GEETHANJALI INSTITUTE OF SCIENCE & TECHNOLOGY: NELLORE
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
B. Tech ECE – RG 22 Regulation

Semester - 6 (Theory-7, Lab-3, MC-1)						
Category	**Course Code**	**Course Title**	**Hours per week**			**Credits**
			L	**T**	**P**	**C**
PCC	22A0434T	Microprocessor and Microcontroller	3	0	0	3
PCC	22A0435T	Digital Signal Processing	3	0	0	3
PCC	22A0436T	VLSI Design	3	0	0	3
PEC		**Professional Elective-II:**	3	0	0	3
OEC		**Open Elective-II:**	3	0	0	3
PCC (Lab)	22A0441P	Microprocessor and Microcontroller Lab	0	0	3	1.5
PCC (Lab)	22A0442P	Digital Signal Processing Lab	0	0	3	1.5
PCC (Lab)	22A0443P	VLSI Design Lab	0	0	3	1.5
SC	22A0539	**Skill Oriented Course:** JAVA Programming	1	0	2	2
MC	22A0032M	**Mandatory Course:** Research Methodology	2	0	0	0
					Total credits	**21.5**
Industrial/Research Internship (Mandatory) 2 Months during summer vacation						

S. No.	Course Code	Name of the Professional Elective-II
1	22A0437T	Electronic Measurements and Instrumentation
2	22A0438T	Sensors & Actuators
3	22A0439T	Radar and Satellite Communications
4	22A0440T	Embedded System Design

S. No.	Course Code	Name of the Open Elective-II
1	22A0528T	Machine Learning
2	22A0257T	Modern Control theory
3	22A0150T	Environmental Economics
4	22A0027T	Organizational Behaviour

Category	Credits
Professional Core Courses (PCC)	13.5
Professional Elective Courses (PEC)	3
Open Elective Courses (OEC)	3
Skill Oriented Course (SC)	2
Industrial/Research Internship (Mandatory) 2 Months	-
Total	21.5

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MICROPROCESSOR AND MICROCONTROLLER

Course Code	L:T:P	Credits	Exam. Marks	Exam Duration	Course Type
22A0434T	3:0:0	3	CIE:30 SEE:70	3 Hours	PCC

Course Objectives:

- To introduce fundamental architectural concepts of microprocessors and microcontrollers.
- To impart knowledge on addressing modes and instruction set of 8086 and 8051
- To introduce assembly language programming concepts
- To explain memory and I/O interfacing with 8086 and 8051
- To introduce16 bit and 32 bit microcontrollers.

Syllabus	Total Hours: 48
Unit –I	**10 Hrs**
8086 Architecture: Main features, pin diagram/description, 8086 microprocessor family, internal architecture, bus interfacing unit, execution unit, interrupts and interrupt response, 8086 system timing, minimum mode and maximum mode configuration.	
Unit –II	**10 Hrs**
8086 Programming: Program development steps, instructions, addressing modes, assembler directives, writing simple programs with an assembler, assembly language program development tools.	
Unit –III	**10 Hrs**
8086 Interfacing: Semiconductor memories interfacing (RAM, ROM), Intel 8255 programmable peripheral interface, Interfacing switches and LEDS, Interfacing seven segment displays, software and hardware interrupt applications, Intel 8251 USART architecture and interfacing, Intel 8237a DMA controller, stepper motor, A/D and D/A converters, Need for 8259 programmable interrupt controllers.	
Unit –IV	**9 Hrs**
Microcontroller - Architecture of 8051 –Addressing modes - I/O Pins Ports and Circuits - Instruction set - Arithmetic & Logic Instructions And Programs-Assembly language programming-8051 Programming in C.	
Unit –V	**9 Hrs**
Interfacing Microcontroller–Timers/ Counters , Programming 8051 Timers - Serial Port Programming - Interrupts Programming – LCD & Keyboard Interfacing - ADC, DAC & Sensor Interfacing - External Memory Interface- Stepper Motor and Waveform generation - Comparison of Microprocessor, Microcontroller, Introduction to RISC processors	

Textbooks:

1. K M Bhurchandi, A K Ray, Advanced Microprocessors and Peripherals, 3rd edition, McGraw Hill Education, 2017.
2. Raj Kamal, Microcontrollers: Architecture, Programming, Interfacing and System Design, 2nd edition, Pearson, 2012.

References:

1. Kenneth J. Ayala, the 8051 Microcontroller, 3rd edition, Cengage Learning, 2004.

Course Outcomes:

After the completion of the course students will able to:

CO1: Distinguish between microprocessors & microcontrollers

CO2: Develop assembly language programming

CO3: Describe interfacing of 8086 with peripheral devices

CO4: Understand the concept of Microcontrollers

CO5: Design applications using microcontrollers

CO6: Design external Memory Interface using microcontroller.

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DIGITAL SIGNAL PROCESSING

Course Code	L:T:P	Credits	Exam. Marks	Exam Duration	Course Type
22A0435T	3:0:0	3	CIE:30 SEE:70	3 Hours	PCC

Course Objectives:

- To describe discrete time signals and systems.
- To teach importance of FFT algorithm for computation of Discrete Fourier Transform.
- To expose various implementations of digital filter structures.
- To present FIR and IIR Filter design procedures.
- To outline need of Multi-rate Processing.

Syllabus		Total Hours: 48
Unit –I	**Introduction to discrete time signals and systems**	**10 Hrs**

Introduction to digital signal processing, review of discrete-time signals and systems, analysis of discrete-time linear time invariant systems, frequency domain representation of discrete time signals and systems, analysis of linear time-invariant systems in the z-domain, pole-zero stability.

Unit-II	Discrete Fourier Transform & Fast Fourier Transform	10 Hrs

Discrete Fourier Transform - Introduction, Discrete Fourier Series, properties of DFS, Discrete Fourier Transform, Inverse DFT, properties of DFT, Linear and Circular convolution, convolution using DFT.

Fast Fourier Transform - Introduction, Fast Fourier Transform, Radix-2 Decimation in time and Decimation in frequency FFT, Inverse FFT (Radix-2).

Unit-III	IIR Filters	10 Hrs

IIR Filters-Introduction to digital filters, Analog filter approximations – Butterworth and Chebyshev, Design of IIR Digital filters from analog filters by Impulse invariant and bilinear transformation methods , Frequency transformations, Basic structures of IIR Filters - Direct form-I, Direct form-II, Cascade form and Parallel form realizations

Unit-IV	FIR Filters	9 Hrs

FIR Filters-Introduction, Characteristics of FIR filters with linear phase, Frequency response of linear phase FIR filters, Design of FIR filters using Fourier series and windowing methods (Rectangular, Triangular, Raised Cosine, Hanging, Hamming, Blackman), Comparison of IIR & FIR filters, Basic structures of FIR Filters – Direct form, Cascade form, Linear phase realizations

Unit-V	Multi rate Digital Signal Processing	9 Hrs

Multi rate Digital Signal Processing: Decimation, Interpolation, Sampling rate conversion by a rational factor; Frequency domain characterization of Interpolator and Decimator; Applications.

Textbooks:

1. Digital Signal Processing, Principles, Algorithms, and Applications, John G. Proakis, Dimitris G. Manolakis, Pearson Education, 2007.
2. Discrete Time Signal Processing, A.V.Oppenheim and R.W. Schaffer, PHI.

