.
4	Determination of Resonance characteristics of microstrip ring resonator and computation of dielectric constant of the substrate.
5	Determination of Power division and isolation of microstrip power divider.
6	Simulate Broadside array, End-Fired array of Dipole Antenna and to plot the Radiation pattern.
7	Simulate Linear array(Uniform) Antenna and plot the Radiation pattern
8	Simulate Dipole Antenna and plot the Radiation pattern
9	Simulate and calculate Phase and group velocity(X- band) waveguide at 9GHz
10	Simulate Rectangular Waveguide propagation modes.

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

22ECE162.1	Develop generation and propagation of RF signals using Microwave oscillators through transmission line.
22ECE162.2	Compute the performance parameters and S-Matrix of microwave passive devices by applying the network/field concepts.
22ECE162.3	Determine various antenna parameters for building an RF system.
22ECE162.4	Develop expressions for field intensity of a given antenna / an array of antennas. (Point sources, dipole, thin linear antenna)
22ECE162.5	Select suitable antenna configuration according to specific applications.
22ECE162.6	Illustrate the benefits and hazards of microwave radiation to human health, environment, and society.

Reference Books

1. Microwave Engineering, David M Pozar,4thEdition, 2011, John Wiley, ISBN: 978-0-470-63155-3

2. Antenna Theory and Design, C A Balanis, 3rd Edition,2005, John Wiley & sons, Inc. publication,ISBN-13: 978-0471667827

3. Foundations of Microwave Engineering, R E Collin, 2009, 2nd Edition, IEEE Press on Electromagnetic and Wave Theory, ISBN-13: 978-0-7803-6031-0

4. Computational Electromagnetics with MATLAB, Matthew N.O. Sadiku, 2019, Taylor & Francis Group, ISBN: 13: 978-1-138-55815-1

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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: VI

Course Name : VLSI Design		**Code: 22ECE163**
L: T:P: J	**3:0:2:0**	**CIA Marks:** 50
Credits:	**3**	**SEA Marks:** 50
Hours:	**40**	**SEA Duration: 0**3 Hours

Pre-Requisites: KVL & KCL, MOSFET fundamentals, Digital electronics

Course Learning Objectives: The students will be able to

1	Learn MOS transistor theory and CMOS technologies
2	Learn the operation principles and analysis of inverter and logic circuits
3	Design combinational, sequential and dynamic logic circuits as per the requirements
4	Design memory SRAM, DRAM, ROM
5	Demonstrate the concepts of Static Timing Analysis and CMOS testing

Module -1: CMOS Logic Fundamentals		
Brief History, VLSI Design Flow, MOS Transistors V-I Characteristics, Non-Ideal characteristics, CMOS Logic Inverter DC Characteristics. Different Logic gates by truth table	**No. of Hrs**	**Bloom's Cognitive Levels**
	8	Apply CO2
Module -2: CMOS Fabrication and CMOS Delays		
CMOS Fabrication and lay out, Layout design rules, Scaling – Constant voltage, Constant field, MOSFET Capacitances without derivations, Transient Characteristics of Inverter, RC Delay, Linear Delay model.	**8**	Apply CO2
Module–3:		
Logical effort of paths and transistor sizing Combinational logic design Circuit families, - Static, Ratioed, CVSL, Dynamic logic, - Comparison of Performance parameters	**8**	Apply CO3
Module–4:		
Sequential logic circuits Sequencing methods and timing, Latches and flipflops **Semiconductor Memories** Memory architecture, SRAM 6T and 8T and 10T SRAM, DRAM 1T and 3T	**8**	Apply CO3
Module–5: STA and Verification		

STA Concepts Timing arcs, Maximum and minimum timing path, Critical path, Clock domain crossing. **Verification** Logic Verification principles, Testing Manufacturing Test Principles, Design for Testability, Built in Self-test, MBIST	**8**	Analyze CO4

Lab Experiments	
Sl. No.	**NOTE: EDA tools with Custom circuit design flow and RTL Design flow to be used**
1	I- V Characteristics of n- MOSFET and p MOSFET
2	Inverter Characteristics Pre-layout
3	Inverter Post layout simulation
4	CMOS NAND gate Design, Pre and Post layout simulation
5	4 Bit adder Timing analysis, Slack calculation
6	4 Bit ALU - Timing analysis, Slack calculation
7	4 Bit Up- down counter - Timing analysis, Slack calculation
8	6T SRAM Characterization
9	Estimation of Path delay and Setup and Hold time analysis for any RTL with predefined clock frequency.
10	Insert Scan chain for a given RTL and analyze.

Course Outcomes: After completing the course, the students will be able to	
22ECE163.1	Demonstrate understanding of MOS transistor theory, CMOS fabrication flow and technology scaling
22ECE163.2	Design the basic gates using the stick and layout diagrams for physical design and estimate sheet resistance and delays.
22ECE163.3	Analyze logic delay and path delay based on logic effort and path effort.
22ECE1634	Analyze timing issues with latches and flipflops
22ECE163.5	Analyze timing consideration in Memory elements, Verification methodologies and Testing issues in VLSI Design.
22ECE163.6	Analyze an RTL design with timing and power constraints and bring up the physical design for the chosen RTL with EDA tools.

Reference Books

1. CMOS VLSI Design- A Circuits and Systems Perspective, Neil H.E.& Weste, David Harris, Ayan Banerjee, Pearson Education, 4th Edition, 2011
2. CMOS Digital Integrate d Circuits: Analysis and De sign - Sung Mo Kang & Yosuf Leblebici, Third Edition, Tata McGraw-Hill. 2003
3. Static Timing Analysis for Nanometer Designs: A Practical Approach, J. Bhasker, R Chadha, Springer, 2009
4. Microelectronics Circuits The ory and Applications, Adel Sedra and K. C. Smith, 6th or 7th Edition, Oxford University Press, International Version, 2009.
5. Basic VLSI Design, Douglas A Pucknell & Kamran Eshragian,, PHI 3rd Edition, (original Edition 1994).

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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: VI

Course Name: Java Programming and its Applications **Course Code: 22ECE164**

L: T: P: J	**0: 0 : 2 : 2**	**CIA Marks:** 50
Credits:	**2**	**SEA Marks:** 50
Hours	**25**	**SEA Duration:** 03 Hours

Pre-Requisites: Basics of C and C++ language, Students should be familiarized about java installation and setting the java environment, Usage of IDEs like Eclipse/Netbeans should be introduced.

Course Learning Objectives: The students will be able to

1	To introduce the use of Eclipse/Netbeans IDE to create Java Applications.
2	Reinforce the understanding of basic object-oriented programming concepts.
3	Create multi-threaded programs and event handling mechanism.
4	To make the students to understand the concept of exception handling
5	Using java programming to develop programs for solving real-world problems.

	No. of Hours	**Blooms Cognitive Levels**
Module-1: Introduction to Java		
Introduction to Java: Features of OOP, Characteristics/Buzz words of Java, Java Environment: JDK, JVM, JRE, Fundamental Programming Structure in Java, Variables, Data Types, Operators & Expressions, Control Statements, Iteration Statements, Command Line Arguments. **Programs:** **1.** Write a java program that prints all real solutions to the quadratic equation $ax^2+bx+c=0$. Read in a, b, c and use the quadratic formula. **2.** Write a program to check prime number **3.** Write a program for Arithmetic calculator using switch case menu	**5**	**Apply CO1**
Module-2: Classes & Objects		
Classes & Objects: Defining Classes & Objects, Access Specifies, Constructors, Overloading Constructor, Method Overloading, Passing and Returning object form Method, new operator, finalize() method, this keyword, Static Keyword, Encapsulation, Polymorphism. Array and String: Single and Multidimensional Array, Definition of String, String Literals, String Class, String Inbuilt Methods, StringBuffer & StringBuilder Class, Use of Wrapper class. **Programs:** **4.** Create a Java class called Student with the following details as variables within it: USN, Name, Branch, Phone. Write a Java program to create n Student objects and print the USN, Name, Branch, and Phone of these objects with suitable headings. **5.** Design a super class called **Staff** with details as StaffId, Name, Phone, Salary. Extend this class by writing three subclasses namely Teaching (domain, publications), Technical (skills), and Contract (period). Write a Java program to read and display at least 3 staff objects of all three categories. **6.** Write a java program demonstrating Method overloading and Constructor overloading.	**5**	**Apply CO2**

Module-3: Inheritance, Interfaces & Packages.		
Inheritance: Defining an Inheritance, Types of Inheritance, Constructor in subclass, Method Overriding, super keyword, abstract keyword, final keyword. Interfaces & Packages: Defining an Interface, Implementing an Interface, Difference between Interface & Classes, Extending a Interface, Usage of Package, Classpath, Importing a Package. **Programs:** **7.** Write a program to generate the resume. Create 2 Java classes Teacher (data: personal information, qualification, experience, achievements) and Student (data: personal information, result, discipline) which implements the java interface Resume with the method biodata (). **8.** Develop a java application to implement currency converter (Dollar to INR, EURO to INR, Yen to INR and vice versa), distance converter (meter to KM, miles to KM and vice versa), time converter (hours to minutes, seconds and viceversa) using packages	**5**	**Apply CO3**
Module-4: Multithreading & IO Programming		
Multithreading: Multi Threaded Programming: What are threads? How to make the classes threadable ; Extending threads; Implementing runnable; Synchronization. IO Programming: Introduction to Stream, Byte Stream, Character stream, Readers and Writers, File Class, File InputStream, File Output Stream, InputStreamReader. **Programs:** **9.** Write a Java program that implements a multi-thread application that has three threads. First thread generates a random integer for every 1 second; second thread computes the square of the number and prints; third thread will print the value of cube of the number.	**5**	**Apply CO4**
Module-5: Exceptions		
Exceptions: Definition of Exception, Classification of Exception, Structure of Try & catch block, Error Vs Exception, Throw Keyword, Throws Keyword, Finally Keyword, Custom Exception. **Programs:** **10.** Write a Java program to read two integers a and b. Compute a/b and print, when b is not zero. Raise an exception when b is equal to zero. **11.** Write a Java program to demonstrate the String functions for the following a. Append - add at end b. Insert – add at particular index c. Search d. List all string starts with given letter	**5**	**Apply CO5**
List of Sample Projects		
1. Airline Reservation System **2.** Electricity Billing System **3.** Library Management System **4.** Online Bank Management System **5. e**-Healthcare Management System **6.** Online Quiz Management System **7.** Stock Management System **8**. Weather Report Application **9.** Telephone Billing System **10.** Currency Converter		

Course Outcomes: After completing the course, the students will be able to	
22ECE164.1	Use Eclipse/NetBeans IDE to design, develop, debug Java Projects
22ECE164.2	Analyze the necessity for Object Oriented Programming paradigm over structured programming and become familiar with the fundamental concepts in OOP.
22ECE164.3	Demonstrate the ability to design and develop java programs, analyze, and interpret object oriented data and document results
22ECE164.4	Apply the concept of Multithreading and IO programming for Java Program applications
22ECE164.5	Apply the concepts of exception/event handling, abstraction to develop robust programs.
22ECE164.6	Develop a Project using JAVA using the concepts

Reference Books

1. E Balagurusamy, Programming with Java, McGraw Hill, 7th Edition, 2020.
2. Herbert Schildt, C: Java the Complete Reference, McGraw Hill, 11th Edition, 2020
3. Core Java Volume-I Fundamentals Horstmann & Cornell, - Pearson Education. - Eight Edition
4. Head First Java: A Brain-Friendly Guide, 2nd Edition- Kathy Sierra, Bert Bates

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>
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Project Report- 25 Marks
Presentation & Demonstration- 50 Marks
Viva-Voce- 15 Marks

Project
Assessed for 100 marks
reduced to 50 marks</td></tr>
<tr><td>30</td><td>30</td></tr>
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<tr><td>Practical</td><td colspan="2">Weekly Assessment (Record/Project)-10 Marks
Lab IA test-10 Marks</td></tr>
<tr><td colspan="4">Total- 50 marks</td><td>Total- 50 marks</td></tr>
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Dept. of Electronics and Communication Engineering Choice Based Credit System (CBCS and Outcome Based Education (OBE)		
Semester: VI		
Course Name: Information Theory & Coding		**Course Code: 22ECE1651**
L: T: P: J	**3: 0: 0: 0**	**CIA Marks:** 50
Credits:	**3**	**SEA Marks:** 50
Hours	**40**	**SEA Duration:** 03 Hours
Pre-Requisites: Set theory, Discrete mathematics, Probability theory and Statistics		
Course Learning Objectives: The students will be able to		
1	Understand the concept of Entropy, Rate of information and order of the source with reference to dependent and independent source.	
2	Study various source encoding algorithms.	
3	Model discrete & continuous communication channels.	
4	Study Various Error Control Coding Algorithms	

