Department: Electronics and Computer Engineering **Rev:** Course Structure/01/NEP/2023-24

Class: T.Y. B. Tech **Semester:** V

Course Code	Course Type	Course	Teaching Scheme				Evaluation Scheme					Credits
			L	T	P	Total Hrs.	CA1	CA2	MSE	ESE	Total	
23EC3501	PCC	Digital Signal Processing	3	-	-	3	10	10	30	50	100	3
23EC3502	PCC	Embedded System	3	-	-	3	10	10	30	50	100	3
23EC3503	PCC	Object Oriented Programming	3	-	-	3	10	10	30	50	100	3
23EC3504	PEC	Program Elective Course -I	3	-	-	3	10	10	30	50	100	3
23EC3505	PCC	Digital Signal Processing Laboratory	-	-	2	2	15	15	-	20	50	1
23EC3506	PCC	Embedded System Laboratory	-	-	2	2	15	15	-	20	50	1
23EC3507	PCC	Object Oriented Programming Laboratory	-	-	2	2	15	15	-	20	50	1
23EC3508	CEP	Mini Project – III	-	-	2	2	25	25		-	50	1
23EC3509	INT/FT	Industrial Training / Field Training – I	-	-	-	-	-	-	-	-	50	Audit
23ECMDXX	MDM	Multidisciplinary Minor-III	3	-	-	3	10	10	30	50	100	3
23OEEC31	OE*	Open Elective-III	3	-	-	3	10	10	30	50	100	3
23HSSM05	VEC	Aptitude Skills–III	1	-	-	1	25	25	-	-	50	Audit
23HSSM06	VEC	Language Skills–III	-	-	2	2	25	25		-	50	Audit
		Total	**19**	**-**	**10**	**29**	**180**	**180**	**180**	**360**	**950**	**22**

Biomedical Engineering (Basket A)	Data Science (Basket B)	Industrial Automation (Basket C)
Control System (23ECMDA3)	Data Science and Its Application (23ECMDB3)	Control System (23ECMDC3)

Program Elective Course -I	A. Fuzzy Logic and Neural Network
	B. Network Theory
	C. Object Oriented Analysis and Modelling

Note- (OE*) Open Elective-II Course will be offered to students of other programs and will not be offered to the students of the same program.

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Digital Signal Processing

23EC3501	PCC	Digital Signal Processing	4-0-0	4 Credits

Teaching Scheme:	**Evaluation Scheme:**
Lecture: 4 hrs/week	CA-I: 10 Marks CA-II: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Basics of mathematics.

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

CO1	Interpret various signals and systems.
CO2	Apply Fourier Transform and Z transform techniques for arbitrary and periodic signals.
CO3	Analyze concept of DFT and apply to discrete-time signals.
CO4	Design and realize IIR and FIR filter using several techniques.

Course Contents:

Unit 1: Fundamentals of Signal and System Standard signals- Step, Ramp, Pulse, Impulse, Real and complex exponentials and Sinusoids, Classification of signals- Continuous time (CT) and Discrete Time (DT) signals, Periodic & Aperiodic signals, Deterministic & Random signals, Energy & Power signals Classification of systems- CT systems and DT systems- — Linear & Nonlinear, Time-variant & Time-invariant, Causal & Non-causal, Stable & Unstable.	[6]
Unit 2: Fourier Series and Fourier Transform Fourier series: Representation of Fourier series, Continuous-time periodic signals, Properties of Fourier Series, Dirichlet's conditions, Trigonometric Fourier Series and Exponential Fourier Series, Complex Fourier spectrum. Fourier Transforms: Deriving Fourier Transform from Fourier series, Fourier Transform of arbitrary signal, Fourier Transform of standard signals, Fourier Transform of Periodic Signals, Properties of Fourier Transform.	[6]
Unit 3: Z transform Z-transform and its properties, Inverse z-transforms; Solution of difference equation using Z transform, relation between FT and ZT, relation between S plane and Z plane, Stability criteria.	[6]
Unit 4: Discrete Fourier Transform Introduction, Discrete Fourier transform (DFT), properties of DFT, Circular and linear convolution, method of circular convolution of two sequences, Filtering long duration sequences – overlap save and overlap-add method.	[6]
Unit 5: Infinite Impulse Response Digital filters Introduction, Design of analog Butterworth and Chebyshev Filters, Frequency transformation in analog domain, Design of IIR digital filters from Analog filters - Impulse invariance techniques, Bilinear transform, Realization of IIR filters - Direct, cascade, and parallel forms.	[6]
Unit 6: Finite Impulse Response Digital Filters Introduction, Linear phase FIR filters, Location zeros of linear phase FIR filters, Design FIR filters using Hamming Window, Hanning Window and Rectangular Windows, Frequency sampling method of designing FIR filters, Realization of FIR filters Linear phase structures, Transversal structures.	[6]

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Text Books:

1. Signals and Systems;-P.Ramesh Babu et al, 5th Edition, Scitech publishers, 2017.
2. Digital Signal Processing - 4th Edition -2007 ,P Ramesh babu.
3. Digital Signal Processing, Principles, Algorithms, and Applications: John G. Proakis, Dimitris G. Manolakis. Pearson Education , PHI. 2007.
4. Discrete Time Signal Processing. V. Oppenheim and R.W. Schaffer. PHI.
5. Fundamentals of Digital Signal Processing - Loney Ludeman. John Wiley, 2009

Reference Books:

1. Digital Signal Processing - Fundamentals and Applications - Li Tan, Elsevier. 2008
2. Fundamentals of Digital Signal Processing using Matlab - Robert J. Schilling. Sandra L, Harris, Thomson. 2007
3. Digital Signal Processing - S.Salivahanan. A.Vallavaraj and CGnanapriya.TMH.2009
4. Discrete Systems and Digital Signal Processing with MATLAB -Taan S.EIAli.CRC press. 2009

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Embedded System

23EC3502	PCC	Embedded System	3-0-0	3 Credits

Teaching Scheme:	**Evaluation Scheme:**
Lecture: 3 hrs/week	CA-I: 10 Marks CA-II: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Digital Electronics.

