SEM/YEAR : **III SEM**
COURSE CODE : **16EC202**
TITLE OF THE COURSE : **ANALOG ELECTRONICS CIRCUITS – I**
L: T/A:P: C : **3 :1 : 0 : 4**

Course objectives

1. Know the formation and properties of semiconductor materials
2. Understand the operation of diode and its application as rectifiers
3. Understand the importance of regulators
4. Interpret the need for biasing of transistor
5. Demonstrate the working of FET and MOSFET and its applications as amplifiers & oscillators
6. Infer the importance of Power amplifiers

Course outcomes

1. Design half wave, Full wave rectifiers and regulators for the given specifications
2. Interpret the need of biasing of transistor and construct biasing circuits
3. Design transistor amplifiers, feedback amplifiers and Sinusoidal Oscillators.
4. Analyze and design single stage amplifiers at low and high frequencies using transistors and FETs
5. Estimate the requirements and design the power amplifier in real time applications such as transmitters in communication systems.

SEMICONDUCTOR DIODES CIRCUITS **(8 hours)**

Formation of PN junction, open-circuited p-n junction, Energy band diagram of PN diode, PN diode (forward bias and reverse bias), Volt-ampere characteristics of p-n diode, Half wave rectifier, full wave rectifier, efficiency, ripple factor, Inductor filter, Capacitor filter, L- section filter, π - section filter, Basic Regulator Circuit, Series voltage regulator, Shunt regulator, Short circuit protection, Current Limiting, Specifications of Voltage Regulator Circuits. Design of regulator using Zener diode and Transistors.

BJT and BIASING: **(10 hours)**

Junction transistor, Transistor current components, Transistor as an amplifier, Relation between Alpha and Beta, Input and Output characteristics of Common Base and Common Emitter configurations.

BJT biasing, criteria for fixing operating point, Fixed bias, Collector to base bias, Self-bias techniques for stabilization, Stabilization factors, (S, S', S''), Compensation techniques, (Compensation against variation in V_{BE}, Ico) Thermal run away, Thermal stability

SMALL SIGNAL LOW FREQUENCY TRANSISTOR AMPLIFIER MODEL **(12 hours)**

h-parameter representation of a transistor, analysis of single stage transistor amplifier using h-parameters: voltage gain, current gain, input impedance and output impedance of CE, CB, and CC amplifiers using exact and approximate analysis. Miller's and Dual of Miller's theorem, Frequency response of RC coupled amplifier and analysis**, Cascade** connections, Cascode connections, Darlington connections.

Analysis of single stage FET amplifiers - voltage gain, input impedance and output impedance of CS amplifiers.

FEED BACK AMPLIFIERS and OSCILLATORS **(10 hours)**

Concept of feedback, effect of negative feedback on the amplifier Characteristics. Feedback Amplifier Topologies. Method of Analysis of Voltage Series, Current Series, Voltage Shunt and Current Shunt feedback Amplifiers, Design considerations.

Condition for oscillations, LC Oscillators – Hartley and Colpitts oscillators, RC Oscillators - RC Phase Shift and Wein bridge Oscillators, Frequency and amplitude Stability of Oscillators, Crystal Oscillators. Design considerations.

POWER and TUNED AMPLIFIERS **(10 hours)**

Class A Power Amplifier, Maximum Value of Efficiency of Class A Amplifier, Transformer Coupled Amplifier, Push Pull Amplifier, Complimentary Symmetry Circuits (Transformer Less Class B Power Amplifier), Phase Inverters, Class –C amplifier, Class D Operation, , Heat Sinks.

Tuned amplifiers, Quality factor of a tank circuit, Single Tuned Capacitive Coupled Amplifier, CE Double Tuned Amplifier, Stagger tuned amplifiers, Synchronous tuned amplifiers and application of Tuned Amplifiers.

Text Books:

1. Electronic Devices and Circuits – J. Millman, C.C. Halkias, Tata McGraw Hill, 2nd Ed., 1991.
2. Electronic Devices and Circuits – R.L. Boylestad and Louis Nashelsky, Pearson/Prentice Hall, 9th Edition, 2006.
3. Electronic Devices and Circuits – T.F. Bogart Jr., J.S.Beasley and G.Rico, Pearson Education, 6th edition, 2004.

Reference Books:

1. Principles of Electronic Circuits – S. G. Burns and P.R. Bond, Galgotia Publications, 2nd Edn. 1998.
2. Microelectronics – Millman and Grabel, Tata McGraw Hill, 1988.
3. Electronic Devices and Circuits, P. John Paul, New Age International publishers, 2007.

SEM/YEAR : III SEM
COURSE CODE : 16EC203
TITLE OF THE COURSE : NETWORK THEORY
L: T/A:P: C : 3 : 0 : 0 : 3

Course objectives

1. Develop the basic concepts of network analysis, which is the pre-requisite for all the electronics and communication engineering subjects.
2. Solve different complex circuits using various network reduction techniques such as Source transformation, Network theorems etc.
3. Synthesize the transmission line parameters using two-port networks.
4. Evaluate AC and DC transients for complex electrical systems.

Course outcomes

1. Investigate the basic concepts to solve and analyze networks.
2. Design resonant circuits which are used in wireless transmission and communication networks.
3. Understand network theorems to simplify the complex networks and apply for transient analysis in electrical circuits and to analyze the system stability.
4. Evaluate the parameters of two port networks to analyze the performance of transmission lines
5. Understand basic filters which are used in communication systems.

BASIC CONCEPTS & NETWORK TOPOLOGY (12 hours)

Practical sources, Source transformations, Network reduction using Star – Delta transformation, Loop and node analysis With linearly dependent and independent sources for DC and AC networks, Concepts of super node and super mesh. Graph of a network, Concept of tree and co-tree, incidence matrix, tie-set, tie-set and cut-set schedules, Formulation of equilibrium equations in matrix form, Solution of resistive networks, Principle of duality.

NETWORK THEOREMS (8 hours)

Source transformation, Superposition, Thevinin's, Norton's, Maximum power transfer, Reciprocity, Tellegen's, Millman's and Compensation theorems for d.c and a.c excitations.

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DC-AC TRANSIENT ANALYSIS (14 hours)

Transient response of R-L, R-C, R-L-C circuits for d.c excitation – initial conditions – solution using differential equations and Laplace transform approaches

Transient response of R-L, R-C, R-L-C circuits for sinusoidal excitation – initial conditions – Solution using Laplace transform approach only.

NETWORK PARAMETERS (8 hours)

Two port network, Impedance parameters, Admittance parameters, Transmission parameters, hybrid parameters – Inter relationship between parameters – Concept of transformed network – two port network parameters using transformed variables – Interconnection of two port networks.

NETWORK FILTERS **(8 hours)**

Characteristic impedance of symmetrical networks, properties of symmetrical networks, Filter fundamentals, pass and stop bands, characteristic impedance, constant K- low pass filter, constant K-high ass filter, Band pass filter, Band Elimination Filter, Basic concepts of Attenuator and Equalizers.

Text Books:

1. Engineering circuit analysis –by W. H. Hayt, J .E. Kimmerly, and S. M. Durbin Mc Graw Hill Education private limited, 7th Edition.
2. Network Analysis by M.E Van Valkenburg, Prentice Hall of India, 3rd Edition.

Reference Books:

1. Fundamentals of Electric circuits by Charles K Alexander, Mathew N.O Sadiku Tata McGraw Hill.
2. Electrical Circuit Analysis by A Sudhakar and SP Shyam Mohan, TMH.

SEM/YEAR : III SEM
COURSE CODE : 16EC204
TITLE OF THE COURSE : DIGITAL LOGIC DESIGN
L: T/A:P: C : 3 : 0 : 0 : 3

Course objectives

1. Understand number systems and codes and their application to digital circuits and understand Boolean algebra, Karnaugh maps and its application to the design and characterization of digital circuits.
2. Analyze a given combinational or sequential circuit using Boolean algebra as a tool to simplify and design logic circuits.
3. Understand the logic design of programmable devices, including PLDs
4. Demonstrate various synchronous & Asynchronous counters and Universal Shift Registers.

Course outcomes

1. Infer different Number systems, Codes, Logic Gates, Boolean laws and theorems.
2. Apply the knowledge of Boolean algebra to deduce optimal digital circuits.
3. Construct & Implement different types of combinational logic circuits using Logic gates.
4. Develop and test different types of Sequential logic circuits using flip flops, counters, PLDs
5. Design State Machines and sequence generators & sequence detectors
6. Modify traditional design techniques to yield innovative designs

NUMBER SYSTEMS AND BOOLEAN ALGEBRA (8 hours)

Review of number systems, conversion of numbers from one radix to another radix, complement representation of negative numbers-binary arithmetic, 4-bit codes: BCD, Excess-3, Basic logic operations. Properties of Boolean Algebra, switching functions, Canonical and Standard forms-
Algebraic simplification digital logic gates, universal gates and Multilevel NAND/NOR realizations, Gray code, parity checking even parity, odd parity, Hamming code

BOOLEAN FUNCTION MINIMIZATION (8 hours)

De-Morgan Theorem, Minimization of switching functions using Boolean Theorem, K-Map up to 6-variables, Tabular minimization, minimal SOP and POS Realization, Problem solving using K-map such as code converters

COMBINATIONAL LOGIC CIRCUITS (10 hours)

Design of Half adder, Full adder, full subtractor, Ripple carry adder, Carry look ahead adder, Multiplexer, De-Multiplexer Encoder, Priority encoder, Decoder, MUX Realization of switching functions, Parity bit generator, 4 bit Digital Comparator

SEQUENTIAL CIRCUITS **(18 hours)**

Classification of sequential circuits (synchronous and asynchronous): basic flip-flops, truth tables and excitation tables (NAND RS latch, NOR RS latch, RS flip-flop. JK flip-flop, T flip-flop, D flip-flop with reset and clear terminals).Conversion of flip-flops, Design of registers, Buffer register, Shift register, Bi-directional shift register, Universal shift register.

Design of Asynchronous & Synchronous counters - Up, Down, Up down, Johnson counters, Ring counters. Finite state machine-capabilities and limitations, Melay and Moore state machines, Meelay to Moore conversion and vice-versa, Derivation of the SM chart, Reduction of state tables and state assignment. Realization of SM Chart.

PROGRAMMABLE LOGIC DEVICES **(6 hours)**

Basic PLD's-ROM, PROM, PLA, PAL, and Realization of Switching functions using PLD's, comparison of PROM, PLA and PAL

Text Books:

1. Digital Design – Morris Mano, PHI, 3rd Edition, 2006.
2. Fundamentals of Logic Design – Charles H. Roth, Thomson Publications, 3rd Edition.1998.

Reference Books:

1. Switching & Finite Automata theory – Zvi Kohavi, TMH, 2nd Edition
2. Modern Digital Electronics by RP Jain, TMH.

SEM/YEAR : **III SEM**

COURSE CODE : **16EC205**
TITLE OF THE COURSE : **ELECTRO-MAGNETIC FIELD THEORY**
L: T/A:P: C : **3 : 2 : 0 : 4**

Course objectives

1. Study the different coordinate systems, Physical signifiance of Divergence, Curl and Gradient and Understand the applications of Coulomb's law and Gauss law to different charge distributions and the applications of Laplace's and Poisson's Equations to solve real time problems on capacitance of different charge distributions.
2. Understand the physical significance of Biot-Savart's and Amperes's Law for different current distributions.
3. Know the physical interpretation of Maxwell' equations and applications for Plane waves for their behaviour in different media
4. Infer behaviour of E.M. waves incident on the interface between two different media
5. Acquire knowledge of Poyting Theorem and its application of Power flow.

Course Outcomes

1. Evaluate the problems of different charge distributions using Coulomb's law & Gauss law and capacitance problems using Laplace's equation.
2. Infer the concept of work and electrical potential and apply to solve related problems.
3. Understand Biot-Savart's and Amperes Laws and solve related problems on different current distributions.
4. Implement applications of Maxwell's equations in plane waves and their propagation in different Media.
5. Apply the wave propagation principle to analyze the reflection and refraction of EM waves in dispersive media.
6. Analyze the power concept associated with EM with Poynting Theorem and evaluate power associated with Plane waves.

Unit -1 ELECTROSTATICS -1 **(12 hours)**

Review of Vector Calculus, Coordinate systems; Coulomb's Law and Electric Field Intensity: Experiment Law of Coulomb, Electric Field Intensity, Field due to Volume Charge, Line Charge, Ring of charge and Sheet Charge, Related Problems.

Electric Flux Density, Gauss' Law and Divergence: Electric Flux Density, Gauss' Law, Divergence, Gauss' Law Differential form, Applications of Gauss' Law and Divergence Theorem, Related Problems

Unit -2 ELECTROSTATICS - 2 **(08 hours)**

Energy and Potential: Work done in Moving a Point Charge in an Electric Field, Line Integral, Definition of Potential Difference and Potential Gradient, Relation between E & V, Energy Density in static Electric Field, Boundary Conditions, Boundary Conditions for Perfect Dielectrics Related Problems

Poisson's and Laplace's Equations: Poisson's and Laplace's Equations, Uniqueness Theorem, Examples of the Solutions of Laplace's and Poisson's Equations, Related Problems.

Unit -3 MAGNETOSTATICS **(10 hours)**

The Steady Magnetic Field: Biot-Savart Law, Applications of Biot-Savart's law, Ampere's Circuital Law, Curl, Stokes' Theorem, Magnetic Flux and Flux Density, Scalar and Vector Magnetic Potentials, Magnetic Boundary Conditions, Energy in Magnetic Field Related Problems

Unit -4 MAXWELL'S EQUATIONS & PLANE WAVES **(14 hours)**

Faraday's Law of e.m.f, Inconsistency of Ampere's law, Displacement Current, Maxwell's Equation in Point and Integral Form of different media, Boundary Conditions : Dielectric – Dielectric boundary. Related Problems

Wave equations for conducting and Perfect Dielectric, Uniform Plane wave, Relation between E & H, Sinusoidal Wave equations, Wave Propagation in lossless and conducting media, and Propagation in Good Conductors, Skin Effect, & Good Dielectrics, Poynting Vector and Power Considerations, Power loss in plane conductor, Wave Polarization, Related Problems.