Module-1: INFORMATION THEORY	**No. of Hours**	**Blooms Cognitive Levels**
Introduction: Block Diagram for Digital Communication, Measure of information, Information content of message, Average Information content of symbols in Long Independent sequences, Markov Statistical Model of Information Sources, Average Information content of symbols in Long dependent sequences, Entropy of Markoff Sources, Information rate of Markoff Sources	**08**	**Analyse CO1**
Module-2: SOURCE CODING		
Encoding of the Source Output, Shannon's Encoding Algorithm, Shannon Fano Encoding Algorithm, Source coding theorem, Prefix codes, Kraft McMillan Inequality property – KMI, Huffman Codes & Extended Huffman coding	**08**	**Apply CO2**
Module-3: : DISCRETE INFORMATION CHANNELS		
Introduction to Discrete Communication Channels, Channel Matrix, Joint probability Matrix, Binary Symmetric Channel, System Entropies, Mutual Information, Channel Capacity, Channel Capacity of Binary Symmetric Channel and Binary Erasure Channel	**08**	**Apply CO3**
Module-4: ERROR CONTROL CODING		
Introduction to Error Control Coding, Examples, Methods of Controlling Errors, Types of Errors, Types of Codes, Linear Block Codes: matrix description of Linear Block Codes, Error Detection and Error Correction Capabilities of Linear Block Codes, Single Error Correcting Hamming Codes. Binary Cyclic Codes: Algebraic Structure of Cyclic Codes, Systematic and Non Systematic form, Encoding using an (n-k) Bit Shift register, Syndrome Calculation, Error Detection and Correction	**08**	**Analyse CO4**
Module-5: CONVOLUTIONAL CODES		
Convolution Encoder, Time domain approach, Transform domain approach, State Diagram, Code Tree, Trellis Diagram, The Viterbi Algorithm.	**08**	**Apply CO5**

Course Outcomes: After completing the course, the students will be able to	
22ECE1651.1	Calculate Symbol rate, Self-Information, Entropy and Information Rate as a measure of Information for memory less and dependent sources.
22ECE1651.2	Develop efficient representation of data generated by discrete information source.
22ECE1651.3	Analyze discrete channels using joint, conditional, and mutual entropies of variables in terms of their coupled probabilities.
22ECE1651.4	Develop reliable codes for data on imperfect communication channels.
22ECE1651.5	Apply concept of convolutional codes to carry out encoding and decoding operations.
22ECE1651.6	Relate the basics of Information Theory & coding to find solutions for practical problems in terms of storage and secured communication

Text Books

1. Digital and Analog communication systems, K. Sam Shanmugam, John Wiley India Pvt. Ltd, 1996.
2. Digital communication, Simon Haykin, John Wiley India Pvt. Ltd, 2008.

Reference Books

1. ITC and Cryptography, Ranjan Bose, TMH, II Edition, 2007.
2. Principles of digital communication, J. Das, S. K. Mullick, P. K. Chatterjee Wiley Technology & Engineering, 1986.
3. Digital Communications – Fundamentals and Applications, Bernard Sklar, Pearson Education, Second Edition, 2016, ISBN:9780134724058.
4. Information Theory and Coding, Hari Bhat, Ganesh Rao, Cengage, 2017.
5. Error Correction Coding Todd K Moon Wiley Std., Edition, 2006.

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

Semester: 6

Course Name: Nanoelectronics		**Course Code: 22ECE1652**
L: T: P: J	**3: 0:0:0**	**CIA Marks:** 50
Credits:	**3**	**SEA Marks:** 50
Hours/Week (Total)	**3**	**SEA Duration:** 03 Hours

Pre-Requisites:

Course Learning Objectives: The students will be able to

1	Describe nanotechnology with basic fabrication methods for nanostructures.
2	Describe the classification of characterization methods.
3	Describe the various fabrication techniques and physical processes.
4	Discuss the applications of semiconductor nanostructures

Module-1: Introduction	**No. of Hours**	**Blooms Cognitive Levels**
Introduction: Overview of nanoscience and engineering. Development milestones in microfabrication and electronic industry. Moore's law and continued miniaturization, Classification of Nanostructures, Electronic properties of atoms and solids: Isolated atom, Bonding between atoms, Giant molecular solids, Free electron models and energy bands, crystalline solids, Periodicity of crystal lattices, electronic conduction.	**8**	**Understand CO1**
Module-2: Fabrication methods and techniques		
Fabrication methods: Top-down processes, Bottom up processes methods for templating the growth of nanomaterials, ordering of nanosystems. **Fabrication techniques:** requirements of ideal semiconductor, epitaxial growth of quantum wells, lithography and etching, cleaved-edge over growth, growth of vicinal substrates, strain induced dots and wires, electrostatically induced dots and wires, Quantum well width fluctuations, thermally annealed quantum wells, semiconductor nanocrystals, collidal quantum dots, self-assembly techniques. (Text 1).	**8**	**Understand CO2**
Module-3: Characterization		
Characterization: General considerations for imaging, Image magnification and resolution, other considerations for imaging, Light microscopy, Classification, Microscopic techniques, Field ion microscopy, scanning probe techniques, diffraction techniques: bulk and surface diffraction techniques. The characterization of semiconductor nanostructures-Optical and electrical characterization, Structural characterization.	**8**	**Understand CO3**
Module-4: Inorganic semiconductor nanostructures		
Inorganic semiconductor nanostructures: overview of semiconductor physics. Quantum confinement in semiconductor nanostructures: quantum wells, quantum wires, quantum dots, super-lattices, band offsets, electronic density of states, Modulation doping, The quantum Hall effect, Resonant tunnelling, Charging effects.	**8**	**Understand CO4**
Module-5: Applications of semiconductor nanostructures		
Applications of semiconductor nanostructures: Injection lasers, quantum cascade lasers, single-photon sources, biological tagging, optical memories, coulomb blockade devices, photonic structures.	**8**	**Understand CO5**

Course Outcomes: After completing the course, the students will be able to	
22ECE1652.1	Explain the overview and classification of nanostructures.
22ECE1652.2	Explain the top-down and bottom-up fabrication methods and fabrication techniques involved.
22ECE1652.3	Explain Image magnification and microscopic techniques used in characterization.
22ECE1652.4	Explain the Inorganic semiconductor nanostructures with doping and charge effects.
22ECE1652.5	Explain the applications of nano sensors, injection lasers and analyze the effects of nanotechnology applications

Reference Books

i. Ed Robert Kelsall, Ian Hamley, Mark Geoghegan, "Nanoscale Science and Technology", John Wiley, 2007.

ii. Charles P Poole, Jr, Frank J Owens, "Introduction to Nanotechnology", John Wiley, Copyright 2006, Reprint 2011.

iii. T Pradeep, "Nano: The essentials-Understanding Nanoscience and Nanotechnology", TMH.

iv. Ed William A Goddard III, Donald W Brenner, Sergey E. Lyshevski, Gerald J Iafrate, "Hand Book of Nanoscience Engineering and Technology", CRC press, 2003.

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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: VI		
Course Name: Wearable Technology		**Course Code: 22ECE1653**
L: T: P: J	**3 :0 :0 :0**	**CIA Marks: 50**
Credits:	**3**	**SEA Marks: 50**
Hours	**40**	**SEA Duration: 03 Hours**

Prerequisites:

Course Learning Objectives: The students will be able to

1	Identify and understand the need for development of wearable devices and its influence on various sectors.
2	Explore the smart fabrics and their applications in wearable devices.
3	Familiarize the characteristics, working principle and application of special purpose transducers
4	Introduce the adoption of wearable and non-invasive assistive technologies for wearable devices.
5	Provide a basic understanding of evolution of IoT and its functional modules.

Module-1: Wearables: Fundamentals, advancements and roadmap for the future	**No. of Hours**	**Blooms Cognitive Levels/CO Mapping**
World of Wearables, Role of Wearables, Attributes of Wearables, Textiles and clothing: The meta-wearable, Challenges and opportunities. Soft Mechanical and Biochemical Sensors: Mechanical sensors, Biochemical sensors, Tears, Saliva, Wound and interstitial fluids.	**8**	**Understand CO1**
Module-2: Smart Fabrics		
Introduction. Sensor design, physiological basis and sensor placement, electrical contacts and interconnections for smart garments. Textile integration and design of functional garments, functional evaluation. Woven Electronic textiles: Introduction, Textiles, Applications: Touchpad, Textile switch, Textile electrodes, Device-embedded textiles.	**8**	**Understand CO2**
Module-3: Pressure and Flow Sensors		
Concepts of Pressure, Units of Pressure, Mercury Pressure sensors, Bellows, membranes and thin plates, Piezoresistive sensors, capacitance sensors, VRP sensors, optoelectronic pressure sensors, indirect pressure sensor, vacuum sensors. Basics of flow dynamics, thermal transport sensors, ultrasonic sensors, electromagnetic sensors, breeze sensor, Dust and smoke detectors.	**8**	**Understand CO3**
Module-4: Wearable and Non-invasive assistive technologies		
Assistive devices for individuals with severe paralysis: Sip-n-puff, Head controllers, Eye tracking systems, Electromyography (EMG)-based controllers, Voice controllers, Brain-Computer interfaces (BCI), Tongue-operated devices, Wireless tracking of tongue motion, Wearable Tongue Drive System, Sensor Signal processing algorithm, Multimodal Tongue Drive System, Clinal assessment.	**8**	**Understand CO4**
Module-5: Wearables to THINKables: Data Analytics and Machine Learning		
Remote health monitoring using wearable sensors, AI enabled sensors, challenges of AI-enabled sensors in health, future directions. Data analytics for wearable IoT based telemedicine: introduction, need and	**8**	**Understand CO5**

demand of wearables technologies in the society, smart glove design, signal processing pipeline: from sensor signals to classifications		

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

22ECE1653.1	Identify and understand the need for development of wearable devices and its influence on various sectors.
22ECE1653.2	Identify the integration of smart fabrics and wearable devices.
22ECE1653.3	Understand the working principle of special purpose sensors and the need for developing smart sensors.
22ECE1653.4	Explore the role of wearable and non-invasive assistive technologies for wearable devices
22ECE1653.5	Explain and identify AI based wearable applications.
22ECE1653.6	Describe and perform the experiments on the sensors and wearable devices.

Reference Books

1. Jacob Fraden, "Hand Book of Modern Sensors: physics, Designs and Applications", 3rd ed., Springer, 2010.
2. Edward Sazonov, Michael R Neuman, "Wearable Sensors: Fundamentals, Implementation and Applications" Elsevier, 2014
3. Toshiyo Tamura, Wenxi Chen, "Seamless Healthcare Monitoring Advancements in Wearable, Attachable, and Invisible Devices". Springer International Publishing, 2017.Daniel J. Inman, Shashank Priya "Energy Harvesting Technologies", Springer US, 2008
4. Simone Cirani, Gianluigi Ferrari, Marco Picone, Luca Veltri "Internet of Things: Architectures, Protocols and Standards" , Wiley, 2018
5. "Environmental, Chemical and Medical Sensors", by Shantanu Bhattacharya, A K Agarwal, Nripen Chanda, Ashok Pandey and Ashis Kumar Sen, Springer Nature Singapore Pte Ltd. 2018
6. M. Mardonova and Y. Choi, "Review of Wearable Device Technology and Its Applications to the Mining Industry," Energies, vol. 11, p. 547, 2018.

Marks Distribution for Assessment:

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<tr><th rowspan="2">PE-1</th><th rowspan="2">CIA</th><th rowspan="2">SEA</th><th colspan="4">CIA (50)</th><th>SEA
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Additional Assessment Tools (AAT) – Quiz, Presentations,Term Paper, Open ended experiments, Mini Projects, Two-minute video on latest topic, Short MOOC courses.