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

CO1	Explain the architecture, features, and working of microcontrollers.
CO2	Make use of assembly language and embedded c for interfacing external peripherals.
CO3	Explain Fundamental concepts of Embedded System.
CO4	Apply embedded system concepts and communication protocols for real-world applications.
CO5	Develop real-time applications using RTOS-based task scheduling techniques.
CO6	Analyze power optimization, fault tolerance, and safety aspects in embedded systems.

Course Contents:

Unit 1: Introduction to Microcontrollers Evolution of Microcontrollers, Microprocessor vs. Microcontroller, RISC vs. CISC Architecture, Overview of 8051 Microcontroller, Pin Configuration, Memory Organization, and Special Function Registers (SFRs), Instruction Set, Addressing Modes, and Assembly Language Programming, Basics of Embedded C for 8051	[6]
Unit 2: Advanced Microcontrollers and Interfacing ARM Cortex-M Series: Features and Architecture, GPIO, Timers, Interrupts, PWM in ARM Cortex-M, Introduction to AVR and PIC Microcontrollers, Serial Communication Protocols: UART, SPI, I2C, Interfacing External Peripherals (LCD, Keypad, Sensors, Motors) Case Study: Industrial Process Control Using ARM Cortex	[6]
Unit 3: Embedded System Fundamentals Definition and Classification of Embedded Systems, Components of Embedded Systems, Embedded Hardware: Processors, Memory, Peripherals, Embedded Software: Firmware, Drivers, and Application Software, Development Tools: Compilers, Debuggers, Emulators, Software Development Life Cycle (SDLC) in Embedded Systems.	[6]
Unit 4: Embedded System Design & Development Embedded System Design Process, Requirement Analysis and Specification Writing Embedded System Modeling and Design Tools (UML, SysML), Hardware and Software Co-design, Firmware Development and Testing Strategies, Embedded System Performance Analysis, Case Study: Design of a Real-Time Temperature Monitoring System.	[6]
Unit 5: Real-Time Operating Systems (RTOS) Introduction to RTOS: Differences from General OS, Task Scheduling: Cooperative vs. Preemptive Scheduling, Multithreading, Inter-Process Communication (IPC) Synchronization Mechanisms: Mutexes, Semaphores, RTOS-based Design Considerations Case Study: RTOS-Based Traffic Light Controller.	[6]

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Unit 6: Power Optimization, Reliability, and Safety in Embedded Systems Fault Tolerance and Reliability in Embedded Systems, Power Optimization Techniques in Microcontrollers, Watchdog Timers and Reset Mechanisms, Embedded System Testing and Debugging, Safety Standards: ISO 26262 (Automotive), DO-178C (Aerospace)	[6]

Text Books:

1. Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinlay, The 8051 Microcontroller and Embedded Systems, Pearson Education.
2. Raj Kamal, Embedded Systems: Architecture, Programming and Design, McGraw Hill.
3. Joseph Yiu, The Definitive Guide to ARM Cortex-M3 and Cortex-M4 Processors, Elsevier

Reference Books:

1. Wayne Wolf, Computers as Components: Principles of Embedded Computing System Design, Elsevier.
2. Frank Vahid, Tony Givargis, Embedded System Design: A Unified Hardware/Software Introduction, Wiley.
3. David E. Simon, An Embedded Software Primer, Pearson Education.

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Object Oriented Programming

23EC3503	PCC	Object Oriented Programming	3-0-0	3 Credits

Teaching Scheme:	**Evaluation Scheme:**
Lecture: 3 hrs/week	CA-I: 10 Marks CA-II: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Digital Electronics.

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

CO1	Develop programs using object-oriented methodology in java.
CO2	Apply concept of inheritance for code reusability.
CO3	Develop program using multithreading.
CO4	Develop exception handling.
CO5	Develop programs for handling I/O and file streams.
CO6	Develop programs using graphics and applets.

Course Contents:

Unit 1: Basic Syntactical Constructs in Java Java features and java programming environment define class; create object and accessing members, java tokens, data types, and constants. Variables dynamic initialization array string typecasting etc. Operators, expression Operator precedence, evaluation of expression, mathematical functions. Decision making and looping– If, If-Else, nested If-Else. Switch case Conditional operator, while loop, do-while loop, for loop, Continue, return keywords, nesting loops	[6]
Unit 2: Derived Syntactical Construct in Java Constructors and Methods, Types of constructors, Nesting of Methods, This keyword, command line argument. garbage collection, finalize () method, object Class. Visibility control –private, public and protected. Friendly private protected access, default, Examples of visibility control, Arrays and Strings – types of arrays, String classes and string buffers. Vectors, Wrapper classes and enumerated types.	[6]
Unit 3: Inheritance, Interface and Package Inheritance and its types, Types of inheritance Operator over loading and operator over riding Dynamic method dispatch. Final variable and method Using super abstract methods and classes, static members Interfaces –define, implement and access.	[6]
Unit 4: Exception Handling and Multithreading Errors and Exception, types of errors Try, catch, nested try catch Throws, finally statement, build-in exception, creating own exception Examples of exception handling, Multithreaded programming–Creating threads–using ex tending thread class and runnable interface, Thread lifecycle–wait(), notify(), sleep(), suspend() ,stop().	[6]
Unit 5: Managing Input Output Files In Java Introduction and concept of stream, stream classes, By the stream classes, input stream classes, output stream classes Examples of file handling using stream classes Character stream classes Using File IO Class: IO exceptions, creation of files, reading and writing files Handling primitive data types Examples of handling primitive data types	[6]