Reference Books:

1. Digital Signal Processing – A practical approach, S.K.Mitra, 2nd Edition, Pearson Education, New Delhi, 2004.
2. Digital Signal Processing, Schaum's Outline series, MH Hayes, TATA Mc-Graw Hill, 2007.
3. Fundamentals of Digital Signal Processing using Matlab, Robert J. Schilling, Sandra L. Harris, Thomson, 2007.

Course Outcomes (CO):

After the completion of the course students will able to:

CO1: Understand the basic concepts of discrete time signals and systems.

CO2: Formulate difference equations for the given discrete time systems

CO3: Apply FFT algorithms for determining the DFT of a given signal

CO4: Compare FIR and IIR filter structures

CO5: Design digital filter (FIR & IIR) from the given specifications

CO6: Understand the concept of multi rate DSP and applications of DSP

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VLSI DESIGN					
Course Code	**L:T:P**	**Credits**	**Exam. Marks**	**Exam Duration**	**Course Type**
22A0436T	**3:0:0**	**3**	**CIE:30** **SEE:70**	**3 Hours**	**PCC**

Course Objectives:

- To give exposure to different steps involved in fabrication Process of PMOS & NMOS transistors, CMOS & BICOM Inverters.
- To provide knowledge on electrical properties of MOS & BICMOS devices to analyze the behaviour of inverters designed with various loads.
- To apply the design Rules and draw layout of a given logic circuit and basic circuit concepts to MOS circuits.
- To provide concepts to design building blocks of data path of any system using gates.
- To Apply the design for testability methods for combinational & sequential CMOS circuits

Syllabus	**Total hours: 48**
Unit –I::Introduction to Fabrication Process	**10 Hrs**

Introduction: Brief Introduction to IC technology, Moore's Law, Different modes MOSFET operation, Fabrication Process of PMOS, NMOS, CMOS & Bi-CMOS devices, Comparison between CMOS and Bi-polar Technologies.

Fabrication Steps: Wafer Preparation, Oxidation, Photolithography, Etching, Ion Implantations, Metallization, Testing.

Unit –II::Basic Electrical Properties of MOS/BiCMOS & Circuits Concepts	**10 Hrs**

Basic Electrical Properties: Ids Vs Vds relationships , MOS transistor Threshold Voltage-VT, figure of merit-ω0, Transconductance - gm, Output conductance-gds, Pass transistor logic, NMOS Inverter, Pull-up to Pull-down Ratio for NMOS inverter driven by another NMOS inverter, and through one or more pass transistors Various pull ups, CMOS Inverter analysis and design, Bi-CMOS Inverters.

Basic Circuit Concepts: Sheet Resistance Rs and its concepts to MOS, Area Capacitances calculations, Inverter Delays, Driving large Capacitive Loads, Wiring Capacitances, Fan-in and fan-out

Unit –III:: VLSI Circuit Design Processes	**10 Hrs**

VLSI Design Flow, MOS Layers, Stick Diagrams, Design Rules and Layout, Lambda(λ)-based design rules for wires, contacts and Transistors, Layout Diagrams for NMOS and CMOS Inverters Logic Gates and Various MOS Circuits. Scaling of MOS circuits, Limitations of Scaling.

Unit –IV:: Basic building blocks of Analog IC design & Static/Dynamic CMOS Design	**9 Hrs**

Analog IC design: Modelling of transistor, body bias effect, biasing styles, single stage amplifier with resistive load, single stage amplifier with diode connected load, Common Source amplifier, Common Drain amplifier, Common Gate amplifier, current sources and sinks.

Static CMOS Design: Complementary CMOS, Rationed Logic, Pass-Transistor Logic

Dynamic CMOS Design: Dynamic Logic-Basic Principles, Speed and Power Dissipation of Dynamic Logic, Issues in Dynamic Design, Cascading Dynamic Gates, Choosing a Logic Style.

Unit –V::CMOS Testing	**10 Hrs**

CAD Tools for Design and Simulation, Aspects of Design Tools, Test and Testability-System Partitioning, Layout and Testability, Reset/Initialization, Design for Testability ,Testing Combinational Logic, Testing Sequential Logic, Practical Design for Test (OFT) Guidelines, Scan

Design Techniques, Built-In-Self-Test (BIST), Future Trends.

Text Books:

1. Kamran Eshraghian, "Essentials of VLSI Circuits and Systems", Douglas and A. Pucknell and SholehEshraghian, Prentice-Hall of India Private Limited, 2005 Edition.
2. Behzad Razavi , "Design of Analog CMOS Integrated Circuits", McGraw Hill, 2003
3. Modern VLSI Design – Wayne Wolf, 3 Ed., 1997, Pearson Education.

References:

1. Jan M. Rabaey, "Digital Integrated Circuits", AnanthaChandrakasan and Borivoje Nikolic, Prentice-Hall of India Pvt.Ltd, 2nd edition, 2009.
2. John P. Uyemura, "Introduction to VLSI Circuits and Systems", John Wiley & Sons, reprint 2009
3. CMOS VLSI Design-A Circuits and Systems Perspective, Neil H.E Weste, David Harris, Ayan Banerjee, 3rd Edn, Pearson, 2009.

Course Outcomes:

After the completion of the course students will able to:

CO1: Acquire qualitative knowledge about the fabrication process of integrated circuit using MOS transistors.

CO2: Understand the concept of Basic Electrical Properties of MOS/Bi-CMOS Devices

CO3: Apply the basic circuit concepts to MOS circuits.

CO4: Apply the design Rules to draw the Stick diagram &layout of a given logic circuit.

CO5: Design MOSFET based Analog IC Design and MOSFET based logic circuits using various logic styles like static and dynamic CMOS

CO6: Understand the concept of testing and adding extra hardware to improve testability of system.

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ELECTRONIC MEASUREMENTS AND INSTRUMENTATION

Course Code	L:T:P	Credits	Exam. Marks	Exam Duration	Course Type
22A0437T	3:0:0	3	CIE:30 SEE:70	3 Hours	PEC

Course Objectives:

- It provides an understanding of various measuring system functioning and metrics for performance analysis.
- Provides understanding of principle of operation, working of different electronic instruments viz. signal generators, signal analyzers, recorders and measuring equipment.
- Understanding the concepts of various measuring bridges and their balancing conditions.
- Provides understanding of use of various measuring techniques for measurement of different physical parameters using different classes of transducers.

Syllabus	Total Hours: 48
Unit –I	**10 Hrs**

Block Schematics of Measuring Systems: Performance Characteristics, Static Characteristics, Accuracy, Precision, Resolution, Types of Errors, Gaussian Error, Root Sum Squares formula, Dynamic Characteristics, Repeatability, Reproducibility, Fidelity, Lag; Measuring Instruments: DC Voltmeters, D' Arsonval Movement, DC Current Meters, AC Voltmeters and Current Meters, Ohmmeters, Multimeters, Meter Protection, Extension of Range, True RMS Responding Voltmeters, Specifications of Instruments.

Unit –II	10 Hrs

Signal Analyzers: AF, HF Wave Analyzers, Harmonic Distortion, Heterodyne wave Analyzers, Spectrum Analyzers, Power Analyzers, Capacitance-Voltage Meters, Oscillators. Signal Generators: AF, RF Signal Generators, Sweep Frequency Generators, Pulse and Square wave Generators, Function Generators, Arbitrary Waveform Generator, Video Signal Generators, and Specifications

Unit –III	9 Hrs

Oscilloscopes: CRT, Block Schematic of CRO, Time Base Circuits, Lissajous Figures, CRO Probes, High Frequency CRO Considerations, Delay lines, Applications: Measurement of Time, Period and Frequency Specifications. Special Purpose Oscilloscopes: Dual Trace, Dual Beam CROs, Sampling Oscilloscopes, Storage Oscilloscopes, Digital Storage CROs.