B.N.M. Institute of Technology

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Dept. of Electronics and Communication Engineering

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

Semester: VI

Course Name: Artificial Neural Networks		**Course Code: 22ECE1654**
L: T: P: J	**3 : 0 : 0 : 0**	**CIA Marks:** 50
Credits:	**3**	**SEA Marks:** 50
Hours	**40**	**SEA Duration:** 03 Hours

Pre-Requisites: Basic knowledge of calculus, linear algebra, probability theory and programming

Course Learning Objectives: The students will be able to

1	Understand the basics of ANN and comparison with Human brain
2	Demonstrate knowledge on Generalization and function approximation and various architectures of building an ANN
3	Get knowledge of supervised, unsupervised and reinforcement learning using neural networks

Module-1	**No. of Hours**	**Blooms Cognitive Levels**
Introduction: Biological Neuron – Artificial Neural Model - Types of activation functions – Architecture: Feedforward and Feedback, Convex Sets, Convex Hull and Linear Separability, Non-Linear Separable Problem. Xor Problem, Multilayer Networks. **Learning:** Learning Algorithms, Error correction and Gradient Descent Rules, Learning objective of TLNs, Perceptron Learning Algorithm, Perceptron Convergence Theorem.	**8**	**Apply CO1**
Module-2		
Supervised Learning: Perceptron learning and Non Separable sets,α-Least Mean Square Learning, MSE Error surface, Steepest Descent Search, μ-LMS approximate to gradient descent, Application of LMS to Noise Cancelling, Multi-layered Network Architecture, Backpropagation Learning Algorithm, Practical consideration of BP algorithm.	**8**	**Apply CO2**
Module-3		
Support Vector Machines and Radial Basis Function: Learning from Examples, Statistical Learning Theory,Support Vector Machines, SVM application to Image Classification, Radial Basis Function Regularization theory, Generalized RBF Networks, Learning in RBFNs, RBF application to face recognition.	**8**	**Apply CO3**
Module-4		
Attractor Neural Networks: Associative Learning Attractor Associative Memory, Linear Associative memory, Hopfield Network, application of Hopfield Network, Brain State in a Box neural Network, Simulated Annealing, Boltzmann Machine, Bidirectional Associative Memory.	**8**	**Apply CO4**
Module-5		
Self-organization Feature Map: Maximal Eigenvector Filtering, Extracting Principal Components, Generalized Learning Laws, Vector Quantization, Self-organization Feature Maps, Application of SOM, Growing Neural Gas.	**8**	**Apply CO5**

Course Outcomes: After completing the course, the students will be able to	
22ECE1654.1	Understand artificial neural model and its architectures.
22ECE1654.2	Apply steepest descent, LMS algorithm and Backpropagation algorithm
22ECE1654.3	Apply support vector machines to classify images.
22ECE1654.4	Understand attractor neural networks and its applications.
22ECE1654.5	Apply self-organization feature maps.
22ECE1654.6	Understand the role of neural networks in engineering, artificial intelligence, and cognitive modelling and be able to apply the concepts of ANN to real world applications.

Text Books

1. Neural Networks A Classroom Approach– Satish Kumar, McGraw Hill Education (India) Pvt. Ltd, Second Edition.

Reference Books

1. Introduction to Artificial Neural Systems-J.M. Zurada, Jaico Publications, 1994.
2. Artificial Neural Networks-B. Yegnanarayana, PHI, New Delhi 1998

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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: VI

Course Name: Computer Architecture and Organisation		**Course Code:22ECE1655**
L: T: P: J	**3 : 0 : 0 : 0**	**CIA Marks:** 50
Credits:	**3**	**SEA Marks:** 50
Hours	**40**	**SEA Duration:** 03 Hours

Pre-Requisites: Digital Logic solving, Number System

Course Learning Objectives: The students will be able to

1	Explain the basic sub systems of a computer, their organization, structure and operation
2	Illustrate the concept of programs as sequences of machine instructions
3	Demonstrate different ways of communicating with I/O devices
4	Describe memory hierarchy and concept of virtual memory
5	Illustrate organization of simple pipelined processor and other computing systems

Module-1:	**No. of Hours**	**Blooms Cognitive Levels**
Basic Structure of Computers: Computer Types, Functional Units, Basic, Operational Concepts, Bus Structures, Software, Performance – Processor Clock, Basic Performance Equation **Machine Instructions and Programs:** Numbers, Arithmetic Operations and Characters, IEEE standard for Floating point Numbers, Memory Location and Addresses, Memory Operations, Instructions and Instruction Sequencing	**8**	**Understand CO1**
Module-2:		
Addressing Modes, Assembly Language, Basic Input and Output Operations, Stacks and Queues, Subroutines, Additional Instructions.	**8**	**Apply CO2**
Module-3:		
Input/Output Organization: Accessing I/O Devices, Interrupts – Interrupt Hardware, Enabling and Disabling Interrupts, Handling Multiple Devices, Controlling Device Requests, Direct Memory Access	**8**	**Apply CO3**
Module-4:		
Memory System: Basic Concepts, Semiconductor RAM Memories-Internal organization of memory chips, Static memories, Asynchronous DRAMS, Read Only Memories, Cash Memories, Virtual Memories, Secondary Storage-Magnetic Hard Disks	**8**	**Apply CO4**
Module-5:		
Basic Processing Unit: Some Fundamental Concepts, Execution of a Complete Instruction, Multiple Bus Organization, Hardwired Control, Microprogrammed Control	**8**	**Understand CO5**

Course Outcomes: After completing the course, the students will be able to	
22ECE1655.1	Explain the basic organization of a computer system.
22ECE1655.2	Explain the different addressing modes and assembly language instructions.
22ECE1655.3	Explain different ways of accessing an input / output device including interrupts.
22ECE1655.4	Illustrate the organization of different types of semiconductor and other secondary storage memories.
22ECE1655.5	Illustrate simple processor organization based on hardwired control and micro programmed control.
22ECE1655.6	Analyze the architecture and performance issues in different processor families.

Reference Books

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky: Computer Organization, 5th Edition, Tata McGraw Hill, 2002.
2. David A. Patterson, John L. Hennessy: Computer Organization and Design – The Hardware / Software Interface ARM Edition, 4th Edition, Elsevier, 2009.
3. William Stallings: Computer Organization & Architecture, 7th Edition, PHI, 2006.
4. Vincent P. Heuring & Harry F. Jordan: Computer Systems Design and Architecture, 2nd Edition, Pearson Education, 2004.

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B.N.M. Institute of Technology

An Autonomous Institution under VTU

Semester: VI		
Course Name: Introduction to Database Systems		
Course Code: 22ECE1661	**L: T:P: J: 3:0:0:0**	**CIA Marks: 50**
Credits:	**3**	**SEA Marks: 50**
Hours:	**40**	**SEA Duration: 03** Hours
Pre-Requisites: Data Structures using C		
Course Learning Objectives: The students will be able to		
1	Understand about the fundamentals Database system and SQL.	
2	Understand the application domains of Database System in everyday life.	
3	Understand the Concepts of Normal forms and file organization.	
4	Understand and apply Join and Redo – Undo operations.	

Module1: Introduction to Database System		
Basics of Database: Introduction, Database Architecture, RDBMS architecture **Entity – Relationship Model:** Introduction to ER model, Entities and Relationships, Modelling Weak Entities and Design choices, Relational data model and Notation of Keys.	**No. of Hrs** **8**	**Blooms cognitive Levels** Understand CO1
Module 2: Relational Algebra and SQL		
Introduction to Relational Algebra: Operations in Relational Model, uses of Renaming, Join and Division in Relation Algebra, relation model and outer join operation examples, convert ER model to Relational Model calculus, Introduction to Tuple Relational Calculus, Example TRC queries. **SQL:** Data definition using SQL, Basic SQL query block and subqueries, Aggregate functions, Views, Programmatic access of SQL	**8**	Understand CO2
Module 3: Normal Forms		
Normal forms: Introduction, deriving new functional dependencies, proving soundness and completeness of Armstrong's Axioms. **Normal forms- 2:** NF, 3NF, BCNF, Properties of decomposition, Normal forms – 4NF, 5NF	**8**	Understand CO3
Module 4: File Organization		
File Organization: Introduction to file organization, file organization methods, Dynamic file organization using Hashing, Index structures. B+ trees on Disks, performance and reliability of multiple Disks , Relational Query Evaluation.	**8**	Apply CO4
Module 5: Transaction and Concurrency Control		

Join operator processing algorithms, Query optimization, AICD properties and operations in transactions, concurrency control using Locks, Recovery using undo logging method, Recovery using Redo and Undo- Redo logging methods, Recoverable Schedules, and transaction isolation levels.	**8**	Apply CO5

Course Outcomes: After completing the course, the students will be able to	
22ECE1661.1	Understand the DBMS architecture and ER model.
22ECE1661.2	Illustrate the Relational algebra & SQL
22ECE1661.3	Demonstrate Normal forms and its properties.
22ECE1661.4	Apply the concepts of File organization method and Disks
22ECE1661.5	Implement join operator, Undo – Redo logging methods.

Reference Books

1. A Silberschatz, H Korth, S Sudarshan, "Database System and Concepts", fifth Edition McGraw-Hill, Rob, Coronel, "Database Systems", Seventh Edition, Cengage Learning.
2. A First Course in Database Systems, by Jeffrey D. Ullman and Jennifer Widom, Prentice Hall, Third Edition, 2008.

Professional Core Course (PCC)

<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</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, Two-minute video on related topics, Short-term MOOC courses.

B.N.M. Institute of Technology

An Autonomous Institution under VTU

Semester: B. E		
Course Name : Embedded System Design		**Code: 22ECE1662**
L: T:P: J	**3:0:0:0**	**CIA Marks:** 50
Credits:	**3**	**SEA Marks:** 50
Hours		**SEA Duration: 0**3 Hours

Pre-Requisites: Computer Organization, Basic of Microprocessors

Course Learning Objectives: The students will be able to

1	Understand what is Embedded System, ASICs and ASIPs , Single Purpose Processors its design and Optimization and students will be Introduced to FPGAs and their Synthesis
2	Understand Sensors, converters, Arduino Uno, Serial Communication, Timer and Controller Design using Arduino
3	Understand Power Aware Embedded System Design, Real Time Operating System
4	Understand RTS Algorithms, FSM and Statechart, Program State Machines
5	Understand SDL, Data Flow Model Digital Camera Design and Hardware Software Partitioning, Design Optimization.

Module-1: Introduction to Embedded System, ASICs and ASIPs , Introduction to FPGAs and Synthesis		
Introduction to Embedded System, Processors, General Purpose and ASIPs Processor, Designing a Single Purpose Processor Optimization Issues , Introduction to FPFA, FPGA Contd., Behaviour Synthesis on FPGA using VHDL	**No. of Hrs** **8**	**Bloom's Cognitive Levels** Understand CO1
Module–2: Introduction to Sensors, converters, Arduino Uno, Serial Communication, Timer and Controller Design using Arduino		
Sensors and Signals, Discretization of Signals and A/D Converter,Quantization Noise, SNR and D/A Converter , Arduino Uno, Arduino Uno (Contd.), Serial Communication and Timer , Controller Design using Arduino	**8**	Understand CO2
Module–3: Power Aware Embedded System Design, Real Time Operating System		
Power Aware Embedded System - I, Power Aware Embedded System - II ,SD and DD Algorithm , Parallel Operations and VLIW ,Code Efficiency, DSP Application and Address Generation Unit, Real Time O.S - I ,Real Time O.S - II ,	**8**	Understand CO3
Module–4: RTS Algorithms, FSM and Statechart, Program State Machines		
RMS Algorithm , EDF Algorithm and Resource Constraint Issue , Priority Inversion and Priority Inheritance Protocol, Modeling and Specification - I , Modeling and Specification - II FSM and Statechart , Statechart and Statemate Semantics, Statecharts (Contd.) ,Program State Machines	**8**	Apply CO4
Module–5: SDL, Data Flow Model, Scheduling Digital Camera Design and Hardware Software Partitioning, Design Optimization.		

SDL ,Data Flow Model - I,Data Flow Model - II, Hardware Synthesis – I, Hardware Synthesis - II ,Scheduling, Digital Camera Design , Digital Camera - Iterative Design, Hardware Software Partitioning, Optimization - I, Optimization - II, Simulation, Formal Verification	**8**	Apply CO5

Course Outcomes: After completing the course, the students will be able to	
22ECE1662.1	Understand what is Embedded System, ASICs and ASIPs , Single Purpose Processors its design and Optimization and students will be Introduced to FPGAs and their Synthesis
22ECE1662.2	Understand Sensors, converters, Arduino Uno, Serial Communication, Timer and Controller Design using Arduino
22ECE1662.3	Understand Power Aware Embedded System Design, Real Time Operating System
22ECE1662.4	Understand RTS Algorithms, FSM and Statechart, Program State Machines
22ECE1662.5	Understand SDL, Data Flow Model Digital Camera Design and Hardware Software Partitioning, Design Optimization.
22ECE1662.6	Understand what is Embedded System, ASICs and ASIPs , Single Purpose Processors its design and Optimization and students will be Introduced to FPGAs and their Synthesis

Professional Core Course (PCC)

PCC	**CIA**	**SEA**	**CIA (50)**				**SEA**
				I	**II**	**III**	**Conduction: 100 M** **Reduced to: 50 M**
Conduction	**50**	**50**	**Written Test**	**30**	**30**	**30**	**Five questions with each of 20 marks (with internal choice). Student should answer one full question from each module**
				Average of three tests – 30 Marks			
			Assignment	**10**			
			AAT	**10**			
			Total – 50 marks				**Total – 50 marks**

i) CIA: 50%

IA Test: 3 IA tests - Each of 30 Marks - Average of 3 tests	25 Marks
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%

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 50M**
	Total	**50 Marks**

Reference Books
Embedded Systems Design by Prof. Anupam Basu, https://drive.google.com/file/d/1VOACjI9oyGsgUDC7BryI7sXv5MfBhpOd/view Introduction to Embedded Systems - shibu k v, Mcgraw Hill Education,2nd edition, Reprint 2023. Embedded Systems Design by Frank Vahid,3rd Edition, Reprint 2009.