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Unit 6: Graphics in Java Introduction to applet-Applet, Applet Life Cycle. Example of Applet life cycle, html parameters and embedding Applet Graphics Programming– Classes, Line, Examples of graphic programming using Rectangles, circles, Examples of graphic programming using, arcs, polygons.	[6]
Text Books: 1. The complete Reference Java, Herbert Scheildt TMH. 2. Computer Programming in JAVA Junaid Khateel & Dr.G.T.Thampi Dream Tech Press. 3. Core JAVA for Beginners Sharnam Shah & Vaishali Shah SPD.	
Reference Books: 1. Programming in JAVA a primer E Balagurusamy TMH. 2. Programming in JAVA Sachin Malhotra, Saurabh Chaudhary Oxford University Press.	

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Program Elective Course-I

23EC3504A	PEC	Fuzzy Logic and Neural Network	3-0-0	3 Credits

Teaching Scheme:	Evaluation Scheme:
Lecture: 3 hrs/week	CA-I: 10 Marks CA-II: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Physics.

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

CO1	Compare different Neural Network model.
CO2	Analyze various techniques in feedback and feed forward neural network.
CO3	Apply the concept of fuzziness involved in various systems.
CO4	Classify knowledge of application of fuzzy logic control to real time systems.

Course Contents:

Unit 1: Architecture of Neural Networks Introduction to Neural Networks, Humans and Computers, Organization of the Brain, Biological Neuron, Biological and Artificial Neuron Models, Hodgkin-Huxley Neuron Model, Integrate-and-Fire Neuron Model, Spiking Neuron Model, Characteristics of ANN, McCulloch-Pitts Model, Historical Developments, Potential Applications of ANN.	[6]
Unit 2: Essentials of Artificial Neural Networks Artificial Neuron Model, Operations of Artificial Neuron, Types of Neuron Activation Function, ANN Architectures, Classification Taxonomy of ANN – Connectivity, Neural Dynamics (Activation and Synaptic), Learning Strategy (Supervised, Unsupervised, Reinforcement), Learning Rules, Types of Application.	[6]
Unit 3: Single Layer Feed Forward Neural Networks Introduction, Perceptron Models: Discrete, Continuous and Multi-Category, Training Algorithms: Discrete and Continuous Perceptron Networks, Perceptron Convergence theorem, Limitations of the Perceptron Model, Applications. Multilayer Feed forward Neural Networks: Credit Assignment Problem, Generalized Delta Rule, Derivation of Backpropagation (BP) Training, Summary of Backpropagation Algorithm, Kolmogorov Theorem, Learning Difficulties and Improvements.	[6]
Unit 4: Classical & Fuzzy Sets Introduction to fuzzy logic, classical sets - properties, Operations and relations; Fuzzy sets, Membership, Uncertainty, Operations, properties, fuzzy relations, cardinalities, membership functions.	[6]
Unit 5: Fuzzy Logic System Components Fuzzification, Membership value assignment, development of rule base and decision-making system, Defuzzification to crisp sets, Defuzzification methods,	[6]
Unit 6: Applications Neural network Applications: healthcare, business, forecasting, image processing and compression. Fuzzy logic: Medicine and Economics.	[6]

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Text Books:

1. Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications by Rajasekharan and Rai – PHI Publication.
2. Introduction to Neural Networks using MATLAB 6.0 - S.N.Sivanandam, S.Sumathi, S.N.Deepa, TMH, 2006
3. Fuzzy logic and Neural Networks ,M Amirthavalli, SCITECH publication

Reference Books

1. Neural Networks – James A Freeman and Davis Skapura, Pearson Education, 2002.
2. Neural Networks and Learning Machines – Simon Haykins , Pearson Education
3. Neural Engineering by C. Eliasmith and CH. Anderson, PHI
4. Neural Networks and Fuzzy Logic System by Bart Kosko, Pearson Education.

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Program Elective Course-I

23EC3504B	PEC	Network Theory	3-0-0	3 Credits

Teaching Scheme:	**Evaluation Scheme:**
Lecture: 3 hrs/week	CA-I: 10 Marks CA-II: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Physics.

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

CO1	Classify network elements & apply mesh & node analysis.
CO2	Make use of network theorems to analysis linear circuits.
CO3	Determine two port network parameters & interrelation between parameters.
CO4	Explain the concept of series and parallel resonance and define selectivity, bandwidth & quality factor.
CO5	Apply Laplace transform to find transient response as RLC circuit.
CO6	Design and analysis different filters.

Course Contents:

Unit 1: Basic Concepts Basic Electrical Elements, Classification of Network Elements, Energy and Power in Network elements, Mesh and Node Analysis: Loop and Node Analysis with Dependent and independent sources, Super Mesh and Super Node Analysis.	[6]
Unit 2: Network Theorems Maximum Power Transfer Theorem, Principle of Dual Networks, Analysis of Networks using Superposition theorem, Reciprocity Theorem, Thevenin's Theorem, Norton's, Theorem, Millman's Theorem.	[6]
Unit 3: Two port Network Two port networks (z, y) Two port networks parameters, interrelationship between parameters, cascade connection of two port networks.	[6]
Unit 4: Network Topology Basic Terminology: Graph, Types of Graphs, Planar and Non-Planar Graph, Tree, Co-tree, Matrices Associated with Network Graphs: Incidence Matrix, Fundamental Loop Matrix, Fundamental Cutset Matrix with examples.	[6]
Unit 5: Transient Analysis Behavior of circuit elements under switching condition and their Representation, Evaluation of initial and final conditions in RL, RC and RLC circuits for AC and DC excitations with Laplace transforms.	[6]
Unit 6: Filters Definitions, classification & characteristics of different filters, filter fundamental such as attenuation constant, phase shift, propagation constant, characteristic impedance, decibel, neper. Design & analysis of constant K, M derived & composite filters (low pass, high pass, band pass & band stop filters): T & Pi sections.	[6]