Unit -5 REFLECTION, REFRACTION OF PLANE WAVES **(06 hours)**

Reflection and Refraction of Uniform Plane wave: Definitions of Reflection coefficient and Transmission coefficient, Waves at Normal Incidence, for perfect conductor-dielectric boundary & dielectric-dielectric boundary, SWR, Oblique incidence: Perpendicular and Parallel Polarization, for dielectric-dielectric boundary, Brewster angle, Surface Impedance, Related Problems

Text Books:

1. Engineering Electromagnetics-William H. Hayt Jr. and John A. Buck, Tata McGraw Hill, 6th Edition, 2001
2. Electromagnetic Waves and Radiating systems – E. C. Jordan and K.G. Balman, PHI, 2nd Edn.
3. Electromagnetic fields and Wave theory- G.S.N. Raju, Pearson Education, 2006
4. Electromagnetic Field Theory and Transmission Lines- Gottapu Sasibhushana Rao, Wiley Publishers, 2012.

Reference Books:

1. Electromagnetics- Joseph Edminister, Schaum Outline Series, McGraw Hill.
2. Field and Wave Electromagnetics- David K. Cheng, Pearson Education Asia II Editionn.- 1989, Indian Reprint 2001.

SEM/YEAR : **III SEM**
COURSE CODE : **16EC206**
TITLE OF THE COURSE : **PROBABILITY THEORY & STOCHASTIC PROCESSES**
L: T/A:P: C : **3 : 2 : 0 : 4**

Course Objectives

1. Understand probability, random variable and random process concepts and their importance in Electronics and Communication Engineering course
2. Calculate statistics related to Random variables and process such as mean, variance, correlation etc
3. Evaluate standard distribution functions such as Poisson's, Gaussian distributions
4. Apply functions of random variables such as characteristic function, moment generating function to calculate statistics.

Course outcomes

1. Demonstrate the concepts of Probability Theory, random variables /Random process and describe probability models
2. Transform of random variables in one domain to another domain for statistical signal processing, Bio medical processing
3. Understand the different noise sources for noise estimation in noisy signals in signal processing and communication
4. Calculate statistics related to Random variables/process and generate functions of random variables.
5. Extend the concepts to multiple random variables and apply them to analyse practical problems.

PROBABILITY THEORY AND DENSITY FUNCTIONS **(8 hours)**

Probability introduced through Sets and Relative Frequency: Experiments and Sample Spaces, Discrete and Continuous Sample Spaces, Events, Probability Definitions and Axioms, Mathematical Model of Experiments, Probability as a Relative Frequency, Joint Probability, Conditional Probability, Total Probability, Bayes' Theorem and Independent Events

RANDOM VARIABLES **(12 hours)**

Definition of a Random Variable, Conditions for a Function to be a Random Variable, Discrete and Continuous random variables, Mixed Random Variable, Distribution and Density functions, Properties, Binomial, Poisson, Uniform, Gaussian, Exponential, Rayleigh, distributions, Conditional Distribution and density functions, properties.

OPERATIONS ON SINGLE RANDOM VARIABLE **(8 hours)**

Functions of a Random Variable, Expected Value of a Random Variable, Moments about the Origin, Central Moments, Variance and Skew, Chebychev's Inequality, Characteristic Function, Moment Generating Function,

MULTIPLE RANDOM VARIABLES **(12 hours)**

Introduction, Vector Random variables, Joint Distribution and its properties, Marginal Distribution Functions, Joint density and its properties, Conditional Distribution and Density, Statistical independence, Sum of Two Random Variables, Sum of Several Random Variables Central limit theorem, Operations on multiple random variables- Expected Value of a Function of Random Variables: Joint Moments about the Origin, Joint Central Moments, Jointly Gaussian Random Variables: Two Random Variables case, N Random Variable case, Properties.

RANDOM PROCESSES **(10 hours)**

Random process concepts, Classification of Random process, Deterministic and Nondeterministic Processes, Stationary and independence, Distribution and Density Functions, concept of Stationary and Statistical Independence. First-Order Stationary Processes, Second- Order Wide-Sense Stationary, (N-Order) and Strict-Sense Stationary, Correlation and its properties, Cross correlation, covariance, Measurement of correlation, Gaussian Random process, Time Averages and Ergodicity, Mean-Ergodic Processes, Correlation-Ergodic Processes.

Text Books:

1. Probability, Random Variables & Random Signal Principles - Peyton Z. Peebles, TMH, 4th Edition, 2001.
2. Probability, Random Variables and Stochastic Processes – Athanasios Papoulis and S.Unnikrishna Pillai, PHI, 4th Edition, 2002.

Reference books:

1. Probability and Random Processes with Application to Signal Processing – Henry Stark and John W. Woods, Pearson Education, 3rd Edition.
2. Probability Methods of Signal and System Analysis. George R. Cooper, Clave D. MC Gillem, Oxford, 3rd Edition, 1999.
3. Statistical Theory of Communication - S.P. Eugene Xavier, New Age Publications,

SEM/YEAR : **III SEM**
COURSE CODE : **16EC271**
TITLE OF THE COURSE : **ANALOG ELECTRONICS LAB – I**
L: T/A:P: C : **0 : 0 : 4 : 2**

Course objectives

1. Know the usage of electronic equipment and testing of components
2. Know the Understand the PN diode operation in forward and reverse bias
3. Design and Analyze the rectifiers with and without filters
4. Know the characteristics of transistor in CB,CE configurations
5. Construct and accomplish frequency response of Common Emitter, Common Source amplifiers and two stage RC Coupled amplifier
6. Construct sinusoidal oscillators & Power Amplifiers

Course outcomes

1. Demonstrate various electronic components and test equipment like Multi-meter, function generator, CRO etc., in order to measure passive components and observe the waveforms.
2. Design rectifiers with and without filters and regulators.
3. Design D.C. Regulated Power supplies of required voltage and current rating.
4. Design and analyze frequency response of Common Emitter, Common Source amplifier and two stage RC coupled amplifier for different application and power amplifiers.
5. Build sinusoidal oscillators for a given frequency.
6. Construct Class –A and Class-B Power Amplifiers.

(For Laboratory examination – Minimum of 12 experiments)
Identification and Testing of Components
Demonstration of Measuring Instruments

List of Experiments

Note: Use discrete components rig up the experiment and testing

1. Full wave center tapped rectifier with and without capacitor filter
2. Transistor CE characteristics (Input and Output)
3. Transistor CB characteristics (Input and Output)
4. FET characteristics
5. Design of Zener regulator.
6. RC coupled Single stage BJT amplifier and determination of the gain-frequency response, input and output impedances.
7. Two Stage RC Coupled Amplifier
8. Current series Feedback Amplifier
9. BJT-RC Phase shift Oscillator
10. BJT – Colpitts Oscillator
11. Class A Power Amplifier
12. Class B Power Amplifier
13. Diode clipping circuits
14. Single Tuned voltage amplifier.

Equipment:

1. RPS - 0 – 30 V
2. CRO - 0 – 20 M Hz.
3. Function Generators - 0 – 1 M Hz
4. Components
5. Multimeters
6. Ammeters and Voltmeters

SEM/YEAR : III SEM
COURSE CODE : 16EC272
TITLE OF THE COURSE : DIGITAL LOGIC DESIGN LAB
L: T/A:P: C : 0 : 0 : 4 : 2

Course objectives

1. Know the fundamentals of Boolean algebra and theorems, Karnaugh maps including the minimization of logic functions to SOP or POS form and analyze logic to minimize gate count, signals, IC count or time delay.
2. Strengthen the principles of logic design and use of simple memory devices, flip-flops, and sequential circuits.
3. Infer the logic design of programmable devices, including PLDs.
4. Fortify the documentation standards for logic designs, standard sequential devices, including counters and registers.

Course outcomes

1. Minimize logic functions to SOP or POS form and Implement practically using basic gates.
2. Design simple combination logic and experiment using logic gates.
3. Conduct practical experiments to implement design of complex combinational logics.
4. Verify functioning of sequential elements like flip flops,
5. Design counters and implement practically.
6. Design and implement sequence generator

(For Laboratory examination – Minimum of 10 experiments)

Training on usage of Digital trainer boards

List of Experiments
Note: Use discrete components to test and verify the logic gates.

1. Study of simple logic gates (IC 7400, 7402, 7404, 7432, 7486)
2. Simplification, realization of Boolean expressions using logic gates/Universal gates
3. Realization of Half/Full adder and Half/Full Subtractors using logic gates and parallel adder/Subtractors using 7483 chip
4. BCD to Excess-3 code conversion and vice versa.
5. Realization of Binary to Gray code conversion and vice versa.
6. Verification of the properties of decoders and encoders
7. Verification of the functioning of Multiplexer and De-multiplexers
8. Realization of One/Two bit comparator and study of 7485 magnitude comparator
9. Truth table verification of Flip-Flops: (i) JK Master slave (ii) T type and (iii) D type.
10. Realization of 4 bit counters as a sequential circuit and MOD – N counter design.
11. Shift left; Shift right, SIPO, SISO, PISO, PIPO operations using 74S195.
12. Wiring and testing Ring counter/Johnson counter.
13. Wiring and testing of Sequence generator

SEM/YEAR : **IV SEM**
COURSE CODE : **16EC207**
TITLE OF THE COURSE : **ANALOG ELECTRONICS CIRCUITS -II**
L: T/A:P: C : **3 : 0 : 0 : 3**

Course objectives

1. Gain fundamental knowledge of OPAMP and its parameters and understand the principle of working of different blocks of OPAMP.
2. Infer the working of OPAMP as amplifier and other operations such as summer and subtractor
3. Interpret OPAMP as instrumentation amplifier, integrator, differentiator, V to I converter and vice versa etc.
4. Know nonlinear applications of OPAMP as A to D converter and vice versa, LOG amplifier, Peak detector and filters.
5. Understand the internal blocks of 555 timer and its applications as timer, multivibrator and VCO.

Course outcomes

1. Acquaint with a wide variety of op-amp and linear IC applications and enable them to choose an appropriate device or module to best suit the given application.
2. Construct Butterworth filter which produces a maximally flat response in pass band.
3. Design A/D and D/A converters which may be used in serial ADC connected to Motorola Microprocessor.
4. Build a Sample and Hold circuit which is used in digital signal processing in sampling the analog signal to convert it into digital signal.
5. Design different timer and multi-vibrator circuits using 555 timer.

OPERATIONAL AMPLIFIER FUNDAMENTALS **(8 hours)**

Basic Op-Amp circuit, Op-Amp parameters – Input and output voltage, CMRR and PSRR, offset voltages and currents, Input and output impedances, Slew rate and Frequency limitations, Op-Amps as DC Amplifiers- Biasing Op-Amps, Direct coupled –Voltage Followers, Non-inverting Amplifiers, Inverting amplifiers, Summing amplifiers, Difference amplifier

OP-AMPS FREQUENCY RESPONSE AND COMPENSATION **(8 hours)**

Circuit stability, Frequency and phase response, Frequency compensating methods, Bandwidth, Slew rate effects, Zin Mod compensation, and circuit stability precautions

OP-AMP APPLICATIONS **(13 hours)**

Voltage sources, current sources and current sinks, Current amplifiers, instrumentation amplifier, precision rectifiers, Limiting circuits, Clamping circuits, Peak detectors, sample and hold circuits, V to I and I to V converters, Log and antilog amplifiers, Multiplier and divider, Triangular / rectangular wave generators, Wave form generator design, phase shift oscillator, Wein bridge oscillator.

NON-LINEAR CIRCUIT APPLICATIONS **(13 hours)**

Crossing detectors, Inverting Schmitt trigger circuits, Monostable & Astable multivibrator, Active Filters –First and second order Low pass & High pass filters. Introduction, Series Op-Amp regulator, IC Voltage regulators, 723 general purpose regulator, Switching regulator

ANALOG MIXED SIGNAL CIRCUITS **(8 hours)**

555 timer - Basic timer circuit, 555 timer used as astable and monostable multivibrator, Schmitt trigger; VCO, PLL-operating principles, Phase detector / comparator, D/A and A/ D converters – Basic DAC Techniques, AD converters

Text Books:

1. "Operational Amplifiers and Linear IC's", David A. Bell, 2nd edition, PHI/Pearson, 2004
2. Linear Integrated Circuits –D. Roy Chowdhury, New Age International (p) Ltd, 2nd Ed., 2003.
3. Op-Amps & Linear ICs – Ramakanth A. Gayakwad, PHI, 1987. 6th edition, 2004.

Reference Books:

1. "Opamps- Design, Applications and Trouble Shooting", Terrell, Elsevier, 3rd ed. 2006.
2. "Operational Amplifiers", George Clayton and Steve Winder, Elsever 5th ed., 2008
3. "Operational Amplifiers and Linear Integrated Circuits", Robert. F. Coughlin & Fred.F. Driscoll, PHI/Pearson, 2006

SEM/YEAR : IV SEM
COURSE CODE : 16EC208
TITLE OF THE COURSE : CONTROL SYSTEMS
L: T/A:P: C : 3 : 0 : 0 : 3

Course objectives

1. Understand the principles of various types of control systems, transfer function and state space models of various physical systems.
2. Analyze behavior of a control system in time and frequency domains.
3. Design different compensators and controllers in time/frequency domain.
4. Analyze the stability of a control system using root locus, Bode plot and Nyquist techniques.

Course outcomes

1. Describe and simplify a control system using block diagram and signal flow graph techniques
2. Analyze the transient and steady state performances of control systems.
3. Investigate the stability of a system using time domain and frequency domain techniques.
4. Design different compensators and controllers in time/frequency domain.
5. Investigate the controllability and observability of control systems

MATHEMATICAL MODELS OF PHYSICAL SYSTEMS (10 hours)

Concepts of Control Systems- Open Loop and closed loop control systems, Classification of control systems, Mathematical models –Transfer functions and Impulse Response-Simple electrical and mechanical systems, Feedback Characteristics-Effects of feedback, Block diagram representation of systems, Block diagram algebra, Signal flow graph, Mason's gain formula.

TIME DOMAIN ANALYSIS (12 hours)

Standard test signals, Time responses of first order and second order systems, time domain specifications, characteristic Equation, Static error constants, Generalized error series, Effects of P, PI, PD, PID controllers, The concept of stability, Routh-Hurwitz stability criterion, Difficulties and limitations in RH stability criterion, root locus concept, construction of root loci, Stability analysis using root locus, Effects of addition of poles and zeros on root locus plot, Lag, Lead, Lead-Lag Compensators design using root locus technique,

FREQUENCY DOMAIN ANALYSIS (8 hours)

Frequency response characteristics, Frequency domain specifications, Time and frequency domain parameters correlations,

STABILITY ANALYSIS **(8 hours)**

Bode plot, transfer function from the Bode plot, Stability Analysis using Bode Plot, Polar Plot, Nyquist's stability criterion, Lag, Lead, Lead-Lag Compensators design using Bode plot.