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: VI

Course Name : VLSI Physical Design with Timing Analysis		**Course Code: 22ECE1663**
L: T:P: J	**3:0:0:0**	**CIA Marks:** 50
Credits:	**3**	**SEA Marks:** 50
Hours:	**40**	**SEA Duration: 0**3 Hours

Pre-Requisites: The digital design course is a pre-requisite for this course.

Course Learning Objectives: The students will be able to

1	Understand VLSI Physical design flow needed for VLSI chip design
2	Understand the Static Timing Analysis (STA)
3	Understand the steps of VLSI Physical design such as partitioning, chip planning, placement, Routing, and finally Clock routing
4	Understand the Clock Routing, Global Routing, Detailed Routing
5	Understand the several Open-source tools such as Qflow, Yosys, OpenSTA, and OpenROAD

Module-1: Introduction to VLSI Design

	No. of Hrs	**Bloom's Cognitive Levels**
VLSI Physical Design, Complexity Analysis for Algorithms, Graphs for Physical Design, Graph searching Algorithms, Spanning Tree and Shortest Path Algorithms	**8**	Apply CO1

Module–2: Static Timing Analysis (STA) – 1 & Static Timing Analysis (STA) – 2

Static Timing Analysis (STA) – 1 Overview of Timing Analysis, Timing Arcs and Unateness, Delay Parameters of Combinational Circuits, Delay Parameters of Sequential Circuit, Timing Analysis in Sequential Circuit, STA in Sequential Circuit with Clock Skew – Part 1 **Static Timing Analysis (STA) – 2** STA in Sequential Circuit with Clock Skew – Part 2, STA in Sequential Circuit with Clock Jitter, STA considering OCV and CRPR (Setup check), STA considering OCV and CRPR (Hold check), STA for Combinational Circuits – Part 1, STA for Combinational Circuits – Part 2	**8**	Apply CO2

Module–3: Partitioning, Chip Planning & Placement

Partitioning - Introduction to Partitioning – Part 1, Introduction to Partitioning – Part 2, Partitioning Algorithms, Kernighan – Lin (KL) Algorithm, Fidduccia - Mattheyeses (FM) Algorithm **Chip Planning -** Introduction to Floor planning, Floor planning Representations, Floor planning Algorithms – Part 1, Floor planning Algorithms – Part 2, Pin Assignment and Power - Ground Routing **Placement -** Introduction to Placement, Wirelength estimation techniques, Min-cut placement, Placement Algorithms, Placement algorithms and legalization	**8**	Apply CO3

Module–4: Clock Routing, Global Routing, Detailed Routing		
Introduction to Clock Tree Synthesis, Clock Routing Algorithms – Part 1, Clock Routing Algorithms – Part 2, Clock Routing Algorithms – Part 3, **Global Routing:** Introduction and Optimization Goals, Single net routing (Rectilinear routing), Global Routing in the connectivity graph Finding Shortest Paths with Dijkstra's Algorithm, Full-Netlist Routing **Detailed Routing:** Introduction: Detailed Routing, Channel Routing Algorithms – Part 1, Channel Routing Algorithms – Part 2, Switchbox and Over the cell routing	**8**	Apply CO3
Module–5: Advanced Concepts of Timing Analysis, Input files for VLSI physical design flow and Open-source VLSI Physical Design flow		
Advanced Concepts of Timing Analysis: Timing analysis in latches, Time borrowing in latches, Crosstalk Analysis, SSTA - Statistical Static Timing Analysis **Input files for VLSI physical design flow:** Standard Cell Library Low Power Cells in Standard Cell Library, Sub-threshold Standard Cell Library, Timing Library for Standard cells, PDK and Other files **Open-source VLSI Physical Design flow:** Open-Source tool installation and Q-flow, Open-Source tool- YOSYS, OpenSTA Static Timing Analyzer, OpenROAD Physical Synthesis Flow – Part 1, OpenROAD Physical Synthesis Flow – Part 2	**8**	Analyze CO4

Course Outcomes: After completing the course, the students will be able to	
22ECE1663.1	Understand VLSI Physical design flow needed for VLSI chip design
22ECE1663.2	Understand the Static Timing Analysis (STA)
22ECE1663.3	Apply the steps of VLSI Physical design such as partitioning, chip planning, placement, Routing, and finally Clock routing
22ECE16634	Understand the Static Timing Analysis (STA)
22ECE1663.5	Understand the several Open-source tools such as Qflow, Yosys, OpenSTA, and OpenROAD
22ECE1663.6	Identify and apply algorithms to solve real world problems

Reference Books

1. Kahng, A.B., Lienig, J., Markov, I.L., Hu, J., "VLSI Physical Design: From Graph Partitioning to Timing Closure", Springer.
2. Sherwani, N.A., "Algorithm for VLSI Physical Design Automation", 2nd Ed., Kluwer.
3. J. Bhasker and Rakesh Chadha, "Static Timing Analysis for Nanometer Designs A Practical Approach" Springer 2009
4. Bhatnagar, H. "Advanced ASIC Chip Synthesis: Using Synopsys Design Compiler Physical Compiler and Prime Time"; Kluwer Academic Publishers: New York, NY, USA, 2002

Marks Distribution for Assessment:

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

Semester: 6

Course Name: NANOTECHNOLOGY **Course Code: 22ECE1671**

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

Pre-Requisites:

Course Learning Objectives: The students will be able to

1	Understand basics of nanomaterials and their properties.
2	Describe synthesis of nanomaterials by chemical techniques.
3	Learn to analyze and assess parameters involved in synthesis and characterization.
4	Compare models involved in synthesis of nanostructures.

Module-1: Introduction	**No. of Hours**	**Blooms Cognitive Levels**
Introduction: introduction to nanoscience and nanotechnologies, importance and scope of nanotechnology, Development milestones in microfabrication and electronic industry. Moore's law and continued miniaturization, natural nanomaterials, properties at nanoscale (physical, chemical, surface, electrical. magnetic, optical, mechanical), Classification of Nanostructures, Kinetics in Nanostructured Materials.	**8**	**Understand CO1**
Module-2: Types of Nanomaterials and synthesis		
Types of Nanomaterials (Quantum dots, Nanoparticles, Nanocrystals, Dendrimers, Buckyballs, Nanotubes); Synthesis of Nanomaterials- top down and bottom up approach, Ball Milling , Gas, liquid, and solid –phase synthesis of nanomaterials; Lithography techniques (Photolithography, Dip-pen and Electron beam lithography); Thin film deposition; Electrospinning. Bio-synthesis of nanomaterials.	**8**	**Apply CO2**
Module-3: Characterization of Nano materials		
Microscopy-Scanning tunnelling microscope, Atomic force microscope, scanning electron microscopy, Field Emission Scanning Electron Microscopy, transmission electron microscopy, Environmental Scanning Electron Microscopy (ESEM) High Resolution Transmission Electron Microscope (HRTEM), Surface enhanced Raman Spectroscopy, X-ray diffraction technique, X ray Photoelectron Spectroscopy Surface area analysis, particle size analysis, gravimetric analysis.	**8**	**Apply CO3**
Module-4: Nano Structures		
Carbon Nanotubes, Fullerenes, Nanowires, Quantum Dots. Applications of nanostructures. Reinforcement in Ceramics, Drug delivery, Giant magnetoresistance, etc. Cells response to Nanostructures.	**8**	**Apply CO4**
Module-5: Application of Nanotechnology		
Nano electronics, Nano sensors, Nanotechnology in Diagnostics applications, Environmental and Agricultural Applications of nanotechnology, Nano technology for energy systems.	**8**	**Understand CO5**

Course Outcomes: After completing the course, the students will be able to	
22ECE1671.1	Identify various nano materials and describe the basic science behind the properties of materials.
22ECE1671.2	Explain the types and methods of nanomaterial synthesis.
22ECE1671.3	Interpret the creation and characterization of nanoscale materials.
22ECE1671.4	Apply principles of nano materials in describing nanostructures.
22ECE1671.5	Comprehend the applications of nanotechnology at the leading edge of scientific research Apply their knowledge of nanotechnology to identify how they can be exploited for new applications.

Reference Books

1. Textbook of Nanoscience and Nanotechnology, Pradeep T, 2012, Tata McGraw Hill Education Pvt. Ltd. ISBN: 9781259007323.
2. Nano-structured Materials and Nanotechnology, Hari Singh Nalwa, 2002, Gulf Professional Publishing, Academic Press, ISBN:0-12-513920-9
3. Nanomaterials, Nanotechnologies and Design: An Introduction to Engineers and Architects, D. Michael Ashby, Paulo Ferreira, Daniel L. Schodek, Butterworth-Heinemann, 2009. Springer
4. Handbook of Nanotechnology by Bharat Bhushan 2004.

Marks Distribution for Assessment:

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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: VI

Course Name: Wearable Devices **Course Code: 22ECE1672**

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

Pre-Requisites:

Course Learning Objectives: The students will be able to

1	Understand and Identify the need for development of wearable devices and its influence on various sectors.
2	To provide the basic understanding of measurement and instrumentation systems and the insight of the resistive sensors and its applications in real life.
3	To familiarize the characteristics, working principle and application of special purpose transducers
4	Acquaint the usage of wearable devices as assistive devices, diagnostic devices and other modern applications.
5	To impart the importance of smart sensors, sensor interface standards for wearable device applications and to provide a brief overview of the wearable technology and its impact on social life

Module-1: Wearables: Fundamentals, advancements and roadmap for the future	**No. of Hours**	**Blooms Cognitive Levels**
World of Wearables, Role of Wearables, Attributes of Wearables, Textiles and clothing: The meta-wearable, Challenges and opportunities. Wearing sensors for disease detection: introduction, cardiovascular diseases, neurological diseases, gastrointestinal diseases	**8**	**Understand CO1**
Module-2: Sensors, Actuators and low-power electronics		
Mechanical sensors, Biochemical sensors, tears, saliva, wound and interstitial fluids. Biopotential signals and their characteristics, electrode-body interface and electrode noise, Low-power ADCs for biomedical applications, architectural design for low power biopotential acquisition.	**8**	**Understand CO2**
Module-3: Pressure and Flow Sensors		
Concepts of Pressure, Units of Pressure, Mercury Pressure sensors, Bellows, membranes and thin plates, Piezoresistive sensors, capacitance sensors, VRP sensors, optoelectronic pressure sensors, indirect pressure sensor, vacuum sensors. Basics of flow dynamics, thermal transport sensors, ultrasonic sensors, electromagnetic sensors, breeze sensor, Dust and smoke detectors	**8**	**Apply CO3**
Module-4: Smart Fabrics		
Introduction. Sensor design, physiological basis and sensor placement, electrical contacts and interconnections for smart garments. Textile integration and design of functional garments, functional evaluation, Woven electronic textile applications	**8**	**Understand CO4**
Module-5: Wearables to THINKables: Data Analytics and Machine Learning		
Remote health monitoring using wearable sensors, AI enabled sensors, challenges of AI-enabled sensors in health, future directions Data analytics for wearable IoT based telemedicine: introduction, need and demand of wearables technologies in the society, smart glove design, signal processing pipeline: from sensor signals to classifications	**08**	**Understand CO5**

Course Outcomes: After completing the course, the students will be able to	
22ECE1672.1	Identify and understand the need for development of wearable devices and its influence on various sectors.
22ECE1672.2	Understand the wearable devices for detection of biochemical and physiological body signals
22ECE1672.3	Apply the knowledge of sensors to develop suitable special purpose sensors for wearables and the need for developing smart sensors
22ECE1672.4	Acquaint the usage of wearable devices as assistive devices, diagnostic devices and other modern applications.
22ECE1672.5	Understand the usage of Machine Learning and Data analytics in wearables
22ECE1672.6	Analyze the different low cost smart wearables from different companies- case study

Text Books

1. Jacob Fraden, "Hand Book of Modern Sensors: physics, Designs and Applications", 3rd ed., Springer, 2010.
2. Edward Sazonov, Michael R Neuman, "Wearable Sensors: Fundamentals, Implementation and Applications" Elsevier, 2014
3. Toshiyo Tamura, Wenxi Chen, "Seamless Healthcare Monitoring Advancements in Wearable, Attachable, and Invisible Devices". Springer International Publishing, 2017.