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Text Books:

1. A. Sudhakar, Shyammohan S.Palli 'Circuit & Network – Analysis & Synthesis' IIIrd Edition – Tata McGraw Hill Publication (Unit II,IV,V)
2. A.Chakrabarti 'Circuit Theory (Analysis & Synthesis)' - IIIrd Edition (Unit I,II) Dhanpat Rai & co
3. D. Roy Choudhury 'Networks & Systems' - New Age International Publisher (Unit I, II, III)
4. Soni Gupta 'Electrical Circuit Analysis' Dhanpat Rai & Co. (Unit III, IV, V, VI)

Reference Books:

1. William H Hayt, Jack E Kimmerly and Steven M.Durbin, Engineering Circuit Analysis, Tata McGraw Hill
2. M.E.Van Valkenburg ' Network Analysis' – IIIrd Edition , Pearson Education / PHI
3. Josheph Edministrar 'Theory & Problems of Electronic Circuit (Schaum's series) – Tata McGraw Hill, Publication
4. R.G .Kaduskar, S.O.Rajankar, T.S. Khatavkar, Network Fundamentals and Analysis – Wile

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Program Elective Course-I

23EC3504C	PEC	Object Oriented Analysis and Modelling	3-0-0	3 Credits

Teaching Scheme:	Evaluation Scheme:
Lecture: 3 hrs/week	CA-I: 10 Marks CA-II: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Software Engineering.

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

CO1	Explain the basic concepts of object-oriented modeling & its representations concepts.
CO2	Illustrate class modeling concepts.
CO3	Illustrate object modeling.
CO4	Explain basic behavioral modelling.
CO5	Apply advanced behavioral modelling concepts on data.
CO6	Make use of architectural modelling for presentation of data.

Course Contents:

Unit 1: Importance of Modeling Object Orientation -Object Oriented Development and Themes - OO methodology, Three Models, OO Themes: Abstraction, Encapsulation, combining data and behavior, Modeling as Design techniques - Brief overview of OMT by Rumbaugh, Importance of Modeling, Four principles of Modeling, Introducing the UML – overview, conceptual model, architecture, software development lifecycle	[6]
Unit 2: Class Modeling: Object and Class Concepts Objects, Classes, Class Diagrams, Values and Attributes, Operations and Methods, Link and Association concepts -Links and Associations, Multiplicity, Association and Names, Ordering, Association Classes, Qualified Association, Generalization, and Inheritance - Use of Generalization, Sample Class Model.	[6]
Unit 3: Class Modeling: Multiplicity, Aggregation and Object Modeling, Multiplicity, Aggregation, Aggregation Versus Association, Propagation of operations, Multiple Inheritance, Metadata and Constraints-Metadata, Constraints on objects and links, Object modeling, Object instances, Sample Object Model	[6]
Unit 4: Basic Behavioral Modeling Use case Diagram: Notations for Use case diagram – use cases, Actors, Communication lines, System boundaries, Use case relationships - Include and extend, Use case generalization, Sample use case diagrams Sequence Diagrams: Notations for Sequence diagram – Objects/ Participants, Time, events, Activation Bars, signals, message arrows, synchronous and asynchronous messages, return message, create and destroy message, Structured control – optional, conditional, parallel, loop execution, Sample sequence diagrams	[6]

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Unit 5: Advanced Behavioral Modeling Activity Diagram: Notations for Activity Diagram – Actions and Activity nodes, initialization and completion, Decisions, Join and fork, Doing multiple tasks at the same time -Swim lanes, Sample Activity Diagram State Diagram, Notations for State diagram – initial state, final state, transitions and conditions, activity, event, Nested state diagram, concurrent / composite state diagram, Sample state diagram.	[6]
Unit 6: Architectural modeling Component Diagram: Notations for component Diagram – component and interfaces, ports, connectors Sample Component Diagram Deployment Diagram: Notations for Deployment diagram – nodes, artifacts, node instances, communication between nodes, Sample Deployment diagram	[6]

Text Books:

1. Michael Blaha, James Rumbaugh: Object-Oriented Modeling and Design with UML, 2nd Edition, Pearson Education, 2005.
2. Frank Buschmann, Regine Meunier, Hans Rohnert, Peter Sommerlad, Michael Stal: Pattern-Oriented Software Architecture, A System of Patterns, Volume 1, John Wiley and Sons, 2007.
3. Grady Booch et al: Object-Oriented Analysis and Design with Applications, 3 rd Edition, Pearson Education, 2007.

Reference Books

1. Brahma Dathan, Sarnath Ramnath: Object-Oriented Analysis, Design, and Implementation, Universities Press, 2009.
2. Hans-Erik Eriksson, Magnus Penker, Brian Lyons, David Fado: UML 2 Toolkit, Wiley- Dreamtech India, 2004.
3. Simon Bennett, Steve McRobb and Ray Farmer: Object-Oriented Systems Analysis and Design Using UML, 2 nd Edition, Tata McGraw-Hill, 2002

Digital Signal Processing Laboratory

23EC3505	PCC	Digital Signal Processing Laboratory	0-0-2	1 Credits

Teaching Scheme:	**Evaluation Scheme:**
Practical: 2 hrs/week	CA-I: 15 Marks CA-II: 15 Marks End Semester Exam: 20 Marks

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

CO1	Demonstrate elementary signals /waveforms and perform the mathematical operation on discrete signals.
CO2	Apply Fourier series, Fourier transform and z transform on different signal
CO3	Determine the magnitude and phase response of DFT, Inverse DFT
CO4	Design IIR and FIR filter using window techniques.