STATE SPACE ANALYSIS **(12 hours)**

Concepts of state, state space modeling of physical systems, Representation of state space model in different canonical forms, Transfer function and state space model correlations, Solution of state equations, State Transition Matrix and it's Properties, Eigen values, Eigen vectors and diagonalization, Controllability and Observability.

TEXT BOOKS:

1. I.J. Nagrath and M. Gopal, "Control Systems Engineering", New Age International (P) Limited, Publishers, 2nd edition. 2004
2. Katsuhiko Ogata, "Modern Control Engineering", Prentice Hall of India Pvt. Ltd., 3rd edition, 1998.

REFERENCE BOOKS:

1. B. C. Kuo, "Automatic Control Systems", John wiley and sons, 8th edition, 2003.
2. Norman. S. Nise, "Control Systems Engineering", John wiley & Sons, 3rd Edition.
3. Richord C. Dorf and Robert H. Bishof, "Modern Control Systems", Pearson Education, 2nd edition, 2004

SEM/YEAR : IV SEM
COURSE CODE : 16EC209
TITLE OF THE COURSE : MICROPROCESSORS
L: T/A:P: C : 3 : 0 : 0 : 3

Course objectives

1. Understand the architecture of 8085 Microprocessor and Programming
2. Demonstrate basic knowledge of Microprocessor & Interfacing by understanding the architecture of 8086 processor
3. Learn Assembly language programming and coding
4. Interface 8086 with various modules like 8255 – PPI, 8257 – DMA, 8259 – programmable interrupt controller and serial and parallel I/O.
5. Design any type of industrial oriented and real time applications by knowing the concepts of Microprocessors.

Course outcomes

1. Understand the full internal workings of a typical simple CPU including the utilization of the various hardware resources during the execution of instructions
2. Write assembly level language programs to design applications using Microprocessors.
3. Introduce the design of basic I/O hardware and microprocessor interfacing: memory chip selection, memory expansion, I/O interfacing.
4. Interface input and output devices like LCD, LED, Keyboards ADC, DAC and stepper motor to microprocessors.
5. Design the home appliances and toys using Microprocessor & Interfacing hardware.
6. Trouble shoot the problems in computers' hardware.

AN OVER VIEW OF MICROPROCESSOR (8 hours)

Introduction to Microprocessor, Instructions, Programmes, Compliers, Architecture of 8085 Microprocessor. Special functions of General Purpose registers. 8085 flag register and function of 8085 Flags, Assembly language programming, sample programs without detailed explanation

8086 MICROPROCESSOR (12 hours)

Register Organization of 8086, Architecture, Signal Description of 8086, Physical Memory Organization. Minimum and Maximum mode operations of 8086, Timing Diagrams. Addressing modes, Instruction set, Assembler Directives, Procedures and macros, Assembly Language Programs, Stack Structure of 8086.

PERIPHERAL INTERFACE (12 hours)

Various modes of operation and interfacing to 8086, 8255- PPI, 8279-Interfacing Keyboard, Displays, Stepper Motor and actuators, D/A & A/D converter interfacing. Interrupt structure of 8086. Vector interrupt table. Interrupt service routines. Introduction to DOS and BIOS interrupts. 8259 PIC Architecture and interfacing cascading of interrupt controller and its importance

DATA TRANSFER (10 hours)

Serial data transfer schemes. Asynchronous and Synchronous data transfer schemes. 8251 USART architecture and interfacing. TTL to RS 232C and RS232C to TTL conversion. Sample program of serial data transfer. Introduction to High-speed serial communications standards, USB.

ADVANCED MICRO PROCESSORS **(8 hours)**

Overview of RISC Processors. Introduction to 80286, Salient Features of 80386, Real and Protected Mode Segmentation & Paging, Salient Features of Pentium, Branch Prediction,

Text Books:

1. Advanced microprocessor and Peripherals - A. K. Ray and K. M. Bhurchandi, TMH, 20002.
2. Micro Processors & Interfacing – Douglas U. Hall, 2007.

Reference Books:

1. N. Sentil Kumar, M. Saravanan, S. Jeevananthan, "Microprocessors and Microcontrollers", Oxford University Press, 2010.
2. Kenneth J Ayala, "The 8051 Micro Controller Architecture, Programming and Applications", Thomson Publishers, 2nd Edition.

SEM/YEAR : IV SEM
COURSE CODE : 16EC210
TITLE OF THE COURSE : FUNDAMENTALS OF HDL
L: T/A:P: C : 3 : 2 : 0 : 4

Course objectives

1. Learn EDA tools and VLSI designs
2. Create the basic awareness on FPGA and CPLD architectures.
3. Design and implement the fundamental digital logic circuits using VERILOG HDL.
4. Understand the system level design and related concepts.
5. Implement the designs against timing parameters
6. Learn drawing SM charts

Course outcomes

1. Infer the importance of EDA tools and its flow for VLSI designs
2. Demonstrate the architectural details of FPGA and CPLD
3. Design and implement the fundamental digital logic circuits using VERILOG HDL
4. Perform system level design
5. Implement Design rule checks and timing parameters
6. Analyze the Digital circuits using SM charts

INTRODUCTION TO ELECTRONIC DESIGN AUTOMATION (10 hours)

Introduction, FPGA Design flow, ASIC Design flow, architectural design, logic design, simulation, verification and testing, concepts of high level synthesis, EDA Tools: FPGA Design, ASIC Design.

FPGA Based Front End Design- Implementation, FPGA configuration, User constraints Xilinx 3000 Series FPGA architecture, Altera FLEX 10K Series CPLD architecture.

ASIC Design-Schematic entry, Layout creation, DRC, LVS, post layout simulation, parasitic extraction

VERILOG LANGUAGE CONSTRUCTS (10 hours)

Verilog as HDL, Levels of Design Description, Concurrency, Simulation and Synthesis, Functional Verification, System Tasks, Programming Language Interface (PLI), Module. Keywords, Identifiers, White Space Characters, Comments, Numbers, Strings, Logic Values, Strengths, Data Types, Scalars and Vectors, Parameters, Memory, Operators, System Tasks, Exercises.

GATE LEVEL MODELING (8 hours)

AND Gate Primitive, Module Structure, Other Gate Primitives, Tri-State Gates, Array of Instances of Primitives, Additional Examples, Design of Flip-flops with Gate Primitives, Delays, Strengths and Contention Resolution, Net Types, Design of Basic Circuits, Exercises.

BEHAVIORAL, DATA FLOW AND SWITCH LEVEL MODELING (12 hours)

Introduction, Operations and Assignments, Functional Bifurcation, *Initial* Construct, *Always* Construct, Examples, Assignments with Delays, *Wait* construct, Multiple Always Blocks, Designs at Behavioral Level, Blocking and Non-blocking Assignments, The *case* statement, Simulation Flow. *if* and *if-else* constructs, *repeat* construct, *for* loop, *while* loop, *forever* loop, parallel blocks, *force-release* construct, Event. Continuous Assignment

Structures, Delays and Continuous Assignments, Assignment to Vectors, Operators. Basic Transistor Switches, CMOS Switch, Bi-directional Gates, Time Delays with Switch Primitives, Instantiations with Strengths and Delays, Strength Contention with Trireg Nets, Exercises.

SYSTEM TASKS, FUNCTIONS, UDP AND SM CHARTS (10 hours)

Introduction, Parameters, Path Delays, Module Parameters, System Tasks and Functions. File Based Tasks and Functions, Compiler Directives, Hierarchical Access, General Observations, Exercises.

User-Defined Functions, Tasks and Primitives-Introduction, Function, Tasks, User- Defined Primitives (UDP), FSM Design (Moore and Mealy Machines), State Machine Charts, Derivation of SM Charts, Realization of SM Charts, Examples based on SM charts, Linked State Machines.

TEXT BOOKS:

1. Design through Verilog HDL – T.R. Padmanabhan and B. Bala Tripura Sundari, WSE, 2004 IEEE Press.
2. Digital Systems Design using VERILOG – Charles H Roth, Jr. Thomson Publications, 2004.
3. Application-Specific Integrated Circuits, Michael John Sebastian Smith, Addison.

REFERENCE BOOKS:

1. Fundamentals of Logic Design with Verilog – Stephen. Brown and Zvonko Vranesic,TMH, 2005.
2. Advanced Digital Design with Verilog HDL – Michael D. Ciletti, PHI, 2005.
3. A Verilog Primer – J. Bhaskar, BSP, 2003.
4. P.K.Chan & S. Mourad, Digital Design Using Field Pr

SEM/YEAR : IV SEM
COURSE CODE : 16EC211
TITLE OF THE COURSE : SIGNALS AND SYSTEMS
L: T/A:P: C : 3 : 2 : 0 : 4

Course objectives

1. Know the need for orthogonality
2. Understand Fourier representation of periodic signals
3. Differentiate between Convolution and correlation of signals
4. Infer the Ideal characteristics of filters
5. Study the Significance of Sampling theorem
6. Understand Concept of region of convergence(ROC) of Laplace transform & Z Transform

Course outcomes

1. Classify the signals and perform the basic operations on both continuous-time and discrete time systems.
2. Explain the concept of orthogonality of signals and approximate periodic signals with linear combination of orthogonal functions.
3. Classify systems based on their properties and determine the response of LTI system.
4. Analyze similarity in various signals using correlation techniques.
5. Understand the various transform techniques for analyzing continuous- time and discrete time systems.
6. Understand the need, process of sampling and the effects of under sampling

SIGNAL ANALYSIS (8 hours)

Classification of Continuous time & discrete time signals. Concept of impulse function, unit step function, Signum function, Signal operations, Representation of signals using impulse function, Power and Energy of signals

Analogy between vectors and signals, orthogonal signal space, Signal approximation using orthogonal functions, Mean square error, closed or complete set of orthogonal functions, Orthogonality in complex functions.

FOURIER SERIES REPRESENTATION OF PERIODIC SIGNALS AND FOURIER TRANSFORMS (12 hours)

Representation of Fourier series for Continuous time periodic signals , Dirichlet's conditions, , properties of Fourier series, Exponential Fourier series, Relationship between Exponential Fourier series and trigonometric Fourier series, Complex Fourier spectrum.

Concept of Fourier transform, Fourier transform of arbitrary signal, Fourier transform of standard signals, Fourier transform of periodic signals, properties of Fourier transforms, Parseval's theorem, Fourier transforms involving impulse function and Signum function.

SIGNAL THROUGH LINEAR SYSTEMS **(10 hours)**

Linear system, impulse response, Response of a linear system, Linear time invariant (LTI) system, Linear time variant (LTV) system, Transfer function of a LTI system. Filter characteristics of linear systems. Distortionless transmission through a system, bandwidth, Ideal LPF, HPF and BPF characteristics, Causality and Paley-Wiener criterion for physical realization,

CONVOLUTION AND CORRELATION OF SIGNALS **(10 hours)**

Concept of convolution in time domain and frequency domain, Graphical representation of convolution, Convolution property of Fourier transforms , Cross correlation and auto correlation of functions, properties of correlation functions, Energy density spectrum, Power density spectrum, Relation between auto correlation function and energy/power spectral density function. Relation between convolution and correlation

SAMPLING & Z- TRANSFORMS **(10 hours)**

Sampling theorem – Graphical and analytical proof for Band Limited Signals, impulse sampling, Natural and Flat top Sampling, Reconstruction of signal from its samples, effect of under sampling – Aliasing, Introduction to Band Pass sampling.

Z – Transform, properties of ROC, properties of Z – transforms, inversion of Z – transforms Realization of Digital filter structures: Direct form-I, Direct form-II, Transposed form, cascaded form, Parallel form

TEXT BOOKS:

1. Signals, Systems & Communications - B.P. Lathi, BS Publications, 2003.
2. Signals and Systems - A.V. Oppenheim, A.S. Willsky and S.H. Nawab, PHI, 2nd Edn.

REFERENCE BOOKS:

1. Signals & Systems - Simon Haykin and Van Veen, Wiley, 2nd Edition.
2. Fundamentals of Signals and Systems Michel J. Robert, MGH International Edition, 2008.
3. Signals, Systems and Transforms - C. L. Philips, J. M. Parr and Eve A. Riskin, Pearson education.3rd Edition, 2004.

SEM/YEAR : IV SEM
COURSE CODE : 16EC273
TITLE OF THE COURSE : ANALOG ELECTRONICS LAB – II
L: T/A:P: C : 0 : 0 : 4 : 2

Course objectives

1. Study the various applications of Analog (Linear/Non-linear) ICs like OPAMP
2. Have hands on experience on various linear ICs.
3. Design and verify applications of OPAMP as amplifier, adder, subtractor, integrator, differentiator etc.
4. Design and verify Pulse generators using 555 timer.
5. Construct various first order filters using Op-Amp.

Course outcomes

1. Design and verify applications of OPAMP as amplifier, adder, subtractor, integrator, differentiator etc.
2. Implement V-I & I-V converters.
3. Construct the various first order filters like LPF, HPF, BPF and BRF.
4. Design ADC and VCO.
5. Construct and Implement timers using 555 timer

(For Laboratory examination – Minimum of 12 experiments)
List of Experiments
Note: Use discrete components rig up the experiment and testing

1. OP AMP as inverting and non-inverting amplifier
2. OP AMP Applications – Adder, Subtractor, Comparator Circuits
3. OP AMP as Insurmentaion Amplifier
4. OP AMP as Integrator and Differentiator
5. V-I and I-V converter
6. Active Filter Applications – LPF, HPF (first order)
7. Wide band pass filter, wide band reject filter
8. Phase shift and Wein Bridge oscillator using OPAMP
9. Function Generator using OPAMP
10. IC 555 Timer – Monostable and Astable Operation Circuit
11. Schmitt Trigger Circuits – Using IC 741 and IC 555
12. Voltage Regulator using IC 723
13. 4 bit DAC using OP AMP
14. IC 566 VCO applications

Equipment:

1. RPS - 0 – 30 V
2. CRO - 0 – 20 M Hz.
3. Function Generators - 0 – 1 M Hz
4. Components –IC 741, 555, 566, 723
5. Multimeters
6. Ammeters and Voltmeters

SEM/YEAR : IV SEM
COURSE CODE : 16EC274
TITLE OF THE COURSE : MICROPROCESSOR LAB
L: T/A:P: C : 0 : 0 : 4 : 2

Course objectives

1. Demonstrate basic knowledge of Microprocessor & Interfacing by understanding the architecture of 8086 processor
2. Learn Assemblers like MASM/TASM for 8086 microprocessor
3. Learn Assembly language programming and Machine level opcode generation.
4. Interface 8086 with various modules like 8255 – PPI, 8251-USART, serial and parallel I/O.
5. Design any type of industrial oriented and real time applications by knowing the concepts of Microprocessor.