Reference Books

1. "Wearable Electronics Sensors - For Safe and Healthy Living", Subhas Chandra Mukhopadhyay, Springer 2015 ECE(BSW) Page 37
2. "Environmental, Chemical and Medical Sensors", by Shantanu Bhattacharya, A K Agarwal, Nripen Chanda, Ashok Pandey and Ashis Kumar Sen, Springer Nature Singapore Pte Ltd. 2018
3. M. Mardonova and Y. Choi, "Review of Wearable Device Technology and Its Applications to the Mining Industry," Energies, vol. 11, p. 547, 2018.
4. N. Luo, W. Dai, C. Li, Z. Zhou, L. Lu, C. C. Y. Poon, et al., "Flexible Piezoresistive Sensor Patch Enabling Ultralow Power Cuffless Blood Pressure Measurement," Advanced Functional Materials, vol. 26, pp. 1178-1187, 2016.

Marks Distribution for Assessment:

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<tr><td>Assignment</td><td colspan="3">Average of 2 Assignments – 10M</td></tr>
<tr><td>Practical</td><td colspan="3">Weekly Assessment – 10 Marks
IA test – 10 Marks</td></tr>
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B.N.M. Institute of Technology

An Autonomous Institution under VTU, Approved by AICTE

B.E. (Electronics and Communication Engineering)

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

Semester: VI

Course Name: Robotics and Automation **Course Code: 22ECE1673**

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

Pre-Requisites:

Course Learning Objectives: The students will be able to

1	To study the various parts of robots and fields of robotics
2	To study the electronics circuits used in robotic applications
3	To study sensors used in robotics
4	To study the programming aspects of robots for specific applications
5	To study the control of robots for some specific applications

Module-1: Introduction	**No. of Hours**	**Blooms Cognitive Levels/CO Mapping**
History, Robots, Robot Usage, Robot Subsystems, Classification of Robots, Industrial Applications	**8**	**Understand CO1**
Module-2: Actuators and Grippers		
Electric Actuators, Hydraulic Actuators, Pneumatic Actuators, Selection of Motors, Grippers	**8**	**Understand CO2**
Module-3: Sensors, Vision and Signal Conditioning		
Sensor Classification, Internal Sensors, External Sensors, Vision, Signal Conditioning.	**8**	**Understand CO3**
Module-4: Programming of Robots		
Robot Programming: Methods of Robot Programming, Lead through Programming Methods, A Robot Program as a Path in Space, Motion Interpolation, Wait, Signal, and Delay Commands, Branching, Robot Language Structure.	**8**	**Understand CO4**
Module-5: Robot Applications in Manufacturing		
General Considerations in Robot Material Handling, Material Transfer Applications, Machine Loading and Unloading, Processing Applications: Spot Welding, Continuous Arc Welding, Spray Coating	**8**	**Understand CO5**

Course Outcomes: After completing the course, the students will be able to	
22ECE1673.1	Understand the evolution and basics of robotic systems.
22ECE1673.2	Understand various actuators used in robotic applications.
22ECE1673.3	Understand the working of various sensors used in robotic applications
22ECE1673.4	Understand the Robot programming and its languages
22ECE1673.5	Interface hardware and software for building robots
22ECE1673.6	Develop robots for societal applications

Reference Books

1. Introduction to Robotics', 2e, S K Saha, Tata McGraw Hill Education Private Limited, 2008
2. 'Industrial Robotics Technology, Programming and Applications', Mikell P. Groover, Mitchell Weiss, Roger N. Nagel and Nicholas G. Odrey, Mc Graw Hill Book company, 1986
3. 'Industrial Robotics', Bernard Hodges, Jaico Publishing House, 1993

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</table>

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: VI		
Course Name: Automotive Electronics		**Course Code: 22ECE1674**
L: T: P: J	**3 : 0 :0 :0**	**CIA Marks: 50**
Credits:	**3**	**SEA Marks: 50**
Hours	**40**	**SEA Duration: 03 Hours**
Pre-Requisites: Control Systems, Internet of Things, Electronic Circuits, Digital System Design		
Course Learning Objectives: The students will be able to		
1	Understand the basics of automobile dynamics and design electronics to complement those features. ·	
2	Understand principle of working of sensors and actuators used in automobiles for control	
3	Design and implement the electronics that attribute the reliability, safety, and smartness to the automobiles, providing add-on comforts.	

Module-1: Automotive Fundamentals Overview	**No. of Hours**	**Blooms Cognitive Levels/CO Mapping**
Automotive Fundamentals Overview Evolution of Automotive Electronics, Automobile Physical Configuration, Survey of Major Automotive Systems, The Engine - Engine Block, Cylinder Head, Four Stroke Cycle, Engine Control, Ignition System- Spark plug, High voltage circuit and distribution, Spark pulse generation, Ignition Timing, Diesel Engine, Drive Train - Transmission, Drive Shaft, Differential, Suspension, Brakes, Steering System, Starter Battery- Operating principle. **The Basics of Electronic Engine Control-** Motivation for Electronic Engine Control- Exhaust Emissions, Fuel Economy, Concept of an Electronic Engine control system, Definition of General terms, Definition of Engine performance terms, Engine mapping, Effect of Air/Fuel ratio, spark timing and EGR on performance, Control Strategy, Electronic Fuel control system, Analysis of intake manifold pressure, Electronic Ignition.	**8**	**Understand CO1**
Module-2: Automotive Sensors		
Automotive Sensors Automotive Control System applications of Sensors and Actuators - Variables to be measured, Airflow rate sensor, Strain Gauge MAP sensor, Engine Crankshaft Angular Position Sensor, Magnetic Reluctance Position Sensor, Hall effect Position Sensor, Shielded Field Sensor, Optical	**8**	**Understand CO2**

Crankshaft Position Sensor, Throttle Angle Sensor (TAS), Engine Coolant Temperature (ECT) Sensor, Exhaust Gas Oxygen (02/EGO) Lambda Sensors, Piezoelectric Knock Sensor.		
Module-3: Digital Engine Control Systems		
Digital Engine Control Systems Digital Engine control features, Control modes for fuel Control (Seven Modes), EGR Control, Electronic Ignition Control -Closed loop Ignition timing, Spark Advance Correction Scheme, Integrated Engine Control System- Secondary Air Management, Evaporative Emissions Canister Purge, Automatic System Adjustment, System Diagnostics.	**8**	**Understand CO3**
Module-4: Automotive Networking		
Automotive Networking - Bus Systems- Classification, Applications in the vehicle, Coupling of networks, Examples of networked vehicles Buses - CAN Bus, UN Bus, MOST Bus, Bluetooth, Flex Ray, Diagnostic Interfaces.	**8**	**Understand CO4**
Module-5: Automotive Diagnostics		
Automotive Diagnostics- Timing Light, Engine Analyser, On-board diagnostics, Off-board diagnostics, Expert Systems, Occupant Protection Systems - Accelerometer based Air Bag systems. **Future Automotive Electronic Systems-** Alternative Fuel Engines, Electric and Hybrid vehicles, Fuel cell powered cars, Collision Avoidance Radar warning Systems, Low tire pressure warning system, Heads Up display, Speech Synthesis, Navigation - Navigation Sensors - Radio Navigation, Signpost navigation, dead reckoning navigation, Voice Recognition Cell Phone dialling, Advanced Cruise Control, Stability Augmentation, Automatic driving Control	**8**	**Understand CO5**

Course Outcomes: After completing the course, the students will be able to	
22ECE1674.1	Acquire an overview of automotive components, subsystems, and basics of Electronic Engine Control in today's automotive industry
22ECE1674.2	Understand the automotive sensors and actuators for interfacing with microcontrollers / microprocessors during automotive system design.
22ECE1674.3	Understand the fundamentals of digital engine control systems in today's automotive industry.
22ECE1674.4	Understand the networking of various modules in automotive systems, communication protocols and diagnostics of the sub systems.
22ECE1674.5	Understand the importance of automotive diagnostics and get fair idea on future Automotive Electronic Systems
22ECE1674.6	Understanding the design of the electronics that attribute the reliability, safety, and smartness to the automobiles, providing add-on comforts.

Reference Books
1. Understanding Automotive Electronics_ William B. Ribbens_ Elsevier Publishing_6th Edition_2003 2. Bosch Automotive Electrics and Automotive Electronics Systems and Components, Networking and Hybrid Drive_ Robert Bosch Gmbh (Ed.)_ John Wiley& Sons Inc_5th edition_2007

Marks Distribution for Assessment:

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BNM Institute of Technology

Syllabus for Employability Skills-2

SEMESTER – VI

Subject Name	Employability Skills-2 (Technical)	**Weekly Assignments(6 tests)**	Max 10 Min 4
Subject Code	22XXX168	**Evaluation on Resume Building & Etiquettes**	Max 10 Min 4
Number of Contact Hours/Week	2	**Evaluation on Group Discussion & Personal Interviews**	Max 15 Min 6
		Final Company Specific Assessment	Max 15 Min 6
Total Number ofContact Hours	24	**Credits**	1
Industry Readiness hands on Courses (12 hrs)	Tableau and Power BI, Cloud Computing & AWS - fundamental AWS concepts related to compute, database, storage, networking, monitoring, and security with AWS hands-on course experiences		
	Industrial Automation 4.0		
	Competitive Coding		
Personality & Grooming Training (2hrs)	Dressing & Group Discussion Etiquettes, Interview Skills, Resume Building (should include introduction to Github, Hackerrank, LeetCode, Codechef), Email & Telephone Etiquettes, Social Media Etiquettes, & LinkedIn Profiling.		
Interview Preparation Training (2hrs)	**<u>Pre-Preparation Formalities</u>** • Training session on Pre-Preparation formalities of Campus Selection should be conducted Job Profiles analysis must be done. • Understanding the salary breakups & other perks, researching about the Company and the work culture through their websites & other digital platforms like Glassdoor & LinkedIn. • Rewriting resumes keeping the job profiles in view. Group Discussion & Personal Interview		

	• Pre-Placement Talk, Mock GD & Personal Interview training sessions for each individual student should be conducted by the Industry Experts and they should brief students on the area of improvements, presentation & behavioural skills required during the campus selection process.
MOCK RECRUITMENT PROCESS (2hrs)	Aptitude test, Coding test, Group Discussions, Personal Interviews by industry personnel,
	Feedback to be shared to each student,
	Shadowing done by students during interviews to learn better.

BNM Institute of Technology

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

Semester: VII

Course Name: Wireless Communication Technologies
Course Code: 22ECE171

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

Course Learning Objectives: The students will be able to

1	To apply the concepts of Cellular System in capacity expansion techniques.
2	To understand the GSM and TDMA Technology .
3	To apply the concepts of OFDM in LTE.
4	To familiarize the 5G Network architecture and technologies
5	To understand network slicing in 5G and evolution towards 6G.
6	To analyse the ad-hoc networks for real time wireless applications.

Module-1: Evolution and Cellular System Components	**No. of Hours**	**Blooms cognitive Levels**
Different generation of wireless cellular network, 1G, 2G, 2.5G,3G,4G and beyond, Common cellular network components, The Cellular Concept, Cell Fundamentals, Capacity Expansion techniques, Mobility Management	**8**	**Apply CO1**
Module-2: GSM ,TDMA and LTE Technology		
Introduction to GSM and TDMA, GSM Network and System Architecture, GSM Channel Concept, GSM Identities, GSM System Operations, Key enabling technologies and features of LTE, LTE Network architecture	**8**	**Understand CO2**
Module-3: Multicarrier Modulation and LTE standard		
Multicarrier basics, OFDM Basics, OFDM in LTE, Single carrier frequency domain equalization, Overview and channel structure of LTE: Design principles, Network architecture, Radio Interface protocols, Hierarchical channel structure of LTE, Logical channels, Transport channels, Physical Channels, Channel mapping	**8**	**Understand CO3**
Module-4: 5G Overview and Architecture		
5G Overview, Characteristics of 5G, 4G Vs 5G, 5G System Architecture, 5G Deployment architecture, NG core, Network functions in NG core, Communication approach for Core Network Functions, Next Gen Radio Access Networks (NG-RAN), 5G New Radio (5G NR), Technologies accelerating 5G Radio, Small Cells	**8**	**Apply CO4**
Module-5: Network Slicing in 5G and Introduction to 6G		
6Network Slicing in 5G What is network slicing, Requirements for network slicing, Network slicing management, Benefits of network slicing. **Introduction to 6G** Introduction, The societal impact of 6G, Trends and evolution towards 6G, 6G Requirements, The need for a new architecture, Architectural principles.	**8**	**Understand CO5**

Course Outcomes: After completing the course, the students will be able to	
22ECE171.1	Apply the concepts of Cellular System in capacity expansion techniques.
22ECE171.2	Understand the GSM and TDMA Technology .