Experiment List:

01.	To construct a program to plot the following continuous time and discrete time Signals. i. Step Function ii. Impulse Function iii. Exponential Function iv. Ramp Function v. Sine Function
02.	To compose a program for some basic operations like addition, subtraction, shifting and folding on signal
03.	To construct a program to generate Fourier series of a Square Wave.
04.	Evaluate Z Transform of given Signal
05.	To find the DFT/IDFT of a sequence without using the inbuilt functions.
06.	To identify Circular Convolution for given sequence.
07.	To design Low Pass IIR filter for given sequence.
08.	To design High Pass IIR filter for given sequence.
09.	To develop Low Pass FIR filter for given sequence.
10.	To develop of High Pass FIR filter for given sequence.

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Embedded System Laboratory

23EC3506	PCC	Embedded System Laboratory	0-0-2	1 Credits

Teaching Scheme:	**Evaluation Scheme:**
Practical: 2 hrs/week	CA-I: 15 Marks CA-II: 15 Marks End Semester Exam: 20 Marks

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

CO1	Develop knowledge about fundamentals of microcontrollers and Embedded system and its operation.
CO2	Develop Programming skills in embedded systems for various applications.
CO3	Demonstrate serial communication and porting of RTOS on an ARM-based controller."

Experiment List:

01.	Introduction to Microcontroller and Embedded System
02.	Program for turning ON LEDs sequentially using Microcontroller
03.	Program for controlling DC Motor using Microcontroller
04.	Program for controlling stepper Motor using Microcontroller.
05.	a. Program for generating saw-tooth wave using DAC.
05.	b. Program for generating sine wave using DAC.
06.	Program for Polled Loops
07.	Program for Rate Monotonic Scheduling
08.	Program for Earliest Deadline Scheduling
09.	Program for Shared Memory Communication

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Object Oriented Programming Laboratory

23EC3507	PCC	Object Oriented Programming Laboratory	0-0-2	1 Credits

Teaching Scheme:	**Evaluation Scheme:**
Practical: 2 hrs/week	CA-I: 15 Marks CA-II: 15 Marks End Semester Exam: 20 Marks

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

CO1	Interpret the java programming environments
CO2	Develop a program to demonstrate use of decision making and Looping
CO3	Apply programming skills for handling I/O, file streams, graphics and applets.

Experiment List:

01.	Develop program to demonstrate use of IF statement and its different forms.
02.	Develop programs to demonstrate use of a) Switch Case statement b) Conditional If()
03.	Develop programs to demonstrate use of looping statement '_for'
04.	Develop programs to demonstrate use of _while' , _do while'
05.	a) Develop program for implementation of constructor. b) Develop program for implementation of multiple constructors in a class.
06.	Develop program for implementation arrays in java.
07.	Develop program for implementation vectors in java.
08.	Develop program for implementation wrapper class.
09.	Develop program which implements concept of overriding.
10.	Develop program which implement single and multilevel inheritance.
11	Develop minimum two basic applets. Display output with applet viewers and graphics. a) Develop program on basic applet. b) Develop a program using control loops in applets
12	Write a program to create animated shape using graphics and applets.
13	Develop a program to draw following shapes, graphics and applets a) Cone b) Cylinders c) Cube d) Square inside a circle e) Circle inside a square
14	Develop a program to implementation of I/O stream classes.
15	Develop a program to implementation of File stream classes.

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Mini Project-III

23EC3508	CEP	Mini Project III-Hackathon	0-0-2	1 Credit

Teaching Scheme:	**Evaluation Scheme:**
Practical:2Hrs/week	CA-I: 25 Marks CA-II: 25 Marks

Pre-Requisites: Mini Project, Mini Project II.

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

CO1	Select the appropriate method for solving the problem
CO2	Make use of various engineering techniques and tools to give a solution
CO3	Justify the methods /tools used to develop the solution
CO4	Design / simulate the model/ project work
CO5	Summarize the solution with help of a project report and presentation

About Hackathon:

The project is a part of addressing societal and industrial needs. Hackathon is one of the platforms where students will solve real world challenges. This Course focuses on the selection of methods/engineering tools/analytical techniques for problem solving.

Through this course, students will gain the understanding of engineering basics and ideas, gain practical experience, have the opportunity to display their skills and learn about teamwork, financial management, communication skills and responsibility

Course Contents:

Week 1: Survey Design-1 • Ensure case study group students have made necessary communication and done a preparatory visit. • Watch the lecture on survey design and study the notes. • Prepare a questionnaire and try it out with your group members as mock.	[2]
Week 2: Survey Design-2 • Review survey questionnaire prepared by case study groups. • Decide sampling strategy. • Prepare a detailed schedule for fieldwork	[2]
Week 3: Fieldwork • Data Collection: Collect quantitative data (e.g., statistics, usage metrics) and qualitative data (e.g., user stories, testimonials). • Use data collection tools like questionnaires, observation checklists, and digital analytics. • Ensure data accuracy and reliability through proper sampling and recording methods. • 25% Presentation has to be conducted by mentor/guide based on above activity	[2]
Week 4: Trails and Experimentation-1 • Initial Setup and Configuration • Concept Validation • Feasibility Testing	[2]
Week 5: Trails and Experimentation-2 • Prototyping • Functionality Testing	[2]