Unit –IV	10 Hrs

Transducers: Classification, Strain Gauges, Bounded, unbounded; Force and Displacement Transducers, Resistance Thermometers, Hotwire Anemometers, LVDT, Thermocouples, Synchros, Special Resistance Thermometers, Digital Temperature sensing system, Piezoelectric Transducers, Variable Capacitance Transducers, Magneto Strictive Transducers, gyroscopes, accelerometers.

Unit –V	9 Hrs

Bridges: Wheat Stone Bridge, Kelvin Bridge, and Maxwell Bridge.

Measurement of Physical Parameters: Flow Measurement, Displacement Meters, Liquid level Measurement, Measurement of Humidity and Moisture, Velocity, Force, Pressure – High Pressure, Vacuum level, Temperature -Measurements, Data Acquisition Systems.

Text Books:

1. Modern Electronic Instrumentation and Measurement Techniques: A.D. Helbincs, W. D. Cooper: PHI 5th Edition 2003.

2. Electronic Instrumentation: H. S. Kalsi – TMH, 2nd Edition 2004.

References:

1. Electrical and Electronic Measurement and Measuring Instruments – A K Sawhney, Dhanpat Rai & Sons, 2013.
2. Electronic Instrumentation and Measurements – David A. Bell, Oxford Univ. Press, 1997.
3. Industrial Instrumentation: T.R. Padmanabham Springer 2009.
4. Electronic Measurements and Instrumentation – K. Lal Kishore, Pearson Education 2010.

Course Outcomes:

After the completion of the course students will able to:

CO1: Measure electrical parameters with different meters and understand the basic definition of measuring parameters.

CO2: Use various types of signal generators, signal analyzers for generating and analyzing various real-time signals.

CO3: Operate an Oscilloscope to measure various signals.

CO4: Measure various physical parameters by appropriately selecting the transducers.

CO5: Understand the design of oscilloscopes for different applications.

CO6: Design different transducers for measurement of different parameters.

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SENSORS AND ACTUATORS					
Course Code	**L:T:P**	**Credits**	**Exam. Marks**	**Exam Duration**	**Course Type**
22A0438T	**3:0:0**	**3**	**CIE:30** **SEE:70**	**3 Hours**	**PEC**

Course Objectives:

- To understand modelling concept;
- To get exposed with basics of Sensors, Actuators and Mechatronics;
- To learn different types of Sensors;
- To study MEMS and smart Sensors;
- To study few case studies on advanced driver assistance system and self driving cars as Applications of Sensors, actuators and Mechatronics concepts.
- To develop problem solving skills and experience in real time applications through few case studies

Syllabus	**Total Hours: 48**
Unit –I:: Sensors	**10 Hrs**

Difference between sensor, transmitter and transducer - Primary measuring elements - selection and characteristics: Range; resolution, Sensitivity, error, repeatability, linearity and accuracy, impedance, backlash, Response time, Dead band. Signal transmission - Types of signal: Pneumatic signal; Hydraulic signal; Electronic Signal Principle of operation, construction details, characteristics and applications of potentiometer, Proving Rings, Strain Gauges, Resistance thermometer, Thermistor, Hot-wire anemometer, Resistance Hygrometer, Photo-resistive sensor.

Unit –II:: Transducers	**9 Hrs**

Inductive transducers: - Principle of operation, construction details, characteristics and applications of LVDT, Induction potentiometer, variable reluctance transducer, synchros, microsyn.
Capacitive transducers: - Principle of operation, construction details, characteristics of Capacitive transducers – different types & signal conditioning- Applications:- capacitor microphone, capacitive pressure sensor, proximity sensor

Unit –III:: Actuators	**10 Hrs**

Definition, types and selection of Actuators; linear; rotary; Logical and Continuous Actuators, Pneumatic actuator- Electro-Pneumatic actuator; cylinder, rotary actuators, Mechanical actuating system: Hydraulic actuator - Control valves; Construction, Characteristics and Types, Selection criteria.
Electrical Actuating systems: Solid-state switches, Solenoids, Electric Motors- Principle of operation and its application: D.C motors - AC motors - Single phase & 3 Phase Induction Motor; Synchronous Motor; Stepper motors - Piezoelectric Actuator.

Unit –IV:: Micro Sensors and Micro Actuators	**10 Hrs**

Micro Sensors: Principles and examples, Force and pressure micro sensors, position and speed micro sensors, acceleration micro sensors, chemical sensors, biosensors, temperature micro sensors and flow micro sensors
Micro Actuators: Actuation principle, shape memory effects-one way, two way and pseudo

elasticity. Types of micro actuators- Electrostatic, Magnetic, Fluidic, Inverse piezo effect, other principles.

Unit –V:: Sensor Materials and Processing Techniques	9 Hrs

Materials for sensors: Silicon, Plastics, metals, ceramics, glasses, nano materials Processing techniques: Vacuum deposition, sputtering, chemical vapour deposition, electro plating, photolithography, silicon micro machining, Bulk silicon micro machining, Surface silicon micro machining, LIGA process.

Text Books:

1. Patranabis.D, "Sensors and Transducers", Wheeler publisher, 1994.
2. Sergej Fatikow and Ulrich Rembold, "Microsystem Technology and Microbotics", First edition, Springer –Verlag NEwyork, Inc, 1997.
3. Jacob Fraden, "Hand Book of Modern Sensors: Physics, Designs and Application" Fourth edition, Springer, 2010.

References:

1. Robert H Bishop, "The Mechatronics Hand Book", CRCPress, 2002.
2. Thomas. G. Bekwith and Lewis Buck.N, Mechanical Measurements, Oxford and IBH publishing Co. Pvt. Ltd.,
3. Massood Tabib and Azar, "Microactuators Electrical, Magnetic, thermal, optical, mechanical, chemical and smart structures", First edition, Kluwer academic publishers, Springer, 1997.
4. Manfred Kohl, "Shape Memory Actuators", first edition, Springer.

Course Outcomes:

After the completion of the course students will able to:

CO1: Explain fundamental physical and technical base of sensors andactuators,

CO2: Describe basic laws and phenomena that define behaviour ofsensors and actuators.

CO3: Analyze various premises, approaches, procedures and resultsrelated to sensors and actuators.

CO4: Create analytical design and development solutions for sensorsand actuators.

CO5: Describe development and application of sensors and actuators

CO6: Understanding basic laws and phenomena on which operation ofsensors and actuators-transformation of energy.

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RADAR & SATELLITE COMMUNICATIONS

Course Code	L:T:P	Credits	Exam. Marks	Exam Duration	Course Type
22A0439T	3:0:0	3	CIE:30 SEE:70	3 Hours	PEC

Course Objectives:

- To explore the concepts of radar and its frequency bands.
- To understand Doppler Effect and get acquainted with the working principles of CW radar, FM-CW radar.
- To impart the knowledge of functioning of MTI and Tracking Radars, design of a Matched Filter in radar receivers.
- To acquire foundation in orbital mechanics and launch vehicles for the satellites.
- To understand the concepts of satellite navigation and GPS.