22ECE171.3	Apply the concepts of OFDM in LTE.
22ECE171.4	Familiarize the 5G Network architecture and technologies.
22ECE171.5	Understand network slicing in 5G and evolution towards 6G.
22ECE171.6	Analyse the ad-hoc networks for real time wireless applications.

Reference Books

1. Introduction to Wireless Telecommunications Systems and Networks, Gary Mullet, First Edition, Cengage Learning India Pvt Ltd., 2013, ISBN -13: 978-8131520123.
2. Introduction to 5G Wireless Networks Saro Velrajan, First edition, 2020, KDP ISBN: 9798643303107
3. "Towards Sustainable and Trustworthy 6g Challenges, Enablers, And Architectural Design", Ömer Bulakçi, Xi Li, Marco Gramaglia, Anastasius Gavras, Mikko Uusitalo, Patrik Rugeland and Mauro Boldi, now Publishers Inc., 2023, ISBN: 978-1-63828-238-9 E-ISBN: 978-1-63828-239-6 DOI: 10.1561/9781638282396
4. Fundamentals of LTE, Arunabha Ghosh, Jan Zhang, Jefferey Andrews, Riaz Mohammed, Prentice Hall, Communications Engg and Emerging Technologies, 2018, ISBN -13: 978-0-13-703311-9
5. Fundamentals of 5G Mobile Networks, Jonathan Rodriguez,Wiley,2015, ISBN:9781118867525
6. Wireless Communications Wireless Communications: Principles and Practice" Theodore Rappaport,2nd Edition, Prentice Hall Communications Engineering and Emerging Technologies Series, 2002, ISBN 0-13-042232-0.

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<tr><td>AAT</td><td colspan="3">10 Marks - Implementation of Wireless protocols using simulation tools.</td></tr>
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BNM Institute of Technology

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

Semester: VII

Course Name: Fiber Optics Communication		**Course Code: 22ECE1721**
L: T: P: J	**3 :0 :0:0**	**CIA Marks:** 50
Credits:	**3**	**SEA Marks:** 50
Hours	**40**	**SEA Duration:** 03 Hours

Pre-Requisites: Concepts of Analog and Digital Communication

Course Learning Objectives: The students will be able to

1	Learn the basic principle of optical fiber communication with different modes of light propagation.
2	Understand the transmission characteristics and losses in optical fiber.
3	Study of optical components and its applications in optical communication networks.
4	Understand the Operational principles of WDM and Optical Components.
5	Understand the working of Optical Amplifiers and Optical Networks

Module-1: Overview of Optical Fiber Communication	**No. of Hours**	**Blooms Cognitive Levels**
Historical development, The general system, Advantages of optical fiber communication, Optical fiber waveguides: Ray theory transmission, Modes in planar guide, Phase and group velocity, cylindrical fiber: Modes, Step index fibers, Graded index fibers, Single mode fibers, Cutoff wavelength, Mode field diameter, effective refractive index. Fiber Materials, Photonic crystal fibers.	**8**	**Apply CO1**
Module-2: Transmission characteristics of optical fiber		
Attenuation, Material absorption losses, Linear scattering losses, Nonlinear scattering losses, Fiber bend loss, Dispersion, Chromatic dispersion, Intermodal dispersion: Multimode step index fiber	**8**	**Understand CO2**
Module-3: Optical sources and Photodetectors		
Light Emitting diodes: LED Structures, Light Source Materials, Quantum Efficiency and LED Power, Modulation. Laser Diodes: Modes and Threshold conditions, Rate equation, External Quantum Efficiency, Resonant frequencies, Laser Diode structures and Radiation Patterns: Single mode lasers, Physical principles of Photodiodes, Photodetector noise, Detector response time.	**8**	**Apply CO3**
Module-4: WDM Concepts and Components		
Overview of WDM: Operational principles of WDM, WDM standards, Mach-Zehnder Interferometer Multiplexers, Isolators and Circulators, Fiber grating filters, Dielectric Thin-Film Filters, Diffraction Gratings, Active Optical Components, Tunable light sources, Fiber splices, fiber connectors and fiber couplers.	**8**	**Understand CO4**
Module-5: Optical Amplifiers and Networks		
Optical Amplifiers and Networks – optical amplifiers, basic applications and types, semiconductor optical amplifiers, EDFA. OPTICAL NETWORKS: Introduction, SONET / SDH, Optical Interfaces, SONET/SDH rings, High – speed light – waveguides.	**8**	**Understand CO5**

Course Outcomes: After completing the course, the students will be able to	
22ECE1721.1	Classification and working of optical fiber with different modes of signal propagation.
22ECE1721.2	Describe the transmission characteristics and losses in optical fiber communication.
22ECE1721.3	Describe the constructional features and the characteristics of optical sources and detectors.
22ECE1721.4	Explain the Operational principles of WDM and Optical Components.
22ECE1721.5	Explain the working of Optical Amplifiers and Optical Networks
22ECE1721.6	Analyze impact of optical fiber communication on human health and society.

Reference Books

1. Gerd Keiser, Optical Fiber Communication, 5th Edition, McGraw Hill Education(India) Private Limited, 2015. ISBN:1-25-900687-5.
2. John M Senior, Optical Fiber Communications, Principles and Practice, 3 d Edition, Pearson Education, 2010, ISBN:978-81-317-3266-3
3. Joseph C Palais, Fiber Optic Communication , Pearson Education, 2005, ISBN:0130085103

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<tr><td>AAT</td><td colspan="3">10 Marks - Presentation on topics related to Optical fiber communication.</td></tr>
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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: VII

Course Name: SoC Design		**Course Code: 22ECE1722**
L: T: P: J	**3:0:0:0**	**CIA Marks: 50**
Credits:	**3**	**SEA Marks: 50**
Hours	**40**	**SEA Duration: 03 Hours**

Course Learning Objectives: The students will be able to

1	The objective of this course is to impart a general understanding of the structure, architecture and operation of systems-on-chip.
2	To cover SoC design and modelling techniques with emphasis on architectural exploration, assertion-driven design and the concurrent development of hardware and embedded software used to implement and model inter component communication is SoC.
3	To provide the overall idea how to integrate various building blocks of a system-on-chip, e.g. processor, on-/off-chip memories are interconnected.
4	To apply Implementation methods as well as techniques for low power consumption are addressed.

Module-1: Introduction to System on Chip	**No. of Hours**	**Blooms Cognitive Levels/CO Mapping**
Review of Moore's law and CMOS scaling, benefits of System On Chip integration in terms of cost, power, and performance. Comparison on System on Board, System on Chip, and System-in-Package. Typical goals in SoC design cost reduction, power reduction, design effort reduction, performance maximization. Productivity gap issues and the ways to improve the gap – IP based design and design reuse.	**8**	**Understand CO1**
Module-2: System On Chip Design Process		
System On Chip Design Process: A canonical SoC Design, SoC Design flow, waterfall vs spiral, top-down vs bottom-up, Specification requirement, Types of Specification, System Design Process, System level design issues, Soft IP vs Hard IP, IP verification and Integration, Hardware-Software co design, Design for timing closure, Logic design issues, Verification strategy, On chip buses and interfaces, Low Power, Hardware Accelerators in Soc	**8**	**Apply CO2**
Module-3: Embedded Memories		
Embedded Memories, cache memories, flash memories, embedded DRAM. Topics related to cache memories. Cache coherence. MESI protocol and Directory-based coherence.	**8**	**Apply CO3**
Module-4: Interconnect architectures for SoC		
Interconnect architectures for SoC. Bus architecture and its limitations. Network on Chip (NOC) topologies. Mesh-based NoC. Routing in an NoC. Packet switching and wormhole routing	**8**	**Apply CO4**
Module-5: MPSoCs:		
MPSoCs: What, Why, How MPSoCs, Techniques for designing MPSoCs,Multichip Packages and chipset based design, Performance and flexibility for MPSoCs design Case Study: A Low Power Open Multimedia Application Platform for LTE.	**8**	**Analyse CO5**

Course Outcomes: After completing the course, the students will be able to	
22ECE1722.1	Learn about the blocks in the system on chip design and its performance.
22ECE1722.2	Analyze the design flow and verification of IPs used in system on chip.
22ECE1722.3	Exposure the concepts of different memory and interconnection methods in SoC
22ECE1722.4	Analyze existing Interconnect architectures for SoC and network on chip
22ECE1722.5	Design & develop the algorithms required for the design of IP and SoC and Exposure to the concept of MPSoCs
22ECE1722.6	Understand the complexity of MPSoC design and analyze its usage in real-time applications.

Reference Books

1. SudeepPasricha and NikilDutt, "On-Chip Communication Architectures: System on Chip Interconnect", Morgan Kaufmann Publishers © 2008.
2. Rao R. Tummala, MadhavanSwaminathan, "Introduction to system on package sopMiniaturization of the Entire Syste", McGraw-Hill, 2008.
3. James K. Peckol, "Embedded Systems: A Contemporary Design Tool", Wiley Student Edition.
4. Michael Keating, Pierre Bricaud, "Reuse Methodology Manual for System on Chip designs", Kluwer Academic Publishers, 2nd edition, 2008.

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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: VII

Course Name: Automotive Electronics **Course Code: 22ECE1723**

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

Pre-Requisites: Analog and Digital Circuits, Control Systems, Embedded systems, Transducers.

Course Learning Objectives: The students will be able to

1	Understand the basics of automobile dynamics and design electronics to complement those features.
2	Understand the working principle of sensors and actuators used in the automotive electronics.
3	Study the principles and functionalities of various automotive communication protocols.
4	Explore the future automotive electronic systems.

Module-1: Automotive Fundamentals Overview	**No. of Hours**	**Blooms Cognitive Levels**
Evolution of Automotive Electronics, Automobile Physical Configuration, Survey of Major Automotive Systems, The Engine - Engine Block, Cylinder Head, Four Stroke Cycle, Engine Control, Ignition System- Spark plug, High voltage circuit and distribution, Spark pulse generation, Ignition Timing, Diesel Engine, Drive Train - Transmission, Drive Shaft, Differential, Suspension, Brakes, Steering System, Starter Battery-Operating principle.	**8**	**Understand CO1**
Module-2: Automotive Sensors and Actuators		
Automotive Sensors- Automotive Control System applications of Sensors and Actuators - Variables to be measured, Airflow rate sensor, Strain Gauge MAP sensor, Engine Crankshaft Angular Position Sensor, Magnetic Reluctance Position Sensor, Hall effect Position Sensor, Shielded Field Sensor, Optical Crankshaft Position Sensor, Throttle Angle Sensor (TAS), Engine Coolant Temperature (ECT) Sensor, Exhaust Gas Oxygen (02/EGO) Lambda Sensors, Piezoelectric Knock Sensor. **Automotive Actuators**-Solenoid, Fuel Injector, EGR Actuator, Ignition System.	**8**	**Understand CO2**
Module-3: Digital Engine Control Systems		

Digital Engine control features, Control modes for fuel Control (Seven Modes), EGR Control, Electronic Ignition Control -Closed loop Ignition timing, Spark Advance Correction Scheme, Integrated Engine Control System- Secondary Air Management, Evaporative Emissions Canister Purge, Automatic System Adjustment, System Diagnostics.	**8**	**Understand CO3**
Module-4: Automotive Networking		
Bus Systems- Classification, Applications in the vehicle, Coupling of networks, Examples of networked vehicles Buses - CAN Bus, UN Bus, MOST Bus, Bluetooth, Flex Ray, Diagnostic Interfaces.	**8**	**Understand CO4**
Module-5: Automotive Diagnostics and Advanced Automotive Systems		
Automotive Diagnostics-Timing Light, Engine Analyzer, On-board diagnostics, Off-board diagnostics, Expert Systems, Occupant Protection Systems -Accelerometer based Air Bag systems. **Advanced Automotive Electronic Systems**-Alternative Fuel Engines, Electric and Hybrid vehicles, Fuel cell powered cars, Collision Avoidance Radar warning Systems, Low tire pressure warning system, Heads Up display, Speech Synthesis, Navigation - Navigation Sensors - Radio Navigation, Signpost navigation, dead reckoning navigation, Voice Recognition Cell Phone dialling, Advanced Cruise Control, Stability Augmentation, Automatic driving Control.	**8**	**Understand CO5**

Course Outcomes: After completing the course, the students will be able to	
22ECE1723.1	Acquire an overview of automotive components, subsystems, and basics of Electronic Engine Control in today‘s automotive industry.
22ECE1723.2	Explore the various automotive sensors and actuators used for the development of automotive systems using microcontrollers.
22ECE1723.3	Identify the importance of Control systems in automotive systems.
22ECE1723.4	Understand the networking of various modules in automotive systems, communication protocols and diagnostics of the sub systems.
22ECE1723.5	Highlight the design of the automotive electronic systems and explore the advanced automotive systems.
22ECE1723.6	Apply the fundamentals of electronics in the development of advanced automotive systems.