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Week 6: Trails and Experimentation-3 • Bug Identification and Fixing • Integration Testing • Security Testing • 75% Presentation has to be conducted by mentor/guide based on above activity.	[2]
Week 7 : Results • Coordinator has to check and verify below points in term of result: • Functional Performance • Accuracy and Precision • Efficiency • Safety	[2]
Week 8: Validation • Coordinator has to check and verify below points in term of validation: • Testing and Verification • Compliance with Standards • 75% Presentation has to be conducted by mentor/guide based on above activity.	[2]
Week 9: Integration Testing • Validate that the hardware integrates seamlessly with other systems or components as intended • Perform compatibility tests with software, other hardware, and network systems.	[2]
Week 10: Documentation and Reporting • Maintain comprehensive documentation of design, development, testing, and validation processes • Provide detailed reports on test results, issues found, and corrective actions taken.	[2]
Week 11: Final Presentation • 100% Presentation has to be conducted by mentor/guide based on above activity. • Prototype/Final Software solution is mandatory at the time of final presentation along with report.	[2]

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Industrial Training/Field Training-I

23EC3509	INT/FT	Industrial Training/Field Training-I	0-0-0	Audit

Teaching Scheme:	**Evaluation Scheme:**
NA	End Semester Exam: 50 Marks

Course Description:

Internship / Training is educational and career development opportunity, providing practical experience in a field or discipline. At the end of the Fourth and Fifth semester, every student should undergo practicaltraining in an industry / professional organization / Research laboratory with the prior approval of the HOD/TPO/Principal of the college and submit the report along with the completion certification from the Industry/ Organization. The report will be evaluated during the Sixth semester by the department.

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

CO1	Show the Technical knowledge in real industrial situations.
CO2	Develop interpersonal communication skills.
CO3	Discuss activities and functions of the industry in which the Internship/training has done.
CO4	Outline the technical report

About Hackathon

The project is a part of addressing societal and industrial needs. Hackathon is one of the platforms where students will solve real world challenges. This Course focuses on the selection of methods/engineering tools/analytical techniques for problem solving.

Through this course, students will gain the understanding of engineering basics and ideas, gain practical experience, have the opportunity to display their skills and learn about teamwork, financial management, communication skills and responsibility

Prerequisite: - Basics of Computer Science Engineering, Good written and Oral Communication.

Guideline for Students::

01	Arrive at work as per schedule, ready to work and stay for the agreed upon time.
02	Always present yourself in a professional manner, including being appropriately dressed at workplace.
03	Communicate any concerns with your supervisor and the internship/Training coordinator in a timely manner and respectfully.
04	Demonstrate enthusiasm and interest in what you are doing, ask questions and take the initiative as appropriate.
05	Complete and submit assigned tasks by designated timelines. Meet all deadlines.

Student's Diary/ Daily Log

The main purpose of writing daily diary is to cultivate the habit of documenting and to encourage the students to searchfor details. It develops the students' thought process and reasoning abilities. The students should record in the daily training diary the day to day account of the observations, impressions, information gathered and suggestions given, if any. It should contain the sketches & drawings related to the observations made by the students.

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The daily training diary should be signed after every day by the supervisor/ in charge of the section where the student has been working. The diary should also be shown to the Faculty Mentor.

Student's Diary and Internship Report should be submitted by the students along with attendance record and an evaluation sheet duly signed and stamped by the industry to the SITCOE immediately after the completion of the training.

It will be evaluated on the basis of the following criteria:

- Regularity in maintenance of the diary.
- Adequacy & quality of information recorded.
- Drawings, sketches and data recorded.
- Thought process and recording techniques used
- Organization of the information.

Internship Report

After completing the internship, the student should prepare a comprehensive report to indicate what he/she has observed and learned in the training period. Daily diary will also help to a great extent in writing the industrial report since much of the information has already been incorporated by the student into the daily diary. The competent authority should sign the training report.

The Internship report should be evaluated on the basis of following criteria:

- Originality.
- Adequacy and purposeful write-up.
- Organization, format, drawings, sketches, style, language etc.
- Variety and relevance of learning experience.
- Practical applications, relationships with basic theory and concepts taught in the course.

Evaluation of Internship/Training

The student should be evaluated based on his training report and presentation, before an expert committee constituted by the concerned department as per norms. The evaluation will be based on the following criteria:

- Quality of content presented.
- Proper planning for presentation.
- Effectiveness of presentation.
- Depth of knowledge and skills.
- Attendance record, daily diary, departmental reports shall also be analyzed along with the Internship Report.

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Multidisciplinary Minor-III

23ECMDA3	MDM	Control System	3-0-0	3 Credits

Teaching Scheme:	**Evaluation Scheme:**
Lecture: 3 hrs/week	CA-I: 10 Marks CA-II: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites:
1. Basics of mathematics
2. Different types of signals and systems
3. Basics of Fourier series, matrix, Differential Equation

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

CO1	Classify control systems and represent in various models.
CO2	Apply standard test signals to a system to determine their characteristics.
CO3	Make use of stability concepts to obtain the desired characteristics.
CO4	Determine the characteristics of a linear control system using various time and frequency domain tools.
CO5	Analyze the system behaviour using various stability analysis techniques and concept of controllers.