Syllabus	Total Hours: 48
Unit –I	**10 Hrs**

Basics of Radar: Introduction, Maximum Unambiguous Range, simple Radar range Equation, Radar Block Diagram and Operation, Radar Frequencies and Applications. Prediction of Range Performance, Minimum Detectable Signal, Receiver Noise, Illustrative Problems.

Radar Equation : Modified Radar Range Equation, SNR, probability of detection, probability of False Alarm, Integration of Radar Pulses, Radar Cross Section of Targets (simple targets - sphere, cone-sphere), Creeping Wave, Transmitter Power, PRF and Range Ambiguities, System Losses (qualitative treatment), Illustrative Problems.

Unit –II	10 Hrs

CW and Frequency Modulated Radar: Doppler Effect, CW Radar – Block Diagram, Isolation between Transmitter and Receiver, Non-zero IF Receiver, Receiver Bandwidth Requirements, Applications of CW radar. Illustrative Problems, FM-CW Radar: Range and Doppler Measurement, Block Diagram and Characteristics, FM-CW altimeter, Multiple Frequency CW Radar

MTI and Pulse Doppler Radar: Introduction, Principle, MTI Radar with - Power Amplifier Transmitter and Power Oscillator Transmitter, Delay Line Cancellers – Filter Characteristics, Blind Speeds, Double Cancellation, Nth Cancellation Staggered PRFs. Range Gated Doppler Filters. MTI Radar Parameters, Limitations to MTI Performance, MTI versus Pulse Doppler Radar.

Unit –III	9 Hrs

Tracking Radar: Tracking with Radar, Sequential Lobing, Conical Scan, Mono pulse Tracking Radar – Amplitude Comparison Mono pulse (one- and two- coordinates), Phase Comparison Mono pulse, Tracking in Range, Acquisition and Scanning Patterns, Comparison of Trackers.

Detection of Radar Signals in Noise : Introduction, Matched Filter Receiver – Response Characteristics and Derivation, Correlation detection and Cross-correlation Receiver, Efficiency of Non-matched Filters, Matched Filter with Non-white Noise, Noise Figure and Noise Temperature.

Unit –IV	10 Hrs

Introduction: Origin of Satellite Communications, Historical Back-ground, Basic Concepts of Satellite Communications, Frequency allocations for Satellite Services, Applications, Future Trends of Satellite Communications.

Orbital Mechanics And Launchers: Orbital Mechanics, Look Angle determination, Orbital perturbations, Orbit determination, launches and launch vehicles, Orbital effects in communication

systems performance.

Unit –V	9 Hrs

Satellite Sub Systems: Attitude and orbit control system, telemetry, tracking, Command and monitoring, power systems, communication subsystems, Satellite antenna Equipment reliability and Space qualification.

Satellite Navigation &Global Positioning System: Radio and Satellite Navigation, GPS Position Location principles, GPS Receivers and codes, Satellite signal acquisition, GPS Navigation Message, GPS signal levels, GPS receiver operation, GPS C/A code accuracy, Differential GPS.

Text Books:

1. Introduction to Radar Systems – Merrill I. Skolnik, TMH Special Indian Edition, 2nd Ed., 2007.
2. Satellite Communications – Timothy Pratt, Charles Bostian and Jeremy Allnutt, WSE, Wiley Publications, 2ndEdition, 2003.

References:

1. Radar: Principles, Technology, Applications – Byron Edde, Pearson Education, 2004.
2. Radar Principles – Peebles, Jr., P.Z., Wiley, New York, 1998.
3. Satellite Communications – Dennis Roddy, McGraw Hill, 2nd Edition, 1996
4. Satellite Communications Engineering – Wilbur L. Pritchard, Robert A Nelson and Henri G. Suyderhoud, 2nd Edition, Pearson Publications, 2003.

Course Outcomes:

After the completion of the course students will able to:

CO1: Derive the radar range equation and to solve some analytical problems.

CO2: Understand the different types of radars and its applications.

CO3: Describe the need and functioning of CW, FM-CW and MTI radars.

CO4: Apply the concept of tracking and different tracking techniques, various components of radar receiver and its performance.

CO5: Understand basic concepts and frequency allocations for satellite communication, orbital mechanics and launch vehicles.

CO6: Analyze the concepts of GEO Stationary Satellite Systems and satellite navigation.

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EMBEDDED SYSTEM DESIGN

Course Code	L:T:P	Credits	Exam. Marks	Exam Duration	Course Type
22A0440T	3:0:0	3	CIE:30 SEE:70	3 Hours	PEC

Course Objectives:

- To teach the basics of an embedded system and RTOS.
- To introduce the typical components of an embedded system & different communication interfaces.
- To provide knowledge on the design process of embedded system applications.

Syllabus	Total Hours: 48

Unit –I: INTRODUCTION TO EMBEDDED SYSTEMS — 10 Hrs

History of embedded systems, Classification of embedded systems based on generation and complexity, Purpose of embedded systems, The embedded system design process-requirements, specification, architecture design, designing hardware and software, components, system integration, Applications of embedded systems, and characteristics of embedded systems.

Unit –II: TYPICAL EMBEDDED SYSTEM — 10 Hrs

Core of the embedded system-general purpose and domain specific processors, ASICs, PLDs, COTs; Memory-ROM, RAM, memory according to the type of interface, memory shadowing, memory selection for embedded systems, Sensors, actuators, I/O components: seven segment LED, relay, piezo buzzer, push button switch, other sub-systems: reset circuit, brownout protection circuit, oscillator circuit real time clock, watch dog timer.

Unit –III: COMMUNICATION INTERFACE — 9 Hrs

Onboard communication interfaces-I2C, SPI, CAN, parallel interface; External communication interfaces-RS232 and RS485, USB, infrared, Bluetooth, Wi-Fi, ZigBee, GPRS, GSM.

Unit –IV: EMBEDDED FIRMWARE DESIGN AND DEVELOPMENT — 10 Hrs

Embedded firmware design approaches-super loop based approach, operating system based approach; embedded firmware development languages-assembly language based development, high level language based development.

Unit –V: RTOS BASED EMBEDDED SYSTEM DESIGN — 9 Hrs

Operating system basics, types of operating systems, tasks, process and threads, multiprocessing and multitasking, task scheduling: non-pre-emptive and pre-emptive scheduling; task communication shared memory, message passing, Remote Procedure Call and Sockets, Task Synchronization: Task Communication/ Synchronization Issues, Task Synchronization Techniques

Text Books:

1. Introduction to Embedded Systems - Shibu KV, Mc Graw Hill Education.
2. Computers as Components –Wayne Wolf, Morgan Kaufmann (second edition).

References:

1. Embedded System Design -frank vahid, tony grivargis, john Wiley.
2. Embedded Systems- An integrated approach - Lyla b das, Pearson education 2012.
3. Embedded Systems – Raj Kamal, TMH

Course Outcomes:

After the completion of the course students will able to:

CO1: Identify hardware and software components of an embedded system
CO2: Learn the basics of OS and RTOS
CO3: Illustrate different Inter Process Communication (IPC) mechanisms used by tasks/process/tasks to communicate in multitasking environment
CO4: Design simple embedded system-based applications

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MACHINE LEARNING
(Common to CE,EEE,ME and ECE)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0528T	3:0:0:0	3	CIE: 30 SEE:70	3 Hours	OEC

Course Objectives:

This course will enable students to:

- Understand basic concepts of Machine Learning
- Study different learning algorithms
- Illustrate evaluation of learning algorithms

Syllabus		Total Hours:48
Unit -I	**Introduction – Human Learning & Machine Learning**	**10Hrs**

Human Learning, Types of Human Learning, Machine Learning, Types of Machine Learning, Applications of Machine Learning, Issues in Machine Learning.