Reference Books

1. William B. Ribbens, “Understanding Automotive Electronics”, 8th Edition, Newnes, 2017.
2. Ronald K. Jurgen, “Automotive Electronics Handbook”, 2nd Edition, Mcgraw-Hill, 2007.
3. Denton, “Automotive Electrical and Electronic systems”, MA 01803, Elsevier Buttorworth-Heinemann, 2004.
4. Robert Bosch Gmbh (Ed.) Bosch Automotive Electrics and Automotive Electronics Systems and Components, Networking and Hybrid Drive, 5th edition, John Wiley& Sons Inc., 2007.

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

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: VII

Course Name: Natural Language Processing **Course Code: 22ECE1724**

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

Course Learning Objectives: The students will be able to

1	Understand, Natural Language Processing Concepts and their Applications.
2	Analysis of regular expression, parsing.
3	Semantic Analysis of Meaning Representation.
4	Understand and implement N-gram models.
5	Design of information retrieval models.

Module-1: Introduction	**No. of Hours**	**Blooms Cognitive Levels**
Introduction to Natural Language Processing, Stages in Natural Language Processing, Origins and Challenges of NLP Language and Grammar-Processing Indian Languages, Introduction to the corpus, elements in the balanced corpus. Design a Python program to illustrate corpus.	**8**	**Apply CO1**
Module-2: Word level Analysis		
Word level Analysis: Regular Expressions-Finite-State Automata-Morphological Parsing-Spelling Error Detection and correction. Part-of-Speech Tagging- Rule-based tagger, Stochastic tagger. Design python program to perform part-of-speech tagging on the text scraped from a website. Design a python program to group similar words together based on the nature of the word.	**8**	**Apply CO2**
Module-3: N-Grams		
N-Grams: Simple N-grams, Smoothing- Laplace smoothing, Good Turing Discounting, Backoff, Entropy, Morphology: Inflectional morphology, Derivational morphology. Develop a Python program to calculate good Turing frequency.	**8**	**Apply CO3**
Module-4: Lexical Semantics		
Semantic: Meaning Representation, Lexical Semantics, Word Sense Disambiguation –Selectional Restriction-based word sense disambiguation, context-based word sense disambiguation Approaches. Lexical Semantics- Python program to do text classification. Meaning Representation- Python program to represent the meaning of the given text.	**8**	**Apply CO4**
Module-5: Information Retrieval		

Information Retrieval-Design features of information retrieval systems-Indexing, eliminating stop words, Stemming, Classical information retrieval Models-Boolean model, Probabilistic model. Applications: Information extraction, Automatic text summarization, topic modelling, Question –Answer System using Python	**8**	**Apply CO5**

Course Outcomes: After completing the course, the students will be able to	
22ECE1724.1	Apply the fundamental concepts of Natural Language Processing, including its origins, challenges, and applications in processing languages and grammars.
22ECE1724.2	Develop skills to analyze text at the word level using regular expressions, morphological parsing, spelling error detection, and part-of-speech tagging.
22ECE1724.3	Understand and implement N-gram models and various smoothing techniques, including Laplace smoothing and Good Turing Discounting.
22ECE1724.4	Gain expertise in semantic analysis, including meaning representation, lexical semantics, and word sense disambiguation using Selectional restriction-based and context-based approaches.
22ECE1724.5	Design and implement information retrieval systems with features such as indexing, stop word elimination, stemming, and classical models like the Boolean and probabilistic models.
22ECE1724.6	Apply the information retrieval systems to tasks like text summarization, topic modeling, and question-answering systems.

Reference Books

1. Siddiqui T., Tiwary U. S. Natural language processing and Information retrieval, OUP, 2023.
2. James A., Natural language Understanding 2e, Pearson Education, 2019
3. Daniel Jurafsky and James H Martin, “Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics, and 2SpeechRecognition”, 2nd Edition, Prentice Hall, 2013.
4. R. Kibble Introduction to Natural Language Processing CO3354 2013
5. Bharati A., Sangal R., Chaitanya V. Natural language processing: a Paninian perspective, PHI, 2006.

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
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<tr><td colspan="3">Average of three tests – 30 Marks</td></tr>
<tr><td>Assignment</td><td colspan="3">Two assignments – Scaled to 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>

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

Semester: VII

Course Name: Fundamental of Data Science		**Course Code: 22ECE1725**
L: T: P: J	**3 : 0 : 0 : 0**	**CIA Marks:** 50
Credits:	**3**	**SEA Marks:** 50
Hours/Week (Total)	**3**	**SEA Duration:** 03 Hours

Course Learning Objectives: The students will be able to

1	Understand the fundamentals of Data Science
2	Analyze the basic tools of EDA and the data science process
3	Explore the different algorithms used in data science
4	Explore Feature Generation and Feature selection
5	Optimize and solve real life problems with different spam filters

Module-1: Fundamentals	**No. of Hours**	**Blooms Cognitive Levels**
Introduction: What is Data Science? Big Data and Data Science hype – and getting past the hype, Why now? – Datafication, Current landscape of perspectives, A data Science Profile, Skill sets. Statistical Inference, Populations and samples, Big Data, new kinds of data, modelling, statistical modeling probability distributions, fitting a model **Program – 1:** Program to find mean, standard deviation and Baye's Theorem Proof	**8**	**Apply CO1**
Module-2: Exploratory Data Analysis		
Exploratory Data Analysis and the Data Science Process: Basic tools plots, graphs and summary statistics) of EDA, Philosophy of EDA, The Data Science Process, Machine Learning Algorithms. Three Basic Algorithms: Linear Regression, k-Nearest Neighbours (kNN), k-means **Program – 2:** Given a dataset, perform EDA on it using python	**8**	**Apply CO2**
Module-3: Spam Filter		
Spam Filter, Linear Regression and Spam Filter, K-NN and spam Filter, Naïve Bayes Algorithm, Spam Filter using Naïve Bayes **Program-3:** Implementation of Spam filter using kNN algorithm	**8**	**Apply CO3**
Module-4: Feature Engineering		
Feature Generation and Feature Selection (Extracting Meaning from Data): Motivating application: user (customer) retention. Feature Generation (brainstorming, role of domain expertise, and place for imagination), Feature Selection algorithms. Filters; Wrappers; Decision Trees; Random Forests. **Program-4:** Implementation of Feature Extraction using Random Forest.	**8**	**Apply CO4**

Module-5: Recommendation Systems		
Building a User-Facing Data Product, Algorithmic ingredients of a Recommendation Engine, Dimensionality Reduction, Singular Value Decomposition, Principal Component Analysis **Program-5:** Build a recommender system using PCA	**8**	**Apply CO5**

Course Outcomes: After completing the course, the students will be able to	
22ECE1725.1	Evaluate the mean standard deviation for a given dataset.
22ECE1725.2	Explore Data Analysis and data science process.
22ECE1725.3	Understand spam filter implementation using basic Machine Learning algorithms
22ECE1725.4	Understand the working of recommendation systems using ML algorithms
22ECE1725.5	Explain feature selection and extraction algorithms
22ECE1725.6	Conduct independent study and analysis of real-world data science problems

Reference Books

1. Sanjeev J. Wagh, Manisha S. Bhende, Anuradha D. Thakare "Fundamentals of Data Science", CRC Press, 2021
2. B. Uma Maheswari, R. Sujatha, "Introduction to Data Science - Practical Approach with R and Python", Wiley, 2021
3. Cathy O Neil, Rachel Schutt, "Doing Data Science-Straight Talk from the Frontline", Orielly, 2014.
4. Jure Leskovek, Anand Rajaraman, Jeffrey Ullman, "Mining of Massive Data Sets", Cambridge UniversityPress, 2014.

Marks Distribution for Assessment:

CIA (50)	**Component**	**Description**	**Marks**
	Written Test	● Total Number of Test: 3 ● Each Theory test will be conducted for 30 marks ● Average of 3 tests = 30 Marks	30
	Assignment	Assignment – 10 Marks	10
	AAT	Open ended experiments	10
		Total Marks	**50**
SEA (50)	**Component**	**Description**	**Marks**
	Written Exam	Theory exam will be conducted for 100 marks and scaled down to 50 Marks The question paper will have 10 full questions each of 20 marks. Students have to answer 5 full questions	**50**
		Total marks for the Course	**100**

Additional Assessment Tools (AAT) –Open ended experiments.

Dept. of Electronics and Communication Engineering Choice Based Credit System (CBCS and Outcome Based Education (OBE)		
Semester: 7th		
Course Name: **Cyber security and Privacy**		**Course Code:** 22ECE1731
L:T:P:J	**3:0:0:0**	**CIA Marks:**50
Credits:	**3**	**SEA Marks:**50
Hours/Week (Total)	**3**	**SEA Duration:**03Hours
Pre-Requisites: Information systems		
Course Learning Objectives: The students will be able to		
1	Recognize cyber security from technological and administrative perspectives	
2	Articulate cyber security governance, risks and compliance in the current business environment	
3	Apply cybersecurity and information privacy in organizational context for risk assessment	
4	Develop cyber security and information privacy policy in selected business domains	

Module-1: Introduction to Cyber Security	**No. of Hours**	**Blooms Cognitive Levels**
Introduction - Introduction to cyber security, Confidentiality, integrity, and availability. **Foundations** - Fundamental concepts, CIA, CIA triangle, data breach at target. **Security management**- Introduction, Governance, risk, and compliance (GRC) - GRC framework, security standards.	**8**	**Understand CO1**
Module-2: Contingency Planning, Policy & Risk management		
Contingency planning - Incidence response, Disaster Recovery, BCP. **Cyber security policy** - ESSP, ISSP, SYSSP. **Risk Management** - Cyber Risk Identification, Assessment, and Control.	**8**	**Understand CO2**
Module-3: Cyber Security Technologies and its Industry Perspective		
Cyber security technologies - Access control, Encryption, Standards. **Industry perspective** - Defense Technologies, Attack, Exploits	**8**	**Apply CO3**
Module-4: Privacy: Foundations and its regulation		
Foundations of privacy - Information privacy, Measurement, Theories. **Privacy regulation** - Privacy, Anonymity, Regulation, Data Breach. The Indian Way - Data Protection, GDPR, DPDP, Aadhar.	**8**	**Apply CO4**
Module-5: Information Privacy		
Economics and strategy, Economic value of privacy, privacy valuation, WTA and WTC, Business strategy and privacy, espionage, Privacy vs safety.	**8**	**Apply CO5**

Course Outcomes: After completing the course, the students will be able to	
22ECE1731.1	Understand and recognize cyber security from technological and administrative perspectives
22ECE1731.2	Understand the concepts of cyber security governance, risks and compliance in the current business environment

22ECE1731.3	Apply cyber security technologies in industry perspective
22ECE1731.4	Develop cyber security and foundations of privacy policy in selected business domains.
22ECE1731.5	Apply information privacy in organizational context for risk assessment

Reference Books

1. Michael E. Whitman, Herbert J. Mattord, (2018). Principles of Information Security, 6th edition, Cenage Learning, N. Delhi.
2. Darktrace, "Technology" https://www.darktrace.com/en/technology/#machine-learning, accessed November 2018.
3. Van Kessel, P. Is cyber security about more than protection? EY Global Information Security Survey 2018-2019.
4. Johnston, A.C. and Warkentin, M. Fear appeals and information security behaviors: An empirical study. MIS Quarterly, 2010.
5. Arce I. et al. Avoiding the top 10 software security design flaws. IEEE Computer Society Center for Secure Design (CSD), 2014.
6. Smith, H. J., Dinev, T., & Xu, H. Information privacy research: an interdisciplinary review. MIS Quarterly, 2011.
7. Subramanian R. Security, privacy and politics in India: a historical review. Journal of Information Systems Security (JISSec), 2010.
8. Acquisti, A., John, L. K., & Loewenstein, G. What is privacy worth? The Journal of Legal Studies, 2013
9. Xu H., Luo X.R., Carroll J.M., Rosson M.B. The personalization privacy paradox: An exploratory study of decision making process for location-aware marketing. Decision Support Systems, 2011.