Course Contents:

Unit 1: Control System Modeling Basic Elements of Control System, Open loop and Closed loop systems, Differential equations and Transfer function, Modeling of Electric systems, Translational and rotational mechanical systems, Block diagram reduction Techniques, Signal flow graph.	[6]
Unit 2: Time Response Analysis Standard input signals and its equation in s domain, Time response analysis of First Order Systems, Time response analysis of second order systems, Time response analysis of second order systems, Steady state errors and error constants, design specifications for second order systems.	[6]
Unit 3: Stability Analysis Concept of Stability, Necessary conditions for Stability, Routh-Hurwitz Criterion, Qualitative stability and conditional stability – limitations of Routh's stability, Relative Stability, Root Locus Technique, Construction of Root Locus, Dominant Poles, Application of Root Locus Diagram	[6]
Unit 4: Frequency Response Analysis Frequency domain Versus Time domain analysis and its correlation, Bode Plots, Polar Plots, Development of Nyquist Plots using polar plot., Frequency Domain specifications from the plots, Stability analysis from plots.	[6]
Unit 5: State Variable Analysis State space advantages and representation, Transfer function from State space, physical variable form, phase variable forms, controllable canonical form, observable canonical form, Solution of homogeneous state equations, state transition matrix and its properties, computation of state transition matrix by Laplace transform method only, Concepts of Controllability and Observability	[6]

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Unit 6: Controllers and Digital Control Systems Introduction to PLC: Block schematic, PLC addressing, any one application of PLC using Ladder diagram, Introduction to PID controller: P, PI, PD and PID Characteristics and concept of Zeigler-Nicholas method. Digital control systems: Special features of digital control systems, Necessity of sample and hold operations for computer control, z-transform and pulse transfer function, Stability and response of sampled-data systems.	[6]

Text Books:

1. N. J. Nagrath and M.Gopal, "Control System Engineering", New Age International Publishers, 5th Edition, 2009.

Reference Books:

1. Benjamin C. Kuo, "Automatic control systems", Prentice Hall of India, 7th Edition,1995.
2. M. Gopal, "Control System – Principles and Design", Tata McGraw Hill, 4th Edition, 2012.
3. Schaum's Outline Series, "Feedback and Control Systems" Tata McGraw-Hill, 2007.
4. John J. D'Azzo& Constantine H. Houpis, "Linear Control System Analysis and Design", Tata McGraw-Hill, Inc., 1995.

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23ECMDB3	MDM	Data Science and Its Application	3-0-0	3 Credits

Teaching Scheme:	**Evaluation Scheme:**
Lecture: 3 hrs/week	CA-I: 10 Marks CA-II: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Basic programming knowledge (preferably Python), foundational mathematics and statistics

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

CO1	Explain basics of data science and data science workflow
CO2	Apply techniques for cleaning and transforming data and visualize data to identify patterns and trends.
CO3	Apply basic statistical methods to analyze data
CO4	Explain the basic concepts of machine learning
CO5	Utilize appropriate visualization techniques to communicate complex data patterns and relationships effectively.
CO6	Apply data science concepts to real-world projects

Course Contents:

Unit 1: Introduction to Data Science and Data Science Workflow What is Data Science, Types of Data: Structured, Unstructured, Semi-structured, Overview of Data Science Workflow: Data Collection, Cleaning, Exploration, Modeling, Evaluation, Introduction to Python and R for Data Science, Tools for Data Science: Jupyter Notebooks, Pandas, Matplotlib, Scikit-learn	[6]
Unit 2: Data Exploration and Preprocessing Data Cleaning: Handling Missing Data, Outliers, and Duplicates, Data Transformation: Normalization, Scaling, Encoding Categorical Data, Data Wrangling with Pandas, Data Visualization: Using Matplotlib and Seaborn, Descriptive Statistics (Mean, Median, Mode, Variance, Standard Deviation)	[6]
Unit 3: Statistical Methods in Data Science Probability Theory Basics, Inferential Statistics: Hypothesis Testing, p-values, Confidence Intervals, Correlation and Causality, Linear Regression and its Statistical Foundations.	[6]
Unit 4: Introduction to Machine Learning Overview of Machine Learning: Supervised vs Unsupervised Learning, Classification Algorithms: Logistic Regression, Decision Trees, Regression Algorithms: Linear Regression, Ridge, Lasso, Model Evaluation: Confusion Matrix, Accuracy, Precision, Recall, F1-score	[6]
Unit 5: Data Visualization and Communication Principles of Effective Data Visualization, Creating Interactive Visualizations with Plotly and Dash, Communicating Data **Science** Findings: Storytelling with Data Visualizing Multivariate Data.	[6]
Unit 6: Real-World Data Science Applications and Project Case Study 1: Customer Segmentation using K-means Clustering, Case Study 2: Predicting House Prices using Regression, End-to-End Project: From Data Collection to Model Deployment, Ethical	[6]

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Considerations in Data Science.	
Text Books: 1. "Python for Data Analysis" by Wes McKinney 2. "Data Science for Business" by Foster Provost and Tom Fawcett 3. "Data Wrangling with Pandas" by Jacqueline Kazil	
Reference Books: 1. "Practical Statistics for Data Scientists" by Peter Bruce, Andrew Bruce, Peter Gedeck 2. "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" by Aurélien Géron 3. "Storytelling with Data" by Cole Nussbaumer Knaflic	

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23ECMDC3	MDM	**Control System**	3-0-0	3 Credits

Teaching Scheme:	**Evaluation Scheme:**
Lecture: 3 hrs/week	CA-I: 10 Marks CA-II: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Programable Logic Controller

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

CO1	Classify control systems and represent in various models.
CO2	Apply standard test signals to a system to determine their characteristics.
CO3	Make use of stability concepts to obtain the desired characteristics.
CO4	Determine the characteristics of a linear control system using various time and frequency domain tools.
CO5	Analyze the system behaviour using various stability analysis techniques and concept of controllers.
CO6	Classify control systems and represent in various models.