Basic types of Data in Machine Learning, Data Preprocessing : Data Cleaning, Data transformation and Data Reduction

Unit -II	**Modeling and Evaluation**	**9Hrs**

Introduction, selecting a Model, training a Model, Model Representation and Interpretability, Evaluating Performance of a Model, Improving Performance of a Model

Unit -III	**Supervised Learning :Classification**	**10Hrs**

Classification – Methods of Classification : Classification model, Classification Learning Steps, Classification by Decision tree Induction, Classification by Back propagation, K-Nearest Neighbor Classification, Random Forest Algorithm, Naïve Baye's Classification

Unit -IV	**Supervised Learning : Regression**	**10Hrs**

Regression – Assumptions in Regression Analysis, Types of Regression: Simple Linear Regression, Multiple Linear Regression, Polynomial Regression, Logistic Regression, Curve Fitting- Method of Least Squares.

Unit -V	**Unsupervised Learning : Clustering**	**9Hrs**

Clustering- Different types of clustering techniques, Partitioning Methods: K-Means Algorithm, K-Medoid's algorithm, Hierarchical Clustering Methods, Density based Clustering Methods- DBSCAN, DENCLUE, OPTICS

Text Books:

1. Machine Learning, SaikatDutt, Subramanian Chandramouli, Amit Kumar Das, Pearson, 2019.

Reference Books:

1. EthernAlpaydin, "Introduction to Machine Learning", MIT Press, 2004.
2. Stephen Marsland, "Machine Learning -An Algorithmic Perspective", Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series,2014.
3. Andreas C. Müller and Sarah Guido "Introduction to Machine Learning with Python: A Guide for

Data Scientists", Oreilly.

Web Resources:

1. Andrew Ng, "Machine Learning Yearning"
2. https://www.deeplearning.ai/machine-learning-
3. https://www.cse.huji.ac.il/~shais/Understanding MachineLearning/index.html

Course Outcomes (CO):

On completion of this course, student will be able to:

CO1: Identify machine learning techniques suitable for a given problem

CO2: Characterize the machine learning algorithms as supervised learning and unsupervised learning

CO3: Solve the problems using various machine learning techniques

CO4: Design application using machine learning techniques

CO5: Analyze and Apply the suitable supervised learning methods for real-world problems

CO6: Understand the features of machine learning to apply on real world problems

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MODERN CONTROL THEORY (Only ECE)					
Course Code	**L:T:P**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
22A0257T	**3:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**OEC**

Course Objectives:

The objectives of the course are to make the students learn about:

- Concepts of state vector, State transition matrix and solution of state equations.
- Importance of controllability and observability concepts.
- Pole placement, state estimation using observers
- Lyapunov criterion for stability analysis
- Types of nonlinearities, their effect on system performance

Syllabus		**Total Hours:49**
Unit-I	**State Variable Description and Solution of State Equation**	**10 Hrs**

Concept of State – Derivation of State Space models for Linear Continuous time Systems from Schematic Models, Differential equations, Transfer functions and block diagrams – Non uniqueness of state model – State diagrams for continuous time state models – Solution of state equations – State transition matrix. Complete response of continuous time systems

Unit-II	**Controllability and Observability**	**10 Hrs**

Tests for controllability and observability for continuous time systems – Time varying case, minimum energy control, time invariant case, Principle of Duality, Controllability and observability of state models in Jordan canonical form and other canonical forms. Effect of state feedback on controllability and observability.

Unit -III	**State Feedback Controllers and Observers**	**9 Hrs**

Design of State Feedback Controllers through Pole placement. Full-order observer and reduced-order observer. State estimation through Kalman Filters

Unit -IV	**Analysis of Nonlinear Systems**	**10 Hrs**

Introduction to nonlinear systems, Types of nonlinearities, Concept of describing functions, Derivation of describing functions for Dead zone, Saturation, backlash, relay with dead zone and Hysteresis - Jump Resonance. Introduction to phase-plane analysis, Method of Isoclines for Constructing Trajectories, Singular points, Phase plane analysis of nonlinear control systems.

Unit -V	**Stability Analysis**	**10 Hrs**

Stability in the sense of Lyapunov. Lyapunov's stability and Lypanov's instability theorems. Direct method of Lypanov for Linear and Nonlinear continuous time autonomous systems

Textbooks:

1. Modern Control Engineering, Katsuhiko Ogata, Prentice Hall, 5th Edition, 2010.
2. Modern Control System Theory, M. Gopal, New Age International Publishers, Revised 2nd edition, 2005.

Course Outcomes(CO):

At the end of studying the course, the student should be able to:

CO1: Model a given dynamic system in state space and obtain the solution for the state equation

CO2: Test whether a given system is controllable and/or observable

CO3: Design a state feedback controller for pole placement

CO4: Design an observer for state estimation

CO5: Apply Lyapunov criterion and determine stability of a given system.

CO6: Analyze nonlinear systems

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ENVIRONMENTAL ECONOMICS
(Common to ME, CSE,AI&ML, CS, DS, ECE,EEE)

Course Code	L:T:P	Credits	Exam marks	Exam Duration	Course Type
22A0150T	3:1:0:0	3	CIE:30 SEE:70	3 Hours	OEC

Course Objectives:

- To impart knowledge on sustainable development and economics of energy
- To teach regarding environmental degradation and economic analysis of degradation
- To inculcate the knowledge of economics of pollution and their management
- To demonstrate the understanding of cost benefit analysis of environmental resources
- To make the students to understand principles of economics of biodiversity

Syllabus		Total Hours:48
Unit-I	**Sustainable Development**	**9 Hrs**
Introduction to sustainable development - Economy-Environment inter linkages - Meaning of sustainable development - Limits to growth and the environmental Kuznets curve – The sustainability debate - Issues of energy and the economics of energy		
Unit-II	**Environmental Degradation**	**9 Hrs**
Economic significance and causes of environmental degradation - The concepts of policy failure, externality and market failure - Economic analysis of environmental degradation – Equi –marginal principle.		
Unit -III	**Economics of Pollution**	**10 Hrs**
Economics of optimal pollution, regulation, monitoring and enforcement - Managing pollution using existing markets: Bargaining solutions – Managing pollution through market intervention: Taxes, subsidies and permits.		
Unit -IV	**Cost – Benefit Analysis**	**10 Hrs**
Cost – Benefit Analysis: Economic value of environmental resources and environmental damage - Concept of Total Economic Value - Alternative approaches to valuation – Cost-benefit analysis and discounting.		
Unit -V	**Economics Of Biodiversity**	**10 Hrs**
Economics of biodiversity: Economics of biodiversity conservation - Valuing individual species and diversity of species -Policy responses at national and international levels. Economics of Climate Change – stern Report		

Textbooks:

1. An Introduction to Environmental Economics by N. Hanley, J. Shogren and B. White Oxford University Press.(2001)
2. Blueprint for a Green Economy by D.W. Pearce, A. Markandya and E.B. Barbier Earthscan, London.(1989)

Reference Books:

1. Environmental Economics: An Elementary Introduction by R.K. Turner, D.W. Pearce and I. Bateman Harvester Wheatsheaft, London. (1994),
2. Economics of Natural Resources and the Environment by D.W. Pearce and R.K. Turner Harvester Wheat sheaf, London. (1990),

E-resources:

1. https://nptel.ac.in/courses/109107171

Course Outcomes(CO):

On completion of this course, student will be able to

CO1: Understand the information on sustainable development and economics of energy

CO2: Understand the information regarding environmental degradation

CO3: Understand the information regarding economic analysis of degradation

CO4: The identification of economics of pollution and their management

CO5: The cost benefit analysis of environmental resources.