Course outcomes

1. To Design Traffic light signals using Microprocessors.
2. Design computers like desktops, laptops using various processors.
3. Design the high speed communication circuits using serial bus connection for computers.
4. Understand the full internal workings of a typical simple CPU including the utilization of the various hardware resources during the execution of instructions.
5. Introduce the design of basic I/O hardware and microprocessor interfacing: memory chip selection, memory expansion, I/O interfacing, different I/O techniques.

(For Laboratory examination – Minimum of 12 experiments)

List of Experiments

Part-A

1. Microprocessor 8086: 10 Experiments
2. Introduction to MASM/TASM.
3. Arithmetic operation – Multi byte addition and subtraction, Multiplication and Division – Signed and unsigned Arithmetic operations, ASCII – arithmetic operations. (Any 4 Experiments)
4. Logic operations – Shift and rotate – Converting packed BCD to unpacked BCD, BCD to ASCII conversion. (Any 2 Experiment)
5. String operations-- Move Block, Reverse string, Sorting, Inserting, Deleting, Length of the string, String comparison. (Any 3 Experiments)
6. Modular Program: Procedures and macros -Near and Far implementation. (Any 1 Experiment)

Part-B

Interfacing 8086 – any 4 Experiments

1. 8251 – USART.
2. Traffic lights
3. Message Displays
4. 8279 - Keyboard
5. Stepper Motor
6. DAC

SEM/YEAR : V SEM
COURSE CODE : 16EC301
TITLE OF THE COURSE : MICRO CONTROLLERS
L: T/A:P: C : 2 : 0 : 2 : 3

Course objectives

1. Understand Basics of Microcontroller, 8051architecture and Pin description, 8051 Addressing modes and instruction set Programming of on-chip peripherals in 8051.
2. Design and develop applications using 8051 Assembly language and C program.
3. Infer Arduino Microcontroller architecture, On-chip peripherals and program using Assembly language and C.

Course Outcomes

1. Explain the architecture and operation of 8051 microcontroller.
2. Develop the programming techniques in assembly language and interfacing various external modules with 8051 and programming in C.
3. Summarize the concept of interrupts and timers and their programming.
4. Describe the architecture and operation of Arduino microcontroller, memories, programming & interfacing with peripherals.
5. Design prototype hardware mini projects using Arduino Microcontroller and demonstrate.

UNIT-1 : INTRODUCTION TO MICROCONTROLLERS (10 hours)

RISC & CISC CPU Architectures, Harvard & Von-Neumann CPU architecture, Computer software. The 8051 Architecture: Introduction, Architecture of 8051, Pin diagram of8051, Memory organization, External Memory interfacing,Stacks. Addressing Modes: Introduction, Instruction syntax, Data types, Subroutines, Addressing modes: Immediate addressing , Register addressing, Direct addressing, Indirect addressing, relative addressing, Absolute addressing, Long addressing, Indexed addressing, Bit inherent addressing, bit direct addressing.

UNIT -2: 8051 PROGRAMMING (10 hours)

Instruction set: Instruction timings, 8051 instructions: Data transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, Subroutine instructions, Bit manipulation instruction. Assembler directives, Assembly language programs and Time delay calculations.

UNIT -3 : 8051 INTERFACING AND APPLICATIONS (10 hours)

Basics of I/O concepts, I/O Port Operation, Interfacing 8051 to LCD, Keyboard, parallel and serial ADC, DAC, Stepper motor interfacing and DC motor interfacing and programming. 8051 Interrupts and Timers/counters: Basics of interrupts, 8051 interrupt structure, Timers and Counters, 8051 timers/counters, programming 8051timers in assembly and C. 8051 Serial Communication: Data communication, Basics of Serial Data Communication, 8051 Serial Communication, connections to RS-232, Serial communication Programming in assembly and C.

UNIT- 4: ARDUINO MICROCONTROLLER (14 hours)

Fundamentals of Embedded system, Getting Started with Arduino Exploring the Board of IDE (with its installation procedure). Interfacing with Arduino: Control LEDS from GPIO Pins, Input-Switch Buttons, DC Motor, Stepper motor, Relay, Sensor Interface: LDR, Analog POT, LM35 and Serial Communication

UNIT- 5: APPLICATIONS OF MICROCONTROLLERS (06 hours)

RPM meter, event counter, temperature controller. (Programs in assembly and C). Development Tools: Simulators, debuggers, cross compilers, in-circuit Emulators for the microcontrollers.

TEXT BOOKS:

1. **"**The 8051 Microcontroller and Embedded Systems – using assembly and C**"-** **,**Muhammad Ali Mazidi and Janice Gillespie Mazidi and RollinD. McKinlay; PHI, 2006 / Pearson, 2006.
2. "Arduino Programming Notebook". Brian W. Evans, 1st edn., 2007.
3. Fundamentals of Microcontrollers and Applications in Embedded systems**,** Ramesh Gaonkar, Penram International Publishing Pvt. Ltd. 2007.

REFERENCE BOOKS:

1. "The 8051 Microcontroller Architecture, Programming &Applications", 2e Kenneth J.
2. Ayala ;, Penram International, 1996 /Thomson Learning 2005.
3. "The 8051 Microcontroller: Hardware, software and applications", V. Udayashankara and Malikarjuna Swamy, TMH, 2009.
4. Microcontrollers: Architecture, Programming, Interfacing and System Design", Raj Kamal, "Pearson Education, 2005
5. Microcontrollers; Architecture implementation and programming- HINTZ, McGraw-Hill
6. Embedded control handbook- MICROCHIP (Vol 1& 2).

SEM/YEAR : V SEM
COURSE CODE : 16EC302
TITLE OF THE COURSE : DIGITAL SIGNAL PROCESSING
L: T/A:P: C : 3 : 2 : 2 : 4

Course objectives

1. Familiarize with the behavior of a system in terms of both its time domain and frequency domain representations.
2. Understand the importance of FFT algorithms.
3. Identify the correct type of filter required for a given problem and be able to demonstrate the design and implementation of such a digital filter.
4. Explain the concept of aliasing and its effect on the design and use of practical systems.

Course Outcomes

1. Apply transform methods to analyze the analog and digital linear time-invariant systems.
2. Convert between time and frequency domain representations of signals and systems.
3. Infer the practical aspects of sampling, reconstruction and select a suitable sampling rate for a given signal processing problem.
4. Analyze and design analog and digital filters for a given Specification.
5. Interpret and demonstrate the applications of the discrete Fourier transform and Implement the digital filters.

UNIT 1 : DISCRETE FOURIER TRANSFORMS (DFT) (12 Hours)

Frequency domain sampling and reconstruction of discrete time signals. DFT as a linear transformation, its relationship with other transforms.
Properties of DFT, multiplication of two DFTs- the circular convolution, additional DFT properties.

UNIT -2 : FFT ALGORITHMS (10 Hours)

Use of DFT in linear filtering, overlap-save and overlap-add method. Direct computation of DFT, need for efficient computation of the DFT (FFT algorithms) Radix-2 FFT algorithm for the computation of DFT and IDFT–decimation-in-time and decimation-in-frequency algorithms. Goertzel algorithm, and chirp-z transform.

UNIT -3 : IIR FILTER DESIGN (10 Hours)

Characteristics of commonly used analog filters –Butterworth and Chebysheve filters, analog to analog frequency transformations. Design of digital IIR filters from analog filters (Butterworth and Chebyshev) - impulse invariance method. Mapping of transfer functions: Approximation of derivative (backward difference and bilinear transformation) method, Matched z transforms

UNIT – 4 : FIR FILTER DESIGN **(10 Hours)**

Introduction to FIR filters, design of FIR filters using - Rectangular, Hamming, Bartlet and Kaiser Windows, FIR filter design using frequency sampling technique.

UNIT – 5 : DIGITAL SIGNAL PROCESSOR **(10 Hours)**

Elementary idea about the architecture and important instruction sets of TMS320C 6XXX processor, writing of small programs in Assembly Language

TEXT BOOKS:

1. Digital signal processing – Principles Algorithms &Applications, Proakis & Monalakis, Pearson education, 4th Edition, New Delhi, 2007.
2. Digital Signal processing – A Computer Based Approach, S. K. Mitra, TMH Publishing Co.
3. Digital Signal Processing Signals using MATLAB, Vinay K. Ingle, III edition, Cengage Learning.

REFERENCE BOOKS:

1. Digital Signal Processing, P. Rameshbabu, Scitech Publications (India).
2. Digital Signal Processing, S.Salivahanan, A.Vallabraj & C. Gnanapriya, TMH Publishing Co.
3. Digital Signal Processing; A Hands on Approach, C. Schuler & M.Chugani, TMH Publishing Co.
4. Texas Instruments DSP Processor user manuals and application notes.

SEM/YEAR : **V SEM**
COURSE CODE : **16EC303**
TITLE OF THE COURSE : **ANALOG COMMUNICATIONS**
L: T/A:P: C : **3 : 0 : 0 : 3**

Course objectives

1. Understand Modulation & demodulation techniques of AM, DSB, SSB &VSB
2. Know Frequency Division Multiplexing
3. Understand Modulation & demodulation techniques of FM
4. Know Characteristics of AM & FM receivers
5. Know Noise Figure in AM & FM receiver systems.

Course outcomes

1. Demonstrate various blocks in communication systems
2. Summarize the types of modulations.
3. Analyze the Modulation techniques in time and frequency domains.
4. Demonstrate & compare Power relations in Amplitude and Frequency modulated techniques.
5. Analyze the sources and effects of noise in analog communication systems.

UNIT- I: AMPLITUDE MODULATION **(8 hours)**

Introduction to communication system, Need for modulation, Frequency Division Multiplexing, Amplitude Modulation, Definition, Time and frequency domains description, single tone modulation, power relations in AM waves, Generation of AM waves-square law Modulator, Principle of Detection of AM Wave-envelope detector.

UNIT – II: DSB & SSB MODULATION TECHNIQUES **(10 hours)**

DSB MODULATION: Double side band suppressed carrier modulators, time and frequency domains description, Generation of DSBSC Waves, Balanced Modulators, Coherent detection of DSB-SC Modulated waves.

SSB modulation: Frequency domain description, Frequency discrimination method for generation of AM SSB Modulated Wave, Time domain description, Phase discrimination method for generating AM SSB Modulated waves. Demodulation of SSB Waves, Vestigial side band modulation: Frequency description, Generation of VSB Modulated wave, Time domain description.

UNIT- III: ANGLE MODULATION **(12 hours)**

Basic concepts, Frequency Modulation: Single tone frequency modulation, Spectrum Analysis of Sinusoidal FM Wave, Narrow band FM, Wide band FM, Constant Average Power, Transmission bandwidth of FM Wave - Generation of FM Waves, Direct FM, Operating principles of PAM and PWM. Detection of FM Waves: Balanced Frequency discriminator, Zero crossing detector.

UNIT –IV: TRANSMITTERS & RECEIVERS **(12 hours)**

Radio Transmitter - Classification of Transmitter, AM Transmitter, FM Transmitter – Variable reactance FM Transmitter, frequency stability in FM Transmitter.

Receiver Types - Tuned radio frequency receiver, Superheterodyne receiver, RF section and Characteristics, Frequency changing and tracking, Intermediate frequency, AGC, FM Receiver, Comparison of FM receiver with AM Receiver.

UNIT – V: NOISE IN ANALOG COMMUNICATION (8 hours)

Noise in Analog communication System, Noise in DSB & SSB System Noise in AM System, Noise in Angle Modulation System, Threshold effect in Angle Modulation System, Pre-emphasis & de-emphasis.

Text Books:

1. An Introduction to Analog& Digital Communications - Simon Haykin, John Wiley, 4TH edition, 2001
2. Electronic Communication Systems – George Kennedy and Bernard Davis, TMH 2004

Reference Books:

1. Principles of Communication Systems – H Taub & D. Schilling, Gautam Sahe, TMH, 2007 3rd Edition.
2. Communication Systems Second Edition – R.P. Singh, SP Sapre, TMH, 2007.
3. Fundamentals of Communication Systems - John G. Proakis, Masond

SEM/YEAR : **V SEM**
COURSE CODE : **16EC304**
TITLE OF THE COURSE : **CMOS VLSI**
L: T/A:P: C : **2 : 2 : 0 : 3**

Course objectives

1. Study the IC Fabrication process and to define the rules governing the process
2. Analyze MOS device properties and short channel effects.
3. Illustrate stick diagrams, layouts for CMOS circuits and other MOS logic structures.
4. List and study various MOS logic structures.
5. Infer MOS characteristics.

Course Outcomes

1. Explain IC Production process and various fabrication processes.
2. Discuss the device properties, circuit design processes, scaling.
3. Design stick diagrams, layouts for various CMOS circuits.
4. Analysis of advanced MOS logic structures.
5. Demonstration of DC, AC and transient responses of the CMOS logic gates.

UNIT 1- BASIC MOS TECHNOLOGY **(10 hours)**

Integrated circuit's era. Enhancement and depletion mode MOS transistors. nMOS fabrication. CMOS fabrication, p well / n well / twin tub process. BiCMOS technology.

CMOS Process Technology:

Lambda Based Design rules, scaling factor, semiconductor Technology overview, basic CMOS technology, MOS mask layer, stick diagram, design rules and layout. Euler Path.

UNIT 2 : MOS TRANSISTOR THEORY **(10 hours)**

n MOS / p MOS transistor, threshold voltage equation, body effect, MOS device design equation, sub threshold region, Channel length modulation, mobility variation, Tunneling, punch through, hot electron effect. MOS models, small signal AC Characteristics, CMOS inverter, βn / βp ratio, noise margin, static load MOS inverters, transmission gate, tristate inverter, BiCMOS inverter.

UNIT 3- LOGIC DESIGN WITH MOSFETS **(10 hours)**

Ideal Switches and Boolean Operations, MOSFET as switch, Basic Logic gates in CMOS, complex Logic Gates in CMOS(combinational), structured Logic design(standard), Layout and stick diagram of the logic discussed. Design of Multiplexers, Transmission Gate circuits.

CMOS Logic Structures: CMOS Complementary Logic, Bi CMOS Logic, Pseudo - nMOS Logic, Dynamic CMOS Logic, Clocked CMOS Logic, Pass Transistor Logic, CMOS Domino Logic.

Clocking: Charge sharing, clock generation, clock distribution, clocked storage elements.