Course Contents:

Unit 1: Control System Modeling Basic Elements of Control System, Open loop and Closed loop systems, Differential equations and Transfer function, Modeling of Electric systems, Translational and rotational mechanical systems, Block diagram reduction Techniques, Signal flow graph.	[6]
Unit 2: Time Response Analysis Standard input signals and its equation in s domain, Time response analysis of First Order Systems, Time response analysis of second order systems, Time response analysis of second order systems, Steady state errors and error constants, design specifications for second order systems.	[6]
Unit 3: Stability Analysis Concept of Stability, Necessary conditions for Stability, Routh-Hurwitz Criterion, Qualitative stability and conditional stability – limitations of Routh's stability, Relative Stability, Root Locus Technique, Construction of Root Locus, Dominant Poles, Application of Root Locus Diagram	[6]
Unit 4: Frequency Response Analysis Frequency domain Versus Time domain analysis and its correlation, Bode Plots, Polar Plots, Development of Nyquist Plots using polar plot., Frequency Domain specifications from the plots, Stability analysis from plots.	[6]
Unit 5: State Variable Analysis State space advantages and representation, Transfer function from State space, physical variable form, phase variable forms, controllable canonical form, observable canonical form, Solution of homogeneous state equations, state transition matrix and its properties, computation of state transition matrix by Laplace transform method only, Concepts of Controllability and Observability	[6]
Unit 6: Controllers and Digital Control Systems Introduction to PLC: Block schematic, PLC addressing, any one application of PLC using Ladder diagram, Introduction to PID controller: P, PI, PD and PID Characteristics and concept of Zeigler-Nicholas method. Digital control systems: Special features of digital control systems, Necessity of sample and hold operations for computer control, z-transform and pulse transfer function, Stability	[6]

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Text Books: 1.N. J. Nagrath and M.Gopal, "Control System Engineering", New Age International Publishers, 5th Edition, 2009.
Reference Books: 1.Benjamin C. Kuo, "Automatic control systems", Prentice Hall of India, 7th Edition,1995. 2.M. Gopal, "Control System – Principles and Design", Tata McGraw Hill, 4th Edition, 2012. 3.Schaum's Outline Series, "Feedback and Control Systems" Tata McGraw-Hill, 2007. 4.John J. D'Azzo& Constantine H. Houpis, "Linear Control System Analysis and Design", Tata McGraw-Hill, Inc., 1995.

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Aptitude Skill III

23HSSM05	VEC	Aptitude Skill III	1-0-0	Audit

Teaching Scheme:	**Evaluation Scheme:**
Lecture: 1 hr/week	CA-I: 25 Marks CA-II: 25 Marks

Pre-Requisites: Programable Logic Controller

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

CO1	Solve the problems on system of equation.
CO2	Solve the problems on seating arrangement.
CO3	Solve the logical reasoning problems.
CO4	Solve the critical analysis problems.
CO5	Solve the problems of Data interpretation.
CO6	Solve the problems of permutations and Combinations

Course Contents:

Unit 1: System of equations quadratic equations, Surds and indices, solution of equations, Ages.	[2]
Unit 2: Seating Arrangements Linear seating Arrangement, Circular seating arrangement, Complex seating arrangement	[2]
Unit.3: Logical Reasoning Numerical based on sense of direction, Blood relations, Odd man Out	[2]
Unit 4: Critical analysis Clocks and Calendar based problems, Crypt arithmetic, heights and distances	[2]
Unit 5: Data Interpretation Table form, Bar form, Line for Pi chart form.	[2]
Unit 6: Permutation and combination Permutation and combinations	[2]

Text Books:

1. RS Aggarwal "A Modern Approach to Verbal & Non-Verbal Reasoning ",S. Chand Publisher; 2016 edition.
2. RS Aggarwal, " Quantitative Aptitude for Competitive Examinations ", S. Chand Publisher; 2016 edition.
3. Raymond Murphy "Essential English Grammar with Answers", Murphy

Reference Books:

1. Rao N,D,V,Prasada, Wren & Martin High School English Grammar and Composition Book, S Chand Publishing, 2017
2. Murphy, Intermediate English Grammar with Answers, Cambridge University Press; Second edition.
3. RS Aggarwal, Objective General English, S. Chand Publisher; 2016 edition

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Language Skill -III

23HSSM06	VEC	Language Skill -III	0-0-2	Audit

Teaching Scheme:	**Evaluation Scheme:**
Practical: 2 hrs/week	CA-I: 25 Marks CA-II: 25 Marks

Pre-Requisites: Programable Logic Controller

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

CO1	Develop a program to read input and return output.
CO2	Develop a program using data types, Strings and variables.
CO3	Develop a program using Unary, Binary and Ternary operator.
CO4	Develop a program using Conditional and Logical statements.

Course Contents:

1. Write a Python program to print "Hello, World!" o Objective: Understand basic syntax, indentation, and output.	[2]
2. Write a program to demonstrate the use of different types of comments in Python. o Objective: Single-line and multi-line comments.	[2]
3. Write a Python program that declares different types of variables and displays their data types using the type() function. o Objective: Variables, data types, and type identification.	[2]
4. Write a program to demonstrate type casting and type conversion between int, float, and string. o Objective: Type conversion, casting functions.	[2]
5. Write a Python script to perform string operations such as slicing, concatenation, upper(), lower(), and len(). o Objective: String manipulation and built-in functions.	[2]
6. Write a program to demonstrate the use of all arithmetic, logical, and bitwise operators. o Objective: Operator functionality.	[2]
7. Write a Python program to use membership and identity operators with examples. o Objective: in, not in, is, is not.	[2]
8. Write a Python program using a ternary operator to find the larger of two numbers. o Objective: Conditional (inline) expressions.	[2]
9. Write a program that takes user input for age and prints whether the person is a child, teenager, adult, or senior citizen using if-elif-else. o Objective: Conditional statements and user input.	[2]
10. Write a program to find the sum of the first 10 natural numbers using a while loop. o Objective: Looping with while.	[2]
11. Write a Python script to display the multiplication table of a number using a for loop. o Objective: Looping with for and range().	[2]
12. Write a program that uses break, continue, and pass statements in appropriate looping scenarios. o Objective: Loop control statements.	[2]

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