CO6: The principles of economics of biodiversity

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ORGANIZATIONAL BEHAVIOUR					
Course Code	**L:T:P:S**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
22A0027T	**3:1:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**OEC**

Course Objectives:

- To enable the students to understand the functions and principles of management.
- To help the students to develop cognizance of the importance of organization behaviour.
- To enable students to understand the leading and motivation.
- Determine the various factors associated with organizational culture.
- Develop the group dynamics in developing team building.

Syllabus		**Total Hours:48**
Unit -I	**Introduction to Management**	**10Hrs**

Nature, Scope and Functions - Principles of Management, Evolution of Management thought: Scientific Management theory, Bureaucracy theory, Administrative theory, Behavioural, Human Relations Approach - Modern Theory - Quantitative Approach, Systems and Contingency.

Unit -II	**Introduction to Organizational Behavior**	**9Hrs**

Meaning, definition, nature, scope and functions - Organizing Process – Making organizing effective-Understanding Individual Behaviour–Attitude -Perception –Learning – Personality.

Unit -III	**Perception &Motivation**	**10Hrs**

Theories of Motivation- Maslow's Hierarchy of Needs - Hertzberg's Two Factor Theory - Vroom's theory of expectancy – Mc Cleland's theory of needs–Mc Gregor's theory X and theory Y– Adam's equity theory – Locke's goal setting theory– Alderfer's ERG theory

Unit -IV	**Organizational Culture**	**9Hrs**

Introduction – Meaning, scope, definition, Nature - Organizational Climate - Leadership - Traits Theory–Managerial Grid - Transactional Vs Transformational Leadership - Qualities of good Leader.

Unit -V	**Group Dynamics**	**10Hrs**

Introduction – Meaning, scope, definition, Nature- Types of groups - Determinants of group behavior - Group process – Group Development - Group norms - Group cohesiveness - Small Groups - Group decision making - Team building –Conflict Management - Conflict in the organization– Conflict resolution

Textbooks:

1. Luthans, Fred, Organisational Behaviour, McGraw-Hill, 12th edition 2011
2. P Subba Rao, Organisational Behaviour, Himalya Publishing House2017

Reference Books:

1. McShane, Organizational Behaviour, TMH 2009
2. Nelson, OrganisationalBehaviour, Thomson,2009.
3. Robbins, P. Stephen, Timothy A. Judge, Organisational Behaviour, Pearson2009.
4. Aswathappa, Organisational Behaviour, Himalaya,2009

Course Outcomes(CO):

On completion of this course, student will be able to:

CO1: Understand the managerial functions and have some basic knowledge on various aspect of management.

CO2: Develop cognizance of the importance of organization behaviour

CO3: Demonstrate the applicability of the concept of organizational behavior to understand the behavior of people in the organization

CO4: Demonstrate the ability to leading and motivation in organization

CO5: Develop the importance of Organizational leadership & culture

CO6: Build team building, group dynamics, group process, group norms to resolve conflicts in organization.

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MICROPROCESSOR AND MICROCONTROLLER LAB

Course Code	L:T:P	Credits	Exam. Marks	Exam Duration	Course Type
22A0441P	0:0:3	1.5	CIE:3 SEE:70	3 Hours	PCC

Course Objectives:

- Formulate problems and implement algorithms using Assembly language.
- Develop programs for different applications.
- Interface peripheral devices with 8086 and 8051.
- Use Assembly/Embedded C programming approach for solving real world problems

Syllabus

MINIMUM TWO EXPERIMENTS MUST CONDUCT:

List of Experiments:

1. PROGRAMS FOR 16 BIT ARITHMETIC OPERATIONS (Using various addressing modes)
   a) Write an ALP to Perform Addition and Subtraction of Multi precision numbers.
   b) Write an ALP to Perform Multiplication and division of signed and unsigned Hexadecimal numbers.
   c) Write an ALP to find square, cube and factorial of a given number.
2. PROGRAMS INVOLVING BIT MANIPULATION INSTRUCTIONS
   a) Write an ALP to find the given data is positive or negative.
   b) Write an ALP to find the given data is odd or even.
   c) Write an ALP to find Logical ones and zeros in a given data.
3. PROGRAMS ON ARRAYS FOR 8086
   a) Write an ALP to find Addition/subtraction of N no 's.
   b) Write an ALP for finding largest/smallest no.
   c) Write an ALP to sort given array in Ascending/descending order.
4. PROGRAM FOR STRING MANIPULATIONS FOR 8086
   a) Write an ALP to find String length.
   b) Write an ALP for Displaying the given String.
   c) Write an ALP for Comparing Two Strings.
   d) Write an ALP to reverse String and Checking for palindrome.
5. PROGRAM FOR DIGITAL CLOCK DESIGN USING 8086
   a) Write an ALP for Designing clock using INT 21H Interrupt.
   b) Write an ALP for Designing clock using DOS Interrupt Functions.
   c) Write an ALP for Designing clock by reading system time.
6. INTERFACING STEPPER MOTOR WITH 8086
   a) Write an ALP to 8086 processors to Interface a stepper motor and operate it in clockwise by choosing variable step-size.
   b) Write an ALP to 8086 processors to Interface a stepper motor and operate it in Anti clockwise by choosing variable step-size.
7. INTERFACING ADC/DAC WITH 8086
   a) Write an ALP to 8086 processors to Interface ADC.
   b) Write an ALP to 8086 processors to Interface DAC and generate Square Wave/Triangular Wave/Step signal.
8. COMMUNICATION BETWEEN TWO MICROPROCESSORS
   a) Write an ALP to have Parallel communication between two microprocessors using 8255
   b) Write an ALP to have Serial communication between two microprocessor kits using 8251.
9. PROGRAMS USING ARITHMETIC AND LOGICAL INSTRUCTIONS FOR 8051

a) Write an ALP to 8051 Microcontroller to perform Arithmetic operations like addition, subtraction, Multiplication and Division.
b) Write an ALP to 8051 Microcontroller to perform Logical operations like AND, OR and XOR.
c) Programs related to Register Banks.

10. PROGRAM TO VERIFY TIMERS/COUNTERS OF 8051
    a) Write a program to create a delay of 25msec using Timer0 in mode 1 and blink all the Pins of P0.
    b) Write a program to create a delay of 50 µsec using Timer1 in mode 0 and blink all the Pins of P2.
    c) Write a program to create a delay of 75msec using counter0 in mode 2 and blink all the Pins of P1.
    d) Write a program to create a delay of 80 µsec using counter1 in mode 1 and blink all the Pins of P3.
11. UART OPERATION IN 8051
    a) Write a program to transfer a character serially with a baud rate of 9600 using UART.
    b) Write a program to transfer a character serially with a baud rate of 4800 using UART.
    c) Write a program to transfer a character serially with a baud rate of 2400 using UART.
12. INTERFACING LCD WITH 8051
    a) Develop and execute the program to interface16*2 LCD to 8051.
    b) Develop and execute the program to interface LCD to 8051 in 4-bit or 8-bit mode.