UNIT 4-SUPER BUFFERS, BI-CMOS AND STEERING LOGIC **(10 hours)**

Introduction, RC delay lines, super buffers- An NMOS super buffer, tri state super buffer and pad drivers, CMOS super buffers, Dynamic ratio less inverters, large capacitive loads, pass logic, designing of transistor logic, General functional blocks - NMOS and CMOS functional blocks.

Special Circuit Layouts and Technology Mapping:
Introduction, Talley circuits, NAND-NAND, NOR- NOR, and AOI Logic, NMOS, CMOS Multiplexers, Barrel shifter, Wire routing and module lay out.

UNIT 5-ELECTRONIC OF CMOS LOGIC GATES (10 hours)

DC Characteristics of inverter, NAND and NOR gates, Inverter switching characteristics, NAND and NOR transient Response.

System Design:

CMOS design methods, structured design methods, Strategies encompassing hierarchy, regularity, modularity & locality.

TEXT BOOKS:

1. Neil Weste and K. Eshragian, "Principles of CMOS VLSI Design: A System Perspective," 2nd edition, Pearson Education (Asia) Pvt.. Ltd., 2000.
2. Eugene D Fabricius "Introduction to VLSI Design", 1st edn., 1990, McGraw-Hill International publications.
3. Douglas A Pucknell & Kamran Eshragian , "Basic VLSI Design" PHI 3rd Edition (original Edition – 1994)

REFERENCE BOOKS:

1. Wayne, Wolf, "Modern VLSI design: System on Silicon" Pearson Education", 4th Edition,2009
2. Sung Mo Kang & Yosuf Lederabic Law, "CMOS Digital Integrated Circuits: Analysis and Design", McGraw-Hill (Third Edition),1994
3. J. P. Uyemura "Introduction to VLSI Circuits and Systems", Wiley Publications, 2001

SEM/YEAR : **V SEM**
COURSE CODE : **16EC305**
TITLE OF THE COURSE : **COMPUTER NETWOKS**
L: T/A:P: C : **2 : 2 : 0 : 3**

Course Objectives

1. Study the concept, terminologies, and technologies used in modern data communication and computer networking.
2. Know the functions of different layers of network architecture.
3. Acquire knowledge about the IEEE standard employed in computer networking.
4. Understand the different protocols and network components.
5. Understand the concept of DNS, Email, WWW and HTTP
6. Study the different encryption standards and public key algorithms

Course Outcomes

1. Recommend appropriate network model for data communication.
2. Understand how reliable data communication is achieved through data link layer.
3. Analyze appropriate routing algorithm for data routing.
4. Implement internet connection to the system and knowledge of trouble shooting.
5. Apply IEEE standards in design of computer networks.

UNIT -1 : INTRODUCTION **(10 hours)**

Network Hardware, Network Software, and Reference Models: OSI, TCP/IP, Network Topologies

Physical Layer: Transmission media: Magnetic Media, Twisted pair, Base band Coaxial Cable, Fiber optics, Wireless Transmission: Electromagnetic Spectrum, Radio Transmission, Microwave Transmission

UNIT -2 : DATA LINK LAYER **(10 hours)**

Data link layer: Design issues: framing, error detection and correction, Elementary Data link Protocols: Stop and wait, Sliding Window protocols: Go-back-N, Selective Repeat, **Medium Access sub layer:** Channel allocation methods, Multiple Access protocols: ALOHA, CSMA, Ethernet and Wireless LAN.

UNIT -3 : NETWORK LAYER **(12 hours)**

Network Layer design issues, Virtual circuit and Datagram subnets, Routing algorithms: Shortest path routing, Flooding, Distance vector routing, Hierarchical routing, Broad cast and Multi cast routing, Congestion Control: Congestion prevention policies.

The Network layer in the internet: The IP Protocol, IP Addresses, and Internet Control Protocols, IPv6.

UNIT -4: TRANSPORT LAYER **(10 hours)**

Transport Services, Elements of Transport Protocols: Addressing, Connection establishment, Connection Release, Flow control and Buffering, Internet Transport Protocols: UDP and TCP.

Session layer: Dialog Control and Synchronization

UNIT -5: APPLICATION LAYER **(10 hours)**

Presentation Layer: Translation, Encryption and Compression

Domain Name System, Electronic Mail, World Wide Web, HyperText Transfer Protocol,

Network Security : Cryptography, Symmetric key algorithms, Public key algorithms, Digital signatures.

Text Books:

1. Computer Networks - Andrew S Tanenbaum, 4th Edition. Pearson Education, 2005.
2. Data Communications and Networking - Behrouz A. Forouzan. Third Edition TMH.

Reference Books:

1. Understanding communications and Networks, 3rd Edition, W.A. Shay, Thomson
2. Data Communications and Networking - Behrouz A. Forouzan. Third Edition TMH.

SEM/YEAR : V SEM
COURSE CODE : 16EC371
TITLE OF THE COURSE : DSP LAB
L: T/A:P: C : 0 : 0 : 4 : 2

Course objectives

1. Enhance the analytical ability of the students in facing the challenges posed by growing trends in communication, control and signal processing areas.
2. Introduce the basic principles, methods, and applications of digital signal processing,
3. To explore its algorithmic, computational, and programming aspects.
4. Learn programming of DSP hardware for real-time signal processing applications.
5. To provide with an appreciation of applications for the techniques and mathematics used in this course.

Course Outcomes

1. Ability to program digital signal processing algorithms in C (CCS Studio) and MATLAB, including the design, implementation, and real-time operation of digital filters, and applications of the fast Fourier transform.
2. Ability to program a DSP chip with a variety of real-time signal processing algorithms, such as filtering for noise reduction or digital audio effects.
3. Analyze the signals in Time and Frequency domain through its respective tools.
4. Estimate the frequency response characteristics of FIR and IIR digital filters.
5. Design of FIR and IIR digital filters.

LIST OF EXPERIMENTS USING MATLAB

1. Verification of sampling theorem.
2. Impulse response of a given system.
3. Linear convolution and Circular convolution of two given sequences.
4. Autocorrelation and Cross correlation of given sequence and verification of its properties.
5. Solving a given difference equation.
6. Computation of N-point DFT of a given sequence and to plot magnitude and phase spectrum.
7. Linear convolution and Circular convolution of two sequences using DFT and IDFT.
8. Design and implementation of FIR filter and IIR filter to meet given specifications.

Additional Expt.

Generation of Gaussian noise (Real and Complex), Computation of its Mean, Mean Square Value and its Skew, Kurtosis, and PSD , Probability Distribution Function.

LIST OF EXPERIMENTS USING DSP PROCESSOR.

1. Linear convolution and circular convolution of two given sequences.
2. Computation of N-point DFT of a given sequence.
3. Realization of an FIR filter (any type) to meet given specifications. The input can be a signal from function generator/speech signal.
4. Audio application such as to plot a time and frequency display of a Microphone plus a cosine using DSP. Read a .wav file and match with their respective spectrograms.
5. Noise removal: Add noise above 3 KHz and then remove, interference suppression using 400Hz tone.
6. Impulse response of first order and second order system.

SEM/YEAR : V SEM
COURSE CODE : 16EC372
TITLE OF THE COURSE : ANALOG COMMUNICATIONS LAB
L: T/A:P: C : 0 : 0 : 4 : 2

Course objectives

1. Understand all types of analog modulation / demodulation principles such as AM, DSB-SC, FM.
2. Recognize the importance of sampling, pre-emphasis and de-emphasis circuits.
3. Know the need for diode detector, and AGC.
4. Know the operation of pulse modulation techniques.

Course Outcomes

1. Demonstrate different modulation and demodulation techniques
2. Demonstrate the operations of different types of detectors.
3. Analyze the signal transmission and receiving fundamental concepts
4. Describe the operation of Frequency division multiplexing.
5. Demonstrate sampling, AGC, PLL, pre-emphasis and de-emphasis circuits.

List of Experiments

(a)Any nine experiments from the following:

1. Verification of Sampling Theorem
2. Amplitude Modulation & Demodulation
3. AM - DSB SC - Modulation & Demodulation
4. Frequency Modulation & Demodulation
5. Pre-emphasis & De-emphasis
6. Spectrum Analysis of Modulated signal using Spectrum Analyzer
7. Diode Detector
8. AGC Circuits
9. Pulse Amplitude Modulation – Modulation & Demodulation
10. PWM, PPM - Modulation & Demodulation
11. Phase Locked loop (PLL)
12. Design of F.M receiver (90.4 MHz)

(b) Any three experiments from the following using MATLAB software:

1. Amplitude Modulation – Modulation & Demodulation
2. AM - DSB SC -. Modulation & Demodulation
3. Frequency Modulation – Modulation. & Demodulation using 8038/2206
4. Pulse Amplitude Modulation – Modulation & Demodulation
5. PWM, PPM - Modulation & Demodulation

Equipment & Software required:
Computer & Software:

i.) Computer Systems with latest specifications
ii) Connected in LAN (Optional)
iii) Operating system (Windows)
iv) Simulations software (MATLAB)

Equipment:

1. Regulated Power Supply - 0 – 30 V
2. CRO - 0 – 20 M Hz.
3. Function Generators - 0 – 1 M Hz
4. Spectrum Analyzer
5. Components
6. Multimeters

SEM/YEAR : V SEM
COURSE CODE : 16EC321
TITLE OF THE COURSE : MEASUREMENTS & VIRTUAL INSTRUMENTATION
L: T/A:P: C : 3 : 0 : 0 : 3

Course objectives

1. Understand the need for measurement of various parameters in electronics and electrical engineering.
2. Know how analog and digital millimeters, Oscilloscopes and signal sources work.
3. Know how different types of bridges are used for various measurements.
4. Know how the transducers work.
5. Know how a PC can be used for producing signals and for taking measurements.

Course outcomes

1. Design Volt-meters & Describe the operation of Oscilloscopes and signal sources.
2. Analyze different types of bridges and design them for specific applications.
3. Describe the operation of transducers and suggest a suitable transducer for an application.
4. Demonstrate how a PC can be used for producing different signals and also for measuring various parameters, using add-on cards.
5. Describe the use of different types of communication buses and protocols for interconnecting different PCs and instruments.

UNIT- I: MEASURING INSTRUMENTS (12 hours)

Analog Voltmeters: Introduction, Multirange analog voltmeter, Loading, AC voltmeter using Rectifiers – Half wave and full wave, Peak responding and True RMS voltmeters.
Digital Instruments: Digital Voltmeters – Introduction, DVM's based on Single slope, dual slope and Successive approximation principles, Resolution and sensitivity, Digital frequency meters, Digital measurement of time.
Oscilloscopes: Introduction, Basic principles using block diagram, Dual beam and dual trace CROs, Delayed time-base oscilloscopes, Digital storage oscilloscopes

UNIT – II: SIGNAL SOURCES & BRIDGES (10 hours)

Introduction, Standard signal generator, Function generator, Sweep frequency generator, Frequency synthesizer. Wheatstone's bridge, Kelvin Bridge, Capacitance Comparison Bridge, Maxwell's bridge, Wein's bridge.

UNIT – III: TRANSDUCERS (8 hours)

Introduction, Resistive transducer, Resistive position transducer, Strain gauges, Resistance Thermometer, Thermistor, Inductive transducer, Differential output transducers, LVDT. Piezoelectric transducer, Photoelectric transducer, Photovoltaic transducer, Semiconductor photo devices, Temperature transducers-RTD, Thermocouple.

UNIT IV: FUNDAMENTALS OF VIRTUAL INSTRUMENTATION (12hours)

Concept of Virtual Instrumentation – PC based data acquisition – Typical on board DAQ card – Resolution and sampling frequency – Multiplexing of analog inputs – Single ended and

differential inputs – Different strategies for sampling of multi-channel analog inputs. Concept of universal DAQ card – Use of timer counter and analog outputs on the universal DAQ card.

UNIT V: CLUSTER OF INSTRUMENTS IN SYSTEM (8 hours)

Interfacing of external instruments to a PC – RS 232C, RS – 422, RS 485 and USB standards – IEEE 488 standard – ISO –OSI model for series bus – introduction to bus protocols of MOD bus and CAN bus.

TEXT BOOKS:

1. "Electronic Instrumentation", H. S. Kalsi, TMH, 3rd 2010
2. Sanjay Gupta, "Virtual Instrumentation, MATLAB", TMH, New Delhi, 2003
3. S. Gupta and J P Gupta,"PC Interfacing for Data Acquisition and Process Control", Instrument Society of America, 1994

REFERENCE BOOKS:

1. Electronic Instrumentation and Measurements", David A Bell, PHI / Pearson Education, 2006.ext Books:
2. Peter W Gofton, "Understanding Serial Communication", Sybes International, 2000
3. Ernest O. Doeblin and Dhanesh N Manik, "Measurement Systems – Application and
4. Design", 5th Edn, TMH, 2007.

SEM/YEAR : **V SEM**
COURSE CODE : **16EC323**
TITLE OF THE COURSE : **DATA STRUCTURE USING C++**
L: T/A:P: C : **3 : 0 : 0 : 3**

Course Objectives

1. Understand Data structures using C++ concepts.
2. Study C++ Concepts, Algorithms, Queues Stacks, Lists, Trees, Graphs and functions.

Course Outcomes

1. Understand concepts in Data structures using C++ concepts
2. Develop skills to handle Algorithms, Queues and Stacks.
3. Analyze functioning of Lists, Trees, Graphs and functions.
4. Apply knowledge of lists, trees, graphs in coding with C++

UNIT -1 : C++ CLASS OVERVIEW **(8 hours)**

Class Definition, Objects, Class Members, Access Control, Class Scope, Constructors and destructors, parameter passing methods, Inline functions, static class members, this pointer, friend functions, dynamic memory allocation and deallocation (new and delete), exception handling

UNIT -2 : ALGORITHMS, PERFORMANCE ANALYSIS **(10 hours)**

Time complexity and space complexity. Review of basic data structures- The list, Stack, Queue, and Implementation using template classes in C++.

Priority Queues: Definition, realizing a Priority Queue using Heaps, Definition, insertion, Deletion, External Sorting- Model for external sorting, Multiway merge, Polyphase merge.

UNIT -3 : SEARCH TREES **(10 hours)**

Binary Search Trees, Definition, Operations- Searching, Insertion and Deletion, AVL Trees, Definition, Height of an AVL Tree, Operations - Insertion, Deletion and Searching. B-Trees, B-Tree of order m, height of a B-Tree, insertion, deletion and searching, Comparison of Search Trees

Graphs: Basic terminology, representations of graphs, graph search methods DFS, BFS.