Marks Distribution for Assessment:

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</table>

B.N.M. Institute of Technology

An Autonomous Institution under VTU

7th Semester: B. E		
Course Name: C Based VLSI Design		**Course Code: 22ECE1732**
L: T:P: J	**3:0:0:0**	**CIA Marks:** 50
Credits:	**3**	**SEA Marks:** 50
Hours	**40**	**SEA Duration: 0**3 Hours

Pre-Requisites: Basic concepts in digital design, Data structures and algorithms, Verilog

Course Learning Objectives: The students will be able

1	To apply the foundational concepts of Electronic Design Automation in modern VLSI system design.
2	To introduce students to key processes in C-based VLSI design, including scheduling, resource allocation, binding, data-path/controller generation, and efficient synthesis of C code.
3	To equip students with techniques for writing hardware-efficient C code and understanding the impact of compiler optimizations on hardware design
4	To introduce methods for verifying high-level synthesis outputs and explore techniques for mapping synthesized designs onto FPGA technology.
5	To explore security challenges in high-level synthesis and examine recent advancements in C-based VLSI design methodologies.

Module-1: Introduction to EDA & C Based VLSI Design		
Introduction to Electronic Design Automation, Introduction to C-based VLSI Design: Background, Introduction to C-based VLSI Design: HLS Flow	**No. of Hrs**	**Bloom's Cognitive Levels**
	8	Apply CO1
Module–2: Scheduling, Resource allocation & Binding		
C-Based VLSI Design: Scheduling, C-Based VLSI Design: Resource allocation and Binding, Data-path and Controller Generation, Efficient Synthesis of C Code	**8**	Apply CO2
Module–3: Hardware Efficient C Coding		
Hardware Efficient C Coding, Impact of Compiler Optimizations in Hardware	**8**	Apply CO3
Module 4: High Level Synthesis		
Verification of High-level Synthesis, FPGA Technology Mapping	**8**	Apply CO4
Module–5:		
Securing Design with High-level Synthesis, Recent Advances in C-Based VLSI Design	**8**	Apply CO5

Course Outcomes: After completing the course, the students will be able to	
22ECE1732.1	Apply EDA principles and use the HLS flow to design hardware systems using C-based VLSI design techniques
22ECE1732.2	Apply scheduling, resource allocation, binding, and synthesis techniques to generate efficient hardware from C-based designs

22ECE1732.3	Write optimized C code for hardware synthesis and evaluate how compiler optimizations influence hardware performance and resource usage.
22ECE1732.4	Verify HLS-generated hardware and perform efficient FPGA technology mapping for implementation.
22ECE1732.5	Identify security issues in HLS-based designs and apply knowledge of emerging trends to improve VLSI design efficiency and reliability.

Professional Core Course (PCC)

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

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**

Text/Reference Books

1. D. D. Gajski, N. D. Dutt, A.C.-H. Wu and S.Y.-L. Lin, High-Level Synthesis: Introduction to Chip and System Design, Springer, 1st edition
2. 2. G. De Micheli. Synthesis and optimization of digital circuits, McGraw Hill, India Edition.
3. 3. Mike Fingeroff, High-Level Synthesis Blue Book, Mentor Graphics Corporation.
4. 4. Philippe Coussy and Adam Morawiec, High-level Synthesis from Algorithm to Digital Circuit, Springer
5. 5. David. C. Ku and G. De Micheli, High-level Syntehsis of ASICs Under Timing and Synchronization Constraints, Kluwer Academic Publishers.

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: VII

Course Name: Introduction to Industry 4.0 and Industrial Internet of Things **Course Code: 22ECE1735**

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

Pre-Requisites: Knowledge on IOT

Course Learning Objectives: The students will be able to

1	Understand What is Industry 4.0? and its associated technologies
2	Understand the role of IOT in industries
3	Understand layers of Industrial IOT
4	Understand role of networking and security in Industrial IOT
5	Work on real time case studies based on the application of Industrial IOT

Module-1: Introduction to Industry 4.0		
Introduction: Sensing & actuation, Communication-Part I, Part II, Networking-Part I, Part II **Industry 4.0:** Globalization and Emerging Issues, The Fourth Revolution, LEAN Production Systems, Smart and Connected Business Perspective, Smart Factories, Cyber Physical Systems and Next Generation Sensors, Collaborative Platform and Product Lifecycle Management, Augmented Reality and Virtual Reality, Artificial Intelligence, Big Data and Advanced Analysis, Cybersecurity in Industry 4.0	**No. of Hrs** **8**	**Bloom's Cognitive Levels** Understand CO1
Module–2: Introduction to Industrial IOT		
Basics of Industrial IoT: Industrial Processes-Part I, Part II, Industrial Sensing & Actuation, Industrial Internet Systems. **Industrial IoT Introduction:** Business Model and Reference Architecture: IIoT-Business Models-Part I, Part II, IIoT Reference Architecture-Part I, Part II.	**8**	Understand CO2
Module–3: Industrial IOT – Layers		
Industrial IoT- Layers: IIoT Sensing-Part I, Part II, IIoT Processing-Part I, Part II, IIoT Communication-Part I. IIoT Communication-Part II, Part III, IIoT Networking-Part I, Part II, Part III.	**8**	Apply CO3
Module 4: Industrial IOT Analytics – Networking and Security		
Big Data Analytics and Software Defined Networks: IIoT Analytics - Introduction, Machine Learning and Data Science - Part I, Part II, R and Julia Programming, Data Management with Hadoop, SDN in IIoT-Part I, Part II, Data Center Networks, Industrial IoT: Security and Fog Computing: Cloud Computing in IIoT-Part I, Part II. **Security and Fog Computing** - Fog Computing in IIoT, Security in IIoT-Part I, Part II, Industrial IoT- Application Domains: Factories and Assembly Line, Food Industry.	**8**	Apply CO4

Module–5: Application domains of Industrial IOT		
Application Domains: Healthcare, Power Plants, Inventory Management & Quality Control, Plant Safety and Security (Including AR and VR safety applications), Facility Management, Oil, chemical and pharmaceutical industry, Applications of UAVs in Industries, Real case studies	**8**	Apply CO5

Course Outcomes: After completing the course, the students will be able to	
22ECE1735.1	Understand What is Industry 4.0? and its associated technologies
22ECE1735.2	Understand the role of IOT in industries
22ECE1735.3	Understand layers of Industrial IOT
22ECE1735.4	Understand role of networking and security in Industrial IOT
22ECE1735.5	Work on real time case studies based on the application of Industrial IOT

Professional Core Course (PCC)

PCC		CIA	SEA	CIA (50)				SEA Conduction: 100 M Reduced to: 50 M
					I	II	III	
Conduction		50	50	Written Test	30	30	30	Five questions with each of 20 marks (with internal choice). Student should answer one full question from each module
					Average of three tests – 30 Marks			
				Assignment	10			
				AAT	10			
				Total – 50 marks				Total – 50 marks

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 eachmodule	20 M x 5 = **100 M** **Reduced to 50 M**
	Total	**50 Marks**

Reference Books

1) S. Misra, A. Mukherjee, and A. Roy, 2020. *Introduction to IoT*. Cambridge University Press.

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

BNM Institute of Technology

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

Semester: VII

RESEARCH METHODOLOGY AND IPR

Course Code: 22ECE174	**L:T:P:J: 2:0:0:0**	**CIE Marks :** 50
Credits:	**2**	**SEE Marks:** 50
Hours:	**25**	**SEE Duration: 03** Hours

Pre-Requisites: Use of internet and online database, clarity on research question/problem and basic of statistics

Course Learning Objectives: The students will be able to

1	To give an overview of the research methodology and explain the technique of defining a research problem
2	To explain the functions of literature review, carry out literature search and develop conceptual frameworks
3	To explain various experimental designs in research and data handling like data sampling and data collection methods
4	To interpret the research findings and prepare a research report
5	To build awareness on the various forms of IPR and to build the perspectives on the concepts and to develop the linkages in technology innovation and IPR.

Module-1: Introduction to Research Methodology

	No. of Hrs	Blooms cognitive Levels
Research Methodology: Introduction, Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Importance of Knowing How Research is Done, Research Process, Criteria of Good Research **Defining the Research Problem**: Research Problem, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem, An Illustration Problems Encountered by Researchers in India.	**05**	**Understand CO1**

Module–2: Literature Review

	No. of Hrs	Blooms cognitive Levels
Reviewing the literature: Place of the literature review in research, Bringing clarity and focus to your research problem, Improving research methodology, Broadening knowledge base in research area, enabling contextual findings, How to review the literature, searching the existing literature, reviewing the selected literature, developing a theoretical framework, Developing a conceptual framework, writing about the literature reviewed. **Research Design**: Meaning of Research Design, Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental Designs, Important Experimental Designs. Use of Endnote or mendeley	**05**	**Apply CO2**

Module–3: Data Sampling and Testing of Hypothesis		
Design of Sampling: Introduction, Sample Design, Sampling and Non- sampling Errors, Types of Sampling Designs. **Data Collection**: Qualitative and Quantitative Data, Experimental and Surveys, Collection of Primary Data, Collection of Secondary Data, Selection of Appropriate Method for Data Collection. **Testing of Hypotheses**: Hypothesis, Basic Concepts concerning Testing of Hypotheses, Procedure for Hypothesis Testing, P-Value approach, Limitations of the Tests of Hypothesis. Case Study Method, ANOVA test using excel or similar tools.	**No. of Hrs** **05**	**Blooms cognitive Levels** **Apply CO3**
Module–4: Interpretation and Report Writing		
Interpretation: Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation. **Report Writing**: Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports. Introduction to Latex and various templates for report and paper writing.	**No. of Hrs** **05**	**Blooms cognitive Levels** **Analyze CO4**
Module–5: Intellectual Property Rights		
Intellectual Property: The Concept, Intellectual Property System in India, Development of TRIPS Complied, Regime in India, Patents Act, 1970, Trade Mark Act, 1999, The Designs Act, 2000, The Geographical Indications of Goods (Registration and Protection) Act1999, Copyright Act,1957, The Protection of Plant Varieties and Farmers' Rights Act, 2001, The Semi-Conductor Integrated Circuits Layout Design Act, 2000, Trade Secrets, Utility Models, IPR and Biodiversity, The Convention on Biological Diversity (CBD) 1992, Competing Rationales for Protection of IPRs, Leading International Instruments Concerning IPR, World Intellectual Property, Organisation (WIPO), WIPO and WTO, Paris Convention for the Protection of Industrial Property, National Treatment, Right of Priority, Common Rules, Patents, Marks, Industrial Designs, Trade Names, Indications of Source, Unfair Competition, Introduction to Patents and Copyrights. Case study on company IPR	**No. of Hrs** **05**	**Blooms cognitive Levels** **Understand CO5**

Course Outcomes: After completing the course, the students will be able to	
22ECE174.1	Understand and define research problem
22ECE174.2	Explain and carry out literature review based on the research problem
22ECE174.3	Apply sampling and data collection techniques and carry out parametric testsof Hypothesis for the research problem
22ECE174.4	Interpret the research findings and create a report
22ECE174.5	Explain various forms of IPR and develop the linkages in technology innovation and IPR
22ECE174.6	Understand and define research problem

Reference Books

1. C.R. Kothari, Gaurav Garg, "Research Methodology: Methods and Techniques", New Age International 4 th Edition, 2018.
2. Ranjit Kumar, "Research Methodology a step-by-step guide for beginners" (For the topic Reviewing the literature under module 2), SAGE Publications 3 rd Edition, 2011.
3. Firuza Karmali (Aibara), " A Short Introduction to LaTeX: A Book for Beginners", Create space Independent Publishing Platform, 2019.
4. Trochim, "Research Methods: the concise knowledge base", Atomic Dog Publishing 2005.
5. Fink A, "Conducting Research Literature Reviews: From the Internet to Paper", Sage Publications 2009.

Marks Distribution for Assessment:

CIA (50)	**Component**	**Description**	**Marks**
	Written Test	● Total Number of Test: 3 ● Each Theory test will be conducted for 30 marks ● Average of 3 tests = 30 Marks	30
	Assignment	Review Paper Writing	10
	AAT	Hypothesis testing using Anova	10
		Total Marks	**50**
SEA (50)	**Component**	**Description**	**Marks**
	Written Exam	Theory exam will be conducted for 100 marks and scaled down to 50 Marks The question paper will have 10 full questions each of 20 marks. Students must answer 5 full questions	**50**
		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