Reference Books:

1. Kenneth.J.Ayala. The 8051 microcontroller, 3rd edition, Cengage learning,2010.
2. Advanced microprocessors and peripherals-A.K ray and K.M.Bhurchandani, TMH, 2nd
3. edition2006.
4. The 8051 Microcontroller and Embedded Systems: Using Assembly and C by Muhammad AliMazidi, Janice GillispieMazidi, Second Edition.

Course Outcomes:

After the completion of the course students will able to:

CO1: Interface the peripheral devices with 8086 microprocessors.

CO2: Interface the peripheral devices with 8051microcontrollers.

CO3: Develop the algorithms using Assembly language.

CO4: Develop programs using embedded C language for different applications.

CO5: Develop the Assembly language programming approach for solving real world problems.

CO6: Develop the Embedded C programming approach for solving real world problems.

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DIGITAL SIGNAL PROCESSING LAB

Course Code	L:T:P	Credits	Exam. Marks	Exam Duration	Course Type
22A0442P	0:0:3	1.5	CIE:30 SEE:70	3 Hours	PCC

Syllabus

LIST OF EXPERIMENTS: (**Conduct all experiments**).

Note: Any TWELVE of the experiments are to be conducted.

1. Generate the following standard discrete time signals.
   i)Unit Impulse ii) Unit step iii) Ramp iv) Exponential v) Saw tooth
2. Generate sum of two sinusoidal signals and find the frequency response (magnitude and phase).
3. Implement and verify linear and circular convolution between two given signals.
4. Implement and verify autocorrelation for the given sequence and cross correlation between two given signals.
5. Compute and implement the N-point DFT of a given sequence and compute the power density spectrum of the sequence.
6. Implement and verify N-point DIT-FFT of a given sequence and find the frequency response (magnitude and phase).
7. Implement and verify N-point IFFT of a given sequence.
8. Design IIR Butterworth filter and compare their performances with different orders (Low Pass Filter /High Pass Filter)
9. Design IIR Chebyshev filter and compare their performances with different orders (Low Pass Filter /High Pass Filter).
10. Design FIR filter (Low Pass Filter /High Pass Filter) using different window techniques (rectangular, hamming and Kaiser)
11. Design and verify Filter (IIR and FIR) frequency response by using Filter design and Analysis Tool.
12. Compute the Decimation and Interpolation for the given signal.
13. Real time implementation of an audio signal using a digital signal processor.
14. Compute the correlation coefficient for the two given audio signals of same length using a digital signal processor.

References:

1. Stephen J. Chapman, “MATLAB Programming for Engineers”, Cengage, November 2012

Online Learning Resources/Virtual Labs:

1. https://www.vlab.co.in

Course Outcomes:

After the completion of the course students will be able to:

CO1: Implement various DSP Algorithms using MATLAB.

CO2: Implement DSP algorithms with Digital Signal Processor.

CO3: Analyze and observe magnitude and phase characteristics (Frequency response Characteristics) of digital IIR-Butterworth filters.

CO4: Analyze and observe magnitude and phase characteristics (Frequency response Characteristics) of digital IIR- Chebyshev filters.

CO5: Analyze and observe magnitude and phase characteristics (Frequency response Characteristics) of digital FIR filters using window techniques.

CO6: Analyze and implement various digital filters.

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VLSI DESIGN LAB

Course Code	L:T:P	Credits	Exam. Marks	Exam Duration	Course Type
22A0443P	0:0:3	1.5	CIE:30 SEE:70	3 Hours	PCC

Course Objectives:

- Design any logic circuit using CMOS transistor.
- Use different software tools for analysis of circuits.
- Design layouts to the CMOS circuits.
- Use different software tools for analog layout

Syllabus

LIST OF EXPERIMENTS: (Conduct Any 10 experiments)

1. Design and analysis of CMOS Inverter
   a) Implement CMOS inverter schematic using 90 nm technology and design its symbol.
   b) Implement test bench for CMOS Inverter and check its output response.
   c) Perform DC and AC analysis for CMOS inverter.
   d) Check the performance of CMOS inverter using parametric sweep.
2. Design and analysis of NAND and NOR Logic gates
   a) Implement NAND/NOR schematic using 90 nm technology and design its symbol.
   b) Implement test bench for NAND/NOR and check its output response.
   c) Perform DC and AC analysis for NAND/NOR.
   d) Check the performance of NAND/NOR using parametric sweep.
3. Design and analysis of XOR and XNOR Logic gates
   a) Implement XOR/XNOR schematic using 90 nm technology and design its symbol.
   b) Implement test bench for XOR/XNOR and check its output response.
   c) Perform DC and AC analysis for XOR/XNOR.
   d) Check the performance of XOR/XNOR using parametric sweep.
4. Design of AOI logic
   a) Design Schematic for AB+C‘D and check its output response.
   b) Design Schematic for AB‘+C‘D and check its output response.
   c) Design Schematic for (A+B‘)(C+D) and check its output response.
   d) Design Schematic for (A+B‘)(C‘+D) and check its output response.
5. Design and analysis of Full adder
   a) Design full adder using Full custom IC design.
   b) Design full adder using Semi custom IC design.
6. Analysis of NMOS and PMOS characteristics
   a) Implement test bench for NMOS/PMOS transistor.
   b) Perform DC and AC analysis for NMOS/PMOS transistor
   c) Check the performance of NMOS/PMOS transistor using parametric sweep.
7. Design and analysis of Common source amplifier
   a) Implement CS amplifier schematic using 90 nm technology and design its symbol.
   b) Implement test bench for CS amplifier and check its output response.

c) Perform DC and AC analysis for CS amplifier.
d) Check the performance of CS amplifier using parametric sweep.

8. Design and analysis of Common drain amplifier
   a) Implement CD amplifier schematic using 90 nm technology and design its symbol.
   b) Implement test bench for CD amplifier and check its output response.
   c) Perform DC and AC analysis for CD amplifier.
   d) Check the performance of CD amplifier using parametric sweep.
9. Design of MOS differential amplifier
   a) Design differential amplifier schematic using 90 nm technology and its symbol.
   b) Implement test bench for differential amplifier and check its output response.
   c) Perform DC and AC analysis for differential amplifier.
   d) Check the performance of differential amplifier using parametric sweep.
10. Design of two stage differential amplifier
   a) Design two stage differential amplifier schematic using 90 nm technology and its symbol.
   b) Implement test bench for two stage differential amplifier and check its output response.
   c) Perform DC and AC analysis for two stage differential amplifier.
   d) Check the performance of two stage differential amplifier using parametric sweep.
11. Design of Inverter Layout
   a) Design and implement inverter schematic.
   b) Design the layout for inverter using 90 nm tech file.
   c) Perform LVS for schematic and layout
   d) Check and remove all DRC violations.
   e) Extract parasitic R and C in layout.
12. Design of NAND/NOR Layout
   a) Design and implement NAND/NOR schematic.
   b) Design the layout for inverter using 90 nm tech file.
   c) Perform LVS for schematic and layout
   d) Check and remove all DRC violations.
   e) Extract parasitic R and C in layout

Software Required:

i. Mentor Graphics Software / Equivalent Industry Standard Software.

ii. Personal computer system with necessary software to run the programs and to implement

Course Outcomes:

After the completion of the course students will able to:

CO1: Apply switching theory to the design logic theory problems.

CO2: Design and simulate basic CMOS circuits like inverter, common source amplifier and differential amplifiers.