UNIT -4 LISTS **(10 hours)**

Dictionaries, linear list representation, skip list representation, operations insertion, deletion and searching, hash table representation, hash functions, collision resolution-separate chaining, open addressing-linear probing, quadratic probing, double hashing, rehashing, extendible hashing, comparison of hashing and skip lists.

UNIT -5 FUNCTIONS **(8 hours)**

Function over Loading, Operator Overloading, Generic Programming- Function and class templates, Inheritance basics, base and derived classes, inheritance types, base class access control, runtime polymorphism using virtual functions, abstract classes, streams I/O. **Text Processing:** Pattern matching Algorithms-Brute force, the Boyer Moore algorithm, the Knuth-Morris-Pratt algorithm, Standard Tries, Compressed Tries, Suffix tries.

TEXT BOOKS:

1. Data structures, Algorithms and Applications in C++, S. Sahni, University Press (India) Pvt. Ltd, 2nd edition, Universities Press Orient Longman Pvt. Ltd.
2. Data structures and Algorithms in C++, Michael T. Goodrich, R. Tamassia and .Mount, Wiley student edition, John Wiley and Sons.

REFERENCE BOOKS:

1. Data structures and Algorithm Analysis in C++, Mark Allen Weiss, Pearson Education. Ltd., Second Edition.
2. Data structures and algorithms in C++, 3rd Edition, Adam Drozdek, Thomson
3. Data structures using C and C++, Langsam, Augenstein and Tanenbaum, PHI.
4. Problem solving with C++, The OOP, Fourth edition, W.Savitch, Pearson education.

SEM/YEAR : V SEM
COURSE CODE : 16EC325
TITLE OF THE COURSE : VSLI TESTING & DESIGN FOR TESTABLILITY
L: T/A:P: C : 3 : 0 : 0 : 3

Course objectives

1. Know about the various test Generation Algorithms and Fault Simulation Techniques.
2. Understand Test generation for combinational logic circuits, Testable combinational logic circuit design
3. Infer Built-In Self-Test analysis, Test pattern generation for BIST
4. Apply Fault Diagnosis Logic Level Diagnosis, Diagnosis by UUT reduction and Fault Diagnosis for Combinational Circuits

Course Outcomes

1. Analyze concepts and techniques of VLSI (Very Large Scale Integration) design verification and testing.
2. Apply fault modeling techniques to detect and correct faults in VLSI circuits
3. Understand test economy, fault modeling and simulation, defects, Automatic Test Pattern Generation (ATPG),
4. Conceptualize design for testability, and built-in self-test (BIST).

UNIT 1- BASICS OF TESTING AND FAULT MODELING (10 Hours)

Introduction to Testing - Faults in digital circuits -Modeling of faults - Logical Fault Models - Fault detection - Fault location -Fault dominance -Logic Simulation - Types of simulation - Delay models - Gate level Event-driven simulation.

UNIT II - TEST GENERATION FOR COMBINATIONAL AND SEQUENTIAL CIRCUITS (10 Hours)

Test generation for combinational logic circuits - Testable combinational logic circuit design -Test generation for sequential circuits - design of testable sequential circuits.

UNIT III - DESIGN FOR TESTABILITY (10 Hours)

Design for Testability - Ad-hoc design - Generic scan based design - Classical scan based design - System level DFT approaches.

UNIT –IV - SELF TEST AND TEST ALGORITHMS (10 Hours)

Built-In Self-Test - Test pattern generation for BIST - Circular BIST - BIST Architectures - Testable Memory Design - Test algorithms - Test generation for Embedded RAMs.

UNIT V - FAULT DIAGNOSIS LOGIC (10 Hours)

Level Diagnosis -Diagnosis by UUT reduction - Fault Diagnosis for Combinational Circuits - Self-checking design - System Level Diagnosis.

TEXTBOOKS

1. "Digital Circuit Testing and Testability", P.K.Lala. Academic Press, 2002.
2. “Logic Design Theory”, N.N. Biswas, PHI publication
3. “Switching & Finite Automata Theory”, Z. Kohavi, TMH

REFERENCE BOOKS

1. A.L. Crouch, "Design Test for Digital IC's and Embedded Core Systems", Prentice Hall International.
2. M. Abramovici, M.A. Breuer and A.D. Friedman, "Digital Systems and Testable Design”, Jaico Publishing House.

SEM/YEAR : **V SEM**
COURSE CODE : **16EC326**
TITLE OF THE COURSE : **DIGITAL AND MIXED MODE VLSI DESIGN**
L: T/A:P: C : **3 : 0 : 0 : 3**

Course objectives

1. Understand Data converter fundamentals
2. Infer DAC and ADC architectures
3. Describe about Amplifiers and non-linear analog circuits
4. State process flow of Sub micron circuit design
5. Interpret Electrical noise

Course Outcomes

1. Summarize data converter fundamentals
2. Experiment with DAC and ADC architectures
3. Select amplifiers and non-linear analog circuits for any application
4. Make use of sub-micron circuit design ideas
5. Illustrate the effects of electrical noise

UNIT -1: DATA CONVERTER FUNDAMENTALS **(06 hours)**

Analog versus Digital Discrete Time Signals, Converting Analog Signals to Data Signals, Sample and Hold Characteristics, DAC Specifications, ADC Specifications, Mixed-Signal Layout Issues.

UNIT -2 : DATA CONVERTERS **(14 hours)**

Data Converters Architectures: DAC Architectures, Digital Input Code, Resistors String, R-2R Ladder Networks, Current Steering, Charge Scaling DACs, Cyclic DAC, Pipeline DAC, ADC Architectures, Flash, Pipeline ADC, Integrating ADC, Successive Approximation ADC.

UNIT-3 : AMPLIFIERS & NON-LINEAR ANALOG CIRCUITS **(12 hours)**

Common-Source (CS) Amplifiers - Miller's Theorem ,Frequency Response, Common-Source Current Amplifier, Source Follower (Common-Drain Amplifier), Common Gate Amplifier, DC Analysis, AC analysis, Transient Analysis

Basic CMOS Comparator Design (Excluding Characterization), Analog Multipliers, Multiplying Quad (Excluding Simulation), Current Mirrors, Differential Amplifier

UNIT -4 : SUB-MICRON CIRCUIT DESIGN **(10 hours)**

Sub-Microns CMOS circuit design: Process Flow, Capacitors and Resistors, MOSFET Switch (upto Bidirectional Switches), Delay and adder Elements, Analog Circuits MOSFET Biasing (upto MOSFET Transition Frequency).

UNIT -5 : ELECTRICAL NOISE **(8 hours)**

Power Spectral Density , Circuit Noise, Calculating and Modeling Circuit Noise ,Thermal Noise , Signal-to-Noise Ratio , Averaging White Noise, Shot Noise, Flicker Noise , Differential Nonlinearity, Integral Nonlinearity ,Offset , Gain Error, Latency ,Dynamic Range
Improving SNR Using Averaging, Decimating Filters for ADCs, Interpolating Filters for DAC.

Text Books:

1. Design, Layout, Stimulation **,**R. Jacaob Baker, Harry WLi, David E Boyce, CMOS Circuit, PHI Edn, 2005
2. CMOS-Mixed Signal Circuit Design, R. Jacaob Baker, (Vol ll of CMOS: Circuit Design, Layout and Stimulation), IEEE Press and Wiley Interscience, 2002.

Reference Books:

1. "Design of Analog CMOS Integrated Circuits", Behzad Razavi, TMH, 2007.
2. Analog and Mixed Mode Design, Vineetha P.Gejji - Prentice Hall, 1st Edition , 2011

SEM/YEAR : V SEM
COURSE CODE : 16EC328
TITLE OF THE COURSE : BIOMEDICAL INSTRUMENTATION
L: T/A:P: C : 3 : 0 : 0 : 3

Course objectives

1. Understand the basic biomedical engineering technology.
2. Familiarize students with various medical equipments and their technical aspects
3. Classify Measurements involved in some medical equipments.
4. Infer introductory idea about human physiology system which is very important with respect to design consideration.

Course Outcomes

1. Interpret technical aspects of medicine.
2. Solve Engineering Problems related to medical field.
3. Understand medical diagnosis and therapy
4. Design and evaluate systems and devices that can measure, test and/or acquire biological information from the human body.

UNIT-1 : FUNDAMENTALS OF BIO– MEDICAL INSTRUMENTATION (07hours)

Sources of bio medical signals and review of basic medical instrumentation system, Performance requirements of medical instrumentation system, PC based medical instruments and general constraints in design of medical instrumentation, Bio-electric signal : Origin of bio–electric signals and recording electrodes, Electrode tissue interface, metal electrolyte interface and electrolyte skin interface, Polarization, skin contact impedance and silver – silver chloride electrodes, Electrodes for ECG and electrodes for EMG, Electrodes for EEG and microelectrodes, Electrical conductivity of electrode jellies and creams.

UNIT -2 : ELECTROCARDIOGRAPH (12 hours)

Physiology of the heart, Electrical activity of the heart and Electrocardiogram (ECG), Normal & Abnormal cardiac Rhythms, Block diagram-description of an Electrocardiograph, The ECG leads, Effects of artifacts on ECG Recordings, Multi- channel ECG machine.

ELECTROENCEPHALOGRAPH: Block diagram description of an Electroencephalograph, 10-20 electrode systems, computerized analysis of EEG.

PATIENT MONITORING SYSTEM: Bedside patient monitoring systems, Central monitors, Measurement of heart rate – Average heart rate meter, Instantaneous heart rate meter, Measurement of pulse rate.

UNIT -3 : BLOOD PRESSURE MEASUREMENT: (06 hours)

Direct method of monitoring Blood pressure, indirect methods of Blood pressure measurements-Automatic Blood pressure measuring apparatus using Korotkoff's method, Rheographic method, Ultrasonic Doppler shift method.

BLOOD FLOW METERS: Electromagnetic blood flow meters, Ultrasonic blood flow meter – Doppler shift flow velocity meters. NMR blood flowmeter.

UNIT -4 : CARDIAC OUTPUT MEASUREMENT: (12 hours)

Indicator dilution method, Dye dilution method, Thermal dilution techniques, Measurement of continuous cardiac output derived from the aortic pressure waveform, Impedance technique.

CARDIAC PACEMAKERS AND DEFIBRILLATORS: Need for cardiac pacemaker, External pacemaker, Implantable pacemaker, Types of Implantable pacemakers, Programmable pacemakers, Rate-responsive pacemakers, Power sources for Implantable pacemaker, Need for a Defibrillator, DC defibrillator, Implantable defibrillators.

UNIT -5 : BIOMEDICAL TELEMETRY & TELEMEDICINE: (13 hours)

Wireless Telemetry single channel Telemetry systems-ECG Telemetry system, Multichannel wireless telemetry system – Telemetry of ECG & Respiration, Multipatient Telemetry, Implantable Telemetry systems.

TELEMEDICINE: Applications, concept, essential parameter for Telemedicine, Telemedicine Technology, Video conferencing, Digital Communication systems ,Telemedicine using Mobile Communication.

PULMONARY FUNCTION ANALYZER: Pulmonary function measurement, Spirometry, Pneumo- tachometer, Measurement of volume –flow volume curve, Nitrogen washout technique.

TEXT BOOKS:

1. Handbook of Biomedical Instrumentation - R.S.Khandupur, 2nd Edition, Tata McGraw- Hill, 2003
2. Medical Instrumentation Application & Design - John G. Webster, 3rd Edition, John Wiley, 1997.

REFERENCE BOOKS:

1. Biomedical Instrumentation & Measurement - Leslie Cromwell & Others, 2nd Edition, Prentice Hall of India, 1979.
2. Biomedical Instrumentation - Arumugam.M., Anuradha Agencies Publishers, Kumbakonam, 2006.

SEM/YEAR : VI SEM
COURSE CODE : 16EC306
TITLE OF THE COURSE : DIGITAL COMMUNICATION
L: T/A:P: C : 3 : 0 : 0 : 3

Course objectives

1. Understand representation of signal in digital form which is suitable for transmission on wireless channel
2. Modification of binary messages for transmission across a shared physical channel subject to distortion and noise
3. Design a digital communication system for a given channel and performance specifications choosing from the available modulation and demodulation schemes
4. Compute the probability of error of digital communication systems on the additive white Gaussian noise channel

Course outcomes

1. Understand the principle features of digital communication systems and their current and future applications
2. Infer the baseband pulse transmission, and provide tools to analyze the performance of different PCM waveform in noise
3. Compute the bandwidth and transmission power by analyzing time and frequency domain spectra of signal required under various modulation schemes.
4. Understand detection of signals at the receiving end using detection theory.
5. Apply Band pass digital modulation and demodulation (binary and M-level; ASK, PSK and FSK) and provide tools to analyze the performance in noise

UNIT -1 : SAMPLING PROCESS: (10hours)

Introduction to Digital communication-Block diagram, Channels for digital communication Sampling process, Sampling theorem, quadrature sampling of bandpass signals, Signal distortion in sampling, Practical aspects of sampling and signal recovery, PAM, TDM.

UNIT-2: WAVEFORM CODING TECHNIQUES: (10 hours)

Elements of PCM: Quantization & Coding, Quantization error, Companding in PCM systems, Differential PCM system, Delta modulation (DM) and its drawbacks, adaptive delta modulation, Comparison of Pulse coding techniques.

UNIT- 3 : BASEBAND SHAPING FOR DATA TRANSMISSION (10 hours)

Discrete PAM signals, power spectra of discrete PAM signals, Inter symbol Interference, Nyquist criterion for distortion less baseband binary transmission, Correlative coding, Eye pattern

UNIT -4 : DETECTION OF SIGNALS (10 hours)

Model of Digital Communication, Gram-Schmidt Orthogonalization procedure, Geometric interpretation of signals, Response of bank of correlators to noisy input, Detection of known signals in noise, ML detector, Probability of error, Correlation receiver, Matched filter, Properties of matched filter.

UNIT-5: PASS BAND MODULATION AND DEMODULATION TECHNIQUES (10hours)

Introduction, coherent modulation techniques-ASK, FSK, PSK, QPSK, signal representation, Generation and detection, deriving probability of error for coherent ASK, FSK, PSK, QPSK, Non coherent binary modulation techniques.

TEXT BOOKS:

1. Digital communications - Simon Haykin, John Wiley, 2005
2. Principles of Communication Systems – H. Taub and D. Schilling, TMH, 2003

REFERENCES:

1. Digital and Analog Communication Systems - Sam Shanmugam, John Wiley, 2005.
2. Digital communications Fundamentals and applications 2nd Edition Bernard Sklar PHI
3. Communication Systems Analog & Digital – Singh &Sapre, TMH, 2004.

SEM/YEAR : VI SEM
COURSE CODE : 16EC307
TITLE OF THE COURSE : ANTENNAS AND WAVE PROPAGATION
L: T/A:P: C : 3 : 0 : 0 : 3

Course objectives

1. Understand the basic antenna parameters and radiation mechanism from an antenna
2. Understand the array concepts in antennas, and their applications.
3. Understand the concepts of Reflector Antennas and their applications.
4. Study the properties of different types of antennas, and special antennas.
5. Understand the methods of measuring various antenna parameters.
6. Study the wave propagation concepts in ground, sky and troposphere regions.

Course outcomes

1. Explain how an antenna radiates and captures radio wave energy.
2. Define the properties and parameters of an antenna.
3. Apply the Friis transmission equation to compute the received powers in a system.
4. Design an antenna array system, lengths of radiating elements, and inter-element distances for the given specifications.
5. Interpret various parametric values like gain, directivity etc. using standard measuring procedures
6. Describe the mechanism of the atmospheric effects on radio wave propagation.

UNIT- 1: ANTENNA FUNDAMENTALS & LINEAR WIRE ANTENNAS (12 hours)

Introduction, Radiation Mechanism – Single Wire, Two Wire, Dipoles, Current Distribution on a Thin Wire Antenna. Antenna Parameters- Radiation Patterns, Main Lobe and Side Lobes, Beam-width, Beam Area, Radiation Intensity, Beam Efficiency, Directivity, Gain and Resolution, Antenna Apertures, Aperture Efficiency, Polarization, Antenna regions, Friis Transmission equation. Radiation from Small Electric Dipole, Quarter wave Monopole and Half wave Dipole – Current Distributions, Evaluation of Field Components, Power Radiated, Radiation Resistance. Introduction to Loop Antennas.

UNIT- 2 : ANTENNA ARRAYS (10 hours)

Two element Arrays – different cases, Principle of Pattern Multiplication, N element Uniform Linear Arrays – Broadside, End-fire Arrays, EFA with Increased Directivity; Binomial Arrays, Effects of Uniform and Non-uniform Amplitude Distributions, Related Problems, Yagi - Uda Arrays, Folded Dipoles and their characteristics.

UNIT – 3 : REFLECTOR ANTENNAS (8 Hours)

Flat Sheet and Corner Reflectors. Paraboloidal Reflectors – Geometry, characteristics, types of feeds, F/D Ratio, Spill Over, Back Lobes, Aperture Blocking, Off-set Feeds, Cassegrain Feeds.

UNIT- 4 : SPECIAL ANTENNAS & ANTENNA MEASUREMENTS (10 hours)

Helical Antennas – Significance, Geometry, basic properties; Design considerations for monofilar helical antennas in Axial Mode and Normal Modes (Qualitative Treatment). Horn Antennas – Types, Optimum Horns, Design Characteristics of Pyramidal Horns.

Measurement of radiation pattern, gain, directivity, impedance and polarization measurements.

UNIT- 5 : WAVE PROPAGATION (10 hours)

Concepts of Propagation – frequency ranges and types of propagations. Ground Wave Propagation, Sky Wave Propagation – Formation of Ionospheric Layers and their Characteristics, Mechanism of Reflection and Refraction, Critical Frequency, MUF & Skip Distance – Calculations for flat and spherical earth cases, Optimum working Frequency, Virtual Height.

Space Wave Propagation – Mechanism, LOS and Radio Horizon. Tropospheric Wave Propagation – Radius of Curvature of path, Effective Earth's Radius, Effect of Earth's Curvature, Field Strength Calculations, M-curves and Duct Propagation, Tropospheric Scattering, Related problems.

TEXT BOOKS

1. C.A Balanis, "Antenna Theory", John Wiley & Sons, 2nd ed., 2001.
2. John D Krauss, Ronald J Marhefka, Ahmad S Khan, "Antennas for all applications " 3rd edition, Mc Graw-Hill,2006
3. K D Prasad, Satya Prakashan, "Antennas & Wave Propagation", Tech India Publications, New Delhi, 2001

REFERENCE BOOKS

1. E.C. Jordan and K.G. Balamain, "Electromagnetic Waves and Radiating Systems". 2nd ed., Pearson Education, 2000.
2. John D Kraus, "Antennas". 2nd ed., Mc Graw-Hill, 1988

SEM/YEAR : VI SEM
COURSE CODE : 16EC308
TITLE OF THE COURSE : ASIC DESIGN
L: T/A:P: C : 2 : 0 : 2 : 3

Course objectives

1. Understand ASICS, its types and CMOS logic.
2. Study ASIC library design and programmable ASICs
3. Interpret design of ASICs using EDIF tools and understand how simulation works.
4. Explain about importance of test, boundary scan and fault simulation.
5. Infer designing of ASICS by giving knowledge about floor planning and placement methods.

Course Outcomes

1. Interpret the various types of ASICs and CMOS logic.
2. Program ASICs and implement ASIC library design
3. Experiment with low level design using EDIF, Distinguish between various types of simulations and work with simulation models
4. Implement boundary scan test, work with fault models and simulate faults.
5. Illustrate floor planning and placement for ASIC construction

UNIT I : TYPES OF ASICS (10 Hours)

Full-Custom ASICs, Standard-Cell-Based ASICs, Gate-Array-Based ASICs, Channeled Gate Array, Channelless Gate Array, Structured Gate Array, Programmable Logic Devices, Field-Programmable Gate Arrays, Design Flow, Case Study : SPARC station1. ASIC Cell Libraries.
CMOS Logic :Combinational Logic Cells, Sequential Logic Cells, Data path Logic Cells: Data path Elements, Adders, Multipliers- Array and carry save chain.

UNIT – II: ASIC LIBRARY DESIGN (10 Hours)

Transistors as Resistors, Transistor Parasitic Capacitance, Delay model based on logical Effort, Standard-Cell Design, Data path Cell Design.
Programmable ASIC: Static RAM, EPROM and EEPROM Technology, Programmable ASIC Logic Cells-ACT1 logic module, Xilinx LCA – XC3000 CLD, Altera Flex, Altera MAX
ASIC I/O Cells: DC Output, AC Output, DC Input, AC Input, Clock Input, Power Input, Xilinx I/O block-XC4000

UNIT III : LOW LEVEL DESIGN ENTRY (10 Hours)

Schematic Entry: Hierarchical Design, Cell Library, Names, Schematic Icons and symbols, Nets, Connections, Vectored instances and Buses, Attributes, Netlist Screener, Schematic Entry tools, Back Annotation. EDIF: EDIF syntax, Schematic Icon-Inverter.
Simulation:
Types of Simulation, The Comparator/MUX Example, Logic Systems, How Logic Simulation Works, Delay Models, Components of Static Timing Analysis, Switch-Level Simulation, Transistor-Level Simulation- SPICE model.

UNIT IV : TESTING **(12 Hours)**

Test: The Importance of Test, Boundary Scan Test – BST cells, BST Registers, Instruction decoder, Boundary scan controller, BSDL, Faults – Reliability, fault models, physical faults, stuck-at faults, logical faults, fault collapsing with a simple logic example, Fault Simulation, Automatic Test-Pattern Generation, Built-In Self-Test.

UNIT V : ASIC CONSTRUCTION **(08 Hours)**

Physical Design, CAD Tools, Power Dissipation, Floor planning and Placement: Floor planning-goals and objectives, tools, I/O and power planning, Placement- goals and objectives, min-cut place algorithm, Routing: Global Routing- goals and objectives, methods, routing between blocks, Circuit Extraction- DRC

TEXT BOOK

1. Michael John Sebastian Smith, Application-Specific Integrated Circuits, Pearson Education, 2001.

REFERENCES

1. JAN. M. Rabaey, Digital Integrated Circuits, Prentice Hall Publications, 2nd Edition, 2001
2. Sabih Gerez, Algorithms for VLSI Design Automation, Wiley Publications, 1999.
3. Wayne Wolf, Modern VLSI Design Pearson Education, 3rd edition, 2002.
4. Samir Palnitkar, Verilog HDL: A Guide to Digital Design and Synthesis, Pearson Education, 2nd edition, 1996

SEM/YEAR : **VI SEM**
COURSE CODE : **16EC309**
TITLE OF THE COURSE : **MICROWAVE ENGINEERING**
L: T/A:P: C : **3 : 0 : 0 : 3**

Course Objectives

1. To give the basic ideas about the characteristics and applications of microwave frequency bands.
2. Study of S parameters of different microwave devices and thus predict the input response.
3. To understand the working of various microwave passive and active devices and circuits.
4. Measurement of microwave frequency, wavelength, impedance, VSWR
5. The basics of MIC's and planar transmission lines.

Course Outcomes

1. Acquire knowledge of semiconductor microwave devices and can describe the limitations of conventional Bipolar and field effect transistors at microwave frequencies.
2. Understand operation of microwave transistor, FETs, Tunnel Diodes, Gunn Diodes and IMPATT and TRAPATT diode are studied.
3. Model the output response of the microwave devices using S Matrix
4. Infer the concept of planar transmission lines and microwave integrated circuits.

UNIT -1 : MICROWAVE NETWORK CHARACTERIZATION AND PASSIVE DEVICES **(12 hours)**

Characteristic features and applications of microwaves- Circuit and S parameter representation of N port microwave networks – Reciprocity Theorem- Lossless networks and unitary conditions- ABCD parameters- Cascaded networks-Relations between S- Y and ABCD parameters. Properties and s-matrices for typical network such as section of uniform transmission line, 3-port networks (reciprocal and nonreciprocal), T-junctions directional coupler, magic tee, ferrite devices, isolator, circulators.

UNIT -2 : MICROWAVE TUBES **(8 hours)**

Generation of microwaves by tubes, limitations of conventional tubes, klystron amplifiers - analysis, reflex klystron oscillator analysis, magnetrons, traveling wave tube (TWT), backward wave oscillator (BWO)-basic principles. Millimeter wave tubes-introduction.

UNIT -3 : MICROWAVE SEMICONDUCTORS **(12 hours)**

High frequency limitations of transistors, microwave transistors (theory only), Manley Rowe relations, parametric amplifiers and frequency multipliers, tunnel diodes, Gunn effect, Gunn Diode oscillators, Avalanche effect, IMPATT & TRAPATT diodes, PIN diodes and their applications, Schottky barrier and backward diodes.

UNIT -4 : MICROWAVE MEASUREMENTS **(8 hours)**

VSWR measurement, microwave power measurement, impedance measurement, frequency measurement, measurement of scattering parameters, Return loss measurement using directional couplers, introduction to vector network analyzer and its uses.

UNIT -5 : PLANAR TRANSMISSION LINES (10 hours)

Planer transmission lines such as strip line, microstrip line, slotline and coplanar waveguides. Characteristics of planar transmission lines. Losses in Microstrip Lines- Quality Factor Q of Microstrip Lines- Substrate materials. Introduction to MIC's:-Technology of hybrid MICs, monolithic MICs, comparison of both MICs.

TEXT BOOKS:

1. Samuel Y. Liao: Microwave devices and Circuits", Prentice Hall of India, New Delhi, 3rd Ed. 2006.
2. Annapurna Das and Sisir K.Das: Microwave Engineering - Tata Tata-McGraw Hill, New Delhi, 2008

REFERENCE BOOKS:

1. R.E. Collin: Foundations for Microwave Engg. - IEEE Press Second Edition (2002).
2. David M. POZAR : Microwave Engg. - John Wiley & Sons - 2nd Edition (2003).
3. Rizzi P.A, "Microwave Engineering, Passive Circuits" Prentice Hall of India.

SEM/YEAR : VI SEM
COURSE CODE : 16EC310
TITLE OF THE COURSE : POWER ELECTRONICS
L: T/A:P: C : 2 : 0 : 2 : 3

Course objectives

1. Study the semiconductors devices as switches suitable for power circuits.
2. Select and design the converters for various forms of power conversions.
3. Understand the operations of various motors.
4. Design and implement the control circuits for various power electronics Applications.

Course Outcomes

1. Compare the different semiconductors devices as switches suitable for power circuits.
2. Selection and design of suitable converters for various forms of power conversions.
3. Analyse various drive circuits suitable for different motors.
4. Design and implementation of control circuits for various power electronics based projects like UPS, SMPS, Air conditioners, Boilers, HVDC power stations etc.

UNIT -1: INTRODUCTION TO POWER ELECTRONICS (08 hours)

INTRODUCTION: Applications of power electronics, power semiconductor devices, control characteristics, types of power electronic circuits, peripheral effects.

Power BJTs, switching characteristics, switching limits, base-drive control, Introduction to IGBTs, isolation of gate and base drives.

UNIT -2 : THYRISTORS (10 hours)

Introduction, characteristics, two transistor model, turn-on and turn off methods, di/dt and dv/dt protection, thyristor types, series and parallel operation of thyristors, thyristor firing circuits.

COMMUTATION TECHNIQUES: Introduction, natural commutation, forced commutation: self-commutation, impulse commutation, resonant pulse commutation and complementary commutation.

UNIT -3 : CONTROLLED RECTIFIERS AND CONTROLLERS (10 hours)

Introduction, principle of phase controlled converter operation, single-phase semi converters, full converters and dual converters. Principle of Three phase half wave converter.

AC VOLTAGE CONTROLLERS: Introduction, principle of ON-OFF and phase control, single-phase, Bi-directional controllers with resistive and inductive loads. Single phase Transformer connection changers. Single phase Cyclo converters.

UNIT -4 : DC CHOPPERS (10 hours)

Introduction, principle of step-down operation, step-down chopper with RL loads, Principle of step-up operation, step-up chopper with Resistive load, performance parameters, Chopper classification (Class A to Class E).

UNIT-5 : DC DRIVES AND INVERTERS (12 hours)

DC DRIVES: Introduction, Basic Characteristics of DC Motors, Operating modes, Single phase Drives. Stepper motor drive, Permanent Magnet stepper motors (bipolar and unipolar motor drive sequence) and Stepper Motor characteristics.

INVERTERS: Introduction, principle of operation, performance parameters, single phase bridge inverters, Three phase inverters, voltage control of single phase inverters, current source inverter, variable DC link inverter, principles of switched mode power supply (SMPS). Introduction to non-conventional energy resources (Wind and Solar Energy)

Text Books:

1. Power Electronics - M. H. Rashid, Prentice Hall of India Pvt. Ltd., (Pearson (Singapore –Asia)) New Delhi, 2002.
2. Modern Power Electronics – P.C. Sen, 2nd Edition S.Chand, 2000.