CO3: Design and simulate combinational and sequential digital circuits.

CO4: Design of various MOS differential amplifier

CO5: Design and analysis of Common drain amplifier and Perform DC and AC analysis

CO6: Design of NAND/NOR Layout and Extract parasitic R and C in layout

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JAVA PROGRAMMING
(Common to EEE,ME and ECE)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0539	1:0:2:0	2	CIE: 30 SEE:70	3 Hours	SC

Course Objectives:

This course will enable students to:

- To introduce the fundamental concepts of object-oriented programming to design & implement object oriented programming concepts in Java.
- To obtain knowledge about the principles of inheritance and polymorphism
- Learn the usage of Control structures in java
- To implement the concept of Array, interfaces, exception handling
- To understand the usage of Threads in java

Syllabus | **Total Hours:48**

Module : 1

Fundamentals of Object Oriented Programming: Introduction, Object Oriented Paradigm, Basic concepts of OOP: Class, Object, Inheritance, Polymorphism, Abstraction, Encapsulation..

Task: introduction to Object Oriented Programming and its basic concepts.

Module : 2

Overview of Java Language: Introduction, Java features, Java program structure, parts of Java, Java Virtual Machine-Java versus C++, How to Compile & Executing a basic java program.

Task: Differences between Java and C++, Execute “Hello welcome to java” program

Module : 3

Variables-Identifiers-Literals- Data types: Integer literals-character literals-Floating point literals- String Literals, Variables, Keywords, Data types.

Task: implementing data types with variables, find valid/invalid variables, Identifiers

Module : 4

Operators: Arithmetic operators, Relational operators, Assignment operators, Conditional operators, Type casting/Type Conversion in java.

Task: Perform all arithmetic operators using a single program, program using typecast/type conversion

Module : 5

Java Statements: Input and Output Statements, Accepting Input from the Keyboard, Displaying output with System.out.printf( ) , Displaying Formatted output with String.format( )

Task: Write a program using I/O statements in java.

Module : 6

Control Structures: Conditional control statements :- if ..statement, if… else statement- if-else-if ladder, Switch statement

Task: Write a program to find a person is eligible for vote >18?, Largest number among 3

numbers?

Module : 7

Looping/Repetitive/Iterative statements: While statement- Do ..While statement-For Statement, Continue statement-Break statement.

Task: print N natural numbers, sum of N natural numbers, Armstrong number, Strong number using for statement.

Module:8

Arrays: Arrays, One-dimensional arrays, Creating an array, Find The Length Of An Array, Types of Arrays:-Two-dimensional arrays, Creating a two-dimensional array.

Task: Find the N^{th} Largest value in an array, Insert and Addition of values using array

Module : 9

Strings: Introduction to strings, Built in strings, Creating Strings, String reverse, String Concatenation, String comparison, Immutability of Strings

Task: write a program to Perform all string operations as single output

Module : 10

Classes , Objects& Methods: Introduction, Defining a class, Adding Variables, Object Creation, Initializing the Instance variables, Access Specifiers, Methods, Constructors, Method Overloading

Task: To implement Class and Object concept, Method Overloading program

Module :11

Interfaces: Interface, Multiple Inheritance using Interfaces.

Exception Handling: Errors in Java Program, Exceptions, throws clause, throw clause, Types of Exceptions,

Task: Implement a program using exception handling, write a program Multiple Inheritance using Interfaces.

Module : 12

Threads: Introduction, Creating Threads, Extending the Threads, Stopping and Blocking a Thread, Life Cycle of a Thread. single Tasking Using a Thread, Multi tasking Using Threads

Task: Implement a program using Threads.

Reference Books:

1. Programming with Java by E.Balagurusamy.
2. Programming in Java by Sachin Malhotra, OXFORD University Press.
3. Java Complete Reference by Herbert Schildt.
4. John R.Hubbard, Programming with Java, Second Edition, Schaum's outline series, TATA McGraw-Hill Company.

Web References:

1. https://www.javatpoint.com/java-tutorial
2. https://www.learnjavaonline.org/
3. https://www.tutorialspoint.com/java/index.htm
4. https://www.w3schools.com/java/
5. https://www.geeksforgeeks.org/java/

Course Outcomes (CO):

On completion of this course, student will be able to

CO1: Understand the basic concepts of OOP

CO2: Compare & Contrast basic constructs of C++ & Java

CO3: Develop a program on operators in Java

CO4: Apply Control statements to solve real time problems

CO5: Analyze the concepts of constructers, overloading, Inheritance and Interfaces in java

CO6: Implementing different types of Threads to solve real time problems

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RESEARCH METHODOLOGY					
Course Code	**L:T:P:S**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
22A0032M	**3-0-0**	**0**	**-**	**-**	**MC**

Course Objectives:

- To understand the basic concepts of research and research problem
- To make the students learn about various types of data collection and sampling design
- To enable them to know the method of statistical evaluation
- To make the students understand various testing tools in research
- To make the student learn how to write a research report
- To create awareness on ethical issues n research

Syllabus		**Total Hours: 30**
Unit -I	**. Foundations of Research**	**6 Hrs**

Meaning of Research –Objectives of Research –Types of Research –Research Approaches – Guidelines for Selecting and Defining Research Problem –Research Design –Concepts related to Research Design –Basic Principles of Experimental Design.

Unit -II	**Sampling Design**	**7 Hrs**

Sampling Design –steps in Sampling Design –Characteristics of a Good Sample Design –Random Sampling Design. Measurement and Scaling Techniques-Errors in Measurement –Tests of Sound Measurement –Scaling and Scale Construction Techniques –Time Series Analysis –Interpolation and Extrapolation. Data Collection Methods –Primary Data –Secondary data –Questionnaire Survey and Interviews.

Unit -III	**Data Analysis**	**6 Hrs**

Correlation and Regression Analysis –Method of Least Squares –Regression vs Correlation – Correlation vs Determination –Types of Correlations and Their Applications

Unit -IV	**Interpretation of Data**	**6 Hrs**

Statistical Inference: Tests of Hypothesis –Parametric vs Non-parametric Tests –Hypothesis Testing Procedure –Sampling Theory –Sampling Distribution –Chi-square Test –Analysis of variance and Co-variance –Multivariate Analysis

Unit -V	**Report Writing and Professional Ethics**	**5 Hrs**

Report Writing and Professional Ethics: Interpretation of Data –Report Writing –Layout of a Research Paper –Techniques of Interpretation-Making Scientific Presentations in Conferences and Seminars –Professional Ethics in Research.

Textbooks:

1. C.R.Kothari,"Research Methodology:Methods and Techniques",2nd edition, New Age International PublishersMathis,JohnH.Jackson,
2. AStep by Step Guide for Beginners,"Research Methodology": Ranjit Kumar, Sage Publications.

Reference Books:

1. P.Narayana Reddy and G.V.R.K.Acharyulu, "Research Methodology and Statistical Tools", 1stEdition,Excel Books,New Delhi.
2. Donald R. "Business Research Methods", Cooper & Pamela S Schindler, 9thedition.
3. S C Gupta, "Fundamentals of Statistics",7thedition Himalaya Publications

Course Outcomes(CO):

On completion of this course, student will be able to:

CO1: Understand basic concepts of research and research problem
CO2: Demonstrate the knowledge of research processes

CO3: Read, comprehend and explain research articles in their academic discipline

CO4: Analyze various types of testing tools used in research

CO5: Understand the method of writing a research report
CO6: Design a research paper without any ethical issues