Reference Books:

1. Power Electronics- M. D. Sing and Khanchandani K. B., Tata McGraw Hill Publishing Company Limited, Reprint 2001.
2. Power Electronics - Cyril W.Lander, 3rd Edition, McGraw Hill, 1993.
3. Power Electronics, Converters, Applications and Design – Ned Mohan, Undeland, Riobbins
4. Thyristorized power controllers – G K Dubey, S R Doradla, A Joshi & R M K Sinha

SEM/YEAR : **VI SEM**
COURSE CODE : **16EC373**
TITLE OF THE COURSE : **DIGITAL & MICROWAVE COMMUNICATION LAB**
L: T/A:P: C : **0 : 0 : 4 : 2**

Course objectives

1. Provide hands-on experience with the components and sub-systems employed in a digital communication system
2. Equip students with various issues related to analog and digital communication such as modulation, Demodulation, Noise handling, Data conversion and Multiplexing
3. Study the functioning of Horn antenna and klystron power supply
4. Setup a Microwave Bench for different measurements.
5. Appreciate the behavior of microwave devices like directional coupler, isolator, circulator, frequency meter and E-plane, H-plane, Magic Tee.

Course outcomes

1. Identify and describe different techniques in modern digital communications, in particular in source coding, modulation and detection, carrier modulation, and channel coding.
2. Understand the basics of information theory and error correcting codes.
3. Determine isolation and insertion losses for different components like isolator, circulator, and directional coupler etc.
4. Analyze how the radiation intensity, radiation pattern and Gain of Horn antenna Design counters and implement practically.
5. Outline the V-I characteristics of LED's and LASER to understand the benefits of optical fiber communication.

(For Laboratory examination – Minimum of 10 experiments)

List of Experiments

1. Verify the Encoding and Decoding process of Delta Modulator
2. Generation and Detection of FSK.
3. Design a [7,4] linear block Encoder and Decoder For a given generated matrix G, find out all possible code vectors and verify error correction and detection possibility by considering any two examples
4. Design a [7, 4] binary cyclic Encoder and Decoder for a given generated by $g(x) = 1 + x + x^3$. Find out all possible code vectors. and verify error correction and detection possibility by considering any two examples
5. Design a convolution Encoder and Decoder of rate r=1/2 with constrain length 3 draw code tree, code trellis and state diagram. By considering an example Decode the data by using Viterbi algorithm PC to PC data transfer by using PCM
6. Reflex Klystron Characteristics
7. Gunn Diode Characteristics
8. Measurement of frequency and wavelength
9. Characteristics of Directional Coupler
10. Characteristics of Isolator /Circulator
11. Gain Measurement of Horn Antenna
12. LED characteristics
13. Laser diode Characteristics
14. Numerical Aperture Measurement

SEM/YEAR : **VI SEM**
COURSE CODE : **16EC374**
TITLE OF THE COURSE : **POWER ELECTRONICS LAB**
L: T/A:P: C : **0 : 0 : 4 : 2**

Course objectives

1. Study the semiconductors devices as switches suitable for power circuits.
2. Selection and design the converters for various forms of power conversions.
3. Understand the operations of various motors.
4. Design and implement the control circuits for various power electronics Applications.

Course Outcomes

1. Compare the different semiconductors devices as switches suitable for power circuits.
2. Selection and design of suitable converters for various forms of power conversions.
3. Analyse various drive circuits suitable for different motors.
4. Design and implementation of control circuits for various power electronics based projects like UPS, SMPS, Air conditioners, Boilers, HVDC power stations etc.

List of Experiments

1. Static characteristics of SCR .
2. Static characteristics of DIAC.
3. Static characteristics of MOSFET.
4. Static characteristics of IGBT
5. Controlled HWR and FWR using RC triggering circuit
6. SCR turn off using i) LC circuit ii) Auxiliary Commutation
7. UJT firing circuit for HWR and FWR circuits.
8. Generation of firing signals for thyristors/ triacs using digital circuits / microprocessor.
9. AC voltage controller using triac – diac combination.
10. Single phase Fully Controlled Bridge Converter with R and R-L loads.
11. Voltage (Impulse) commutated chopper both constant frequency and variable frequency operations.
12. Parallel / series inverter.
13. Characterization of SMP

SEM/YEAR : **VI SEM**
COURSE CODE : **16EC329**
TITLE OF THE COURSE : **DIGITAL IMAGE PROCESSING**
L: T/A:P: C : **3 : 0 : 0 : 3**

Course objectives

1. To understand the basics of Image Processing and color image processing.
2. To appreciate the usage of image transforms in image processing
3. To learn various image processing techniques like image enhancement, restoration.
4. To know segmentation, image compression and basics of watermarking.

Course Outcomes

1. Analyze basics of image and full color image processing techniques
2. Appreciate image manipulations and different digital image processing techniques in various fields and apply the various image transforms used in image processing.
3. Perform basic operations like – Enhancement, Image transform and restoration techniques on image.
4. Make use of image segmentation, compression for various applications.

UNIT - 1 : DIGITAL IMAGE FUNDAMENTALS **(10 hours)**

What is Digital Image Processing, Fundamental Steps in Digital Image Processing, Components of an Image processing system, elements of Visual Perception, Image sensing and acquisition, Image sampling and quantization, basic relationships between pixels. An introduction to mathematical tools in digital image processing.

Color Fundamentals: Color Models, Pseudo color Image Processing, basics of full color image processing, color transformations.

UNIT - 2 : IMAGE TRANSFORMS **(12 hours)**

Two-dimensional orthogonal & unitary transforms, properties of unitary transforms, two dimensional discrete Fourier transform, Discrete cosine transform, sine transform, Hadamard transform, Haar transform, Problems. Introduction to STFT and Wavelet.

UNIT – 3 : IMAGE ENHANCEMENT **(12 hours)**

Image Enhancement in Spatial domain, Some Basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic/Logic Operations, Basics of Spatial Filtering.
Image enhancement in the Frequency Domain filters, Smoothing Frequency Domain filters, Sharpening Frequency Domain filters, homomorphic filtering.

UNIT – 4 : IMAGE RESTORATION **(08 hours)**

A Model of the Image Degradation/Restoration Process, Noise models, Restoration in the presence of noise, Linear Position-Invariant Degradations, Inverse filtering, Minimum Mean Square Error (Wiener) Filter, Constrained Least squares filtering.

UNIT – 5 : IMAGE SEGMENTATION AND COMPRESSION **(08 hours)**

Fundamentals, point, Line and Edge detection, Thresholding, Region based Segmentation.
Fundamentals, Image Compression Models, Error Free Compression, Lossy Compression, Image compression using DCT and DWT (basics).
Watermarking: Basics of Image watermarking using MATLAB

Text Books:

1. "Digital Image Processing" Rafel C.Gonzalez and Richard E.Woods, Pearson Education, 3rd edition 2011
2. "Fundamentals of Digital Image Processing", Anil K. Jain, 2003, Pearson Education.

Reference Books:

1. "Digital Image Processing" S.Jayaraman S.Esakirajan T.Veerakaumar Mc Graw Hill publishers, 2009
2. "Digital Image Processing", S.Sridharoxford publishers, 2011
3. "Digital Image Processing and Analysis" Chanda & Majumdar, 2003, PHI
4. "Digital Image Processing" Vipula Singh, , Elsevier Publications

SEM/YEAR : VI SEM
COURSE CODE : 16EC331
TITLE OF THE COURSE : INTERNET OF THINGS
L: T/A:P: C : 3 : 0 : 0 : 3

Course Objectives

1. Understand Societal ,Business Perspective and Technical knowledge of IoT domain
2. Know IoT Architecture and History
3. Infer IoT Network technologies
4. Provide Applications of IoT in different domains.

Course Outcomes

1. Understand where the IoT concept fits within the broader ICT industry and possible future trends.
2. Understand the various network protocols used in IoT.
3. Be familiar with the key wireless technologies used in IoT systems, such as WiFi, 6LoWPAN, Bluetooth and ZigBee.

UNIT -1 : INTRODUCTION (8 hours)

What is IoT? – Definition and examples and Brief History. Where is IoT headed- Companies, Alliances, Communities, Future potential, Trends and implications. An IoT System - Device, Network, Cloud/database, Big data/analytics, User interface/mobile. Typical constraints in an IoT system, Security and Privacy

UNIT -2 : EVOLUTION OF IOT (10 hours)

The transition from mainframes and personal computing, Planet lab and origins of distributed computing; Robotics, AI and Cyber Computing Infrastructure; M2M communications; P2P networks; Universal identification and RFID; Autonomic computing, Pervasive computing, Ubiquitous computing; Wireless Sensor Networks; The emergence of IoT .

UNIT -3 : IOT ARCHITECTURES AND NETWORK PROTOCOLS (MAC LAYER) (10 hours)

Architectures for IoT**,** Elements of an IoT Architecture, Architectural design considerations. Wireless sensor networks (WSNs) and power consumption, CSMA/CA and slotting, Centralized vs. distributed, State-of-the-art MAC-layer protocols for WSNs

UNIT -4 : WIRELESS TECHNOLOGIES FOR IOT (LAYER 1 & 2) (8 hours)

WiFi (IEEE 802.11), Bluetooth/Bluetooth Smart, ZigBee/ZigBee Smart, UWB (IEEE 802.15.4), 6LoWPAN, Proprietary systems, Introduction to Python Programming

UNIT -5 : IoT DOMAINS (10 hours)

Smart Home, Smart Buildings, smart cities, IoT in telecommunications, smart manufacturing, IoT in environment monitoring, smart vehicles, IoT in healthcare, smart farming, IoT in enterprises, smart transportation, smart energy, smart retail and logistics

TEXT BOOKS:

1. Vijay Madisetti, Arshdeep Bahga "Internet of things, A hands-on-approach" 2014
2. Jean-Philippe Vasseur & Adam Dunkels "Interconnecting smart objects with IP", Morgan Kaufmann Publishers, 2010

REFERENCES:

1. Cuno Pfister, "Getting Started with the Internet of Things", Maker Media Inc, 2011
2. Adrian Mcewen and Hakim, "Designing the Internet of Things", Wiley publication, 2013
3. Zhao, Feng, and Leonidas J. Guibas., "Wireless sensor networks: an information processing approach", Morgan Kaufmann, 2004.
4. Karl, Holger, and Andreas Willig, "Protocols and architectures for wireless sensor networks", John Wiley & Sons, 2007.
5. Dargie, Waltenegus W., and Christian Poellabauer, "Fundamentals of wireless sensor Networks: theory and practice", John Wiley & Sons, 2010.
6. McKinsey Global Institute report, "Unlocking the potential of the Internet of Things".
7. Available from: http://www.mckinsey.com/insights/business_technology/the_internet_of_things_the_value_of_digitizing_the_physical_world

SEM/YEAR : VI SEM
COURSE CODE : 16EC332
TITLE OF THE COURSE : NETWORK SECURITY
L: T/A:P: C : 3 : 0 : 0 : 3

Course Objectives

1. Understand communication security in computer systems and networks.
2. Familiarize with a comprehensive introduction to the field of network security.
3. Analyze services that are most essential for secure communication over the net.

Course Outcomes

1. Recognize the security issues involved in networks and describe its counter measures using various cryptographic techniques.
2. Acquire knowledge on mathematics for modern data encryption methods.
3. Apply various public and private key encryption techniques for secure communication over the networks.
4. Investigate security aspects involved in e-communications.
5. Illustrate the intrusion mechanisms involved in network transactions.

UNIT –I : CONVENTIONAL ENCRYPTION (12 hours)

Services, Mechanisms and Attacks, The OSI security Architecture, A model for network security. Symmetric Ciphers: Symmetric Cipher model, Substitution techniques, Transposition technique, Simplified DES, Data encryption Standard, The strength of DES, Differential and linear cryptanalysis, Block cipher design principles and modes of operation.

UNIT -II : NUMBER THEORY (10 hours)

Introduction to finite fields- Groups ,rings and fields, modular arithmetic, Euclid's Algorithm, Finite fields of the form GF(p), Polynomial arithmetic, Finite Fields of the form GF(2n). Prime numbers, Fermat's and Euler's Theorems, Testing for primarily, the Chinese Remainder Theorem, and Discrete logarithms.

UNIT –III : PUBLIC-KEY CRYPTOGRAPHY (10 hours)

Principles of Public key cryptosystems, The RSA algorithm, Key Management, Diffe-Hellman Key exchange, Elliptic Curve Arithmetic, Authentication functions, Digital signatures, Digital signature standard.

UNIT –IV : NETWORK SECURITY PRACTICE (10 hours)

Electronic Mail Security- Pretty Good Privacy, S/MIME Web security- Secure Electronic Transaction.

UNIT -V : SYSTEM SECURITY (8 hours)

Intruders, Intruder detection, Password management, Viruses and related threats. Firewalls Design Principles, Trusted systems.

Text Books:

1. Cryptography and Network Security-Principles and Practice: William Stallings, Third Edition.

Reference Books:

1. Fundamentals of Network Security-Eric Maiwald, 2009 Edition, Information Security Series
2. Network Security-Private Communication in a public World: Charlie Kaufman, Radia Perlman, Mike Speciner, Second Edition

SEM/YEAR : VI SEM
COURSE CODE : 16EC333
TITLE OF THE COURSE : LOW POWER VLSI
L: T/A:P: C : 3 : 0 : 0 : 3

Course objectives

1. Understand the design of all VLSI circuits making extensive use Computer Aided Design (CAD) VLSI design tool.
2. Infer the levels of scaling techniques and sizing of transistor.
3. Know the operation CAD VLSI design tools as these are developed primarily for and by the VLSI design professionals.
4. Understand all important modules that go into the construction of a complete VLSI CAD tool and design ASIC chips.

Course Outcomes

1. Apply CAD techniques to design VLSI ICs.
2. Understand how CAD tools are developed and the constraints and limitation under which they can be operated successfully.
3. Apply design rules to manufacture VLSI circuits
4. Analyze the floor planning to optimize the area of VLSI circuits.
5. Gain Proficiency for prerequisites for professionals in the area of VLSI design.

UNIT –I : INTRODUCTION TO DESIGN METHODOLOGIES (08 Hours)

VLSI Design problem-The Design Domains-Design methods and Technologies, Traditional VLSI design flow, VLSI Design Styles.

UNIT- II : ALGORITHMIC GRAPH THEORY (08 Hours)

Graph terminology, Data structures for the representation of graphs, Graph Algorithms - Depth first search, Breadth First Search, Dijkstra's Shortest Path algorithm, Prim's algorithm for minimum spanning tree.

UNIT-III: PARTITIONING AND FLOORPLANNING (10 Hours)

Kernighan - Lin Partitioning algorithm Floor plan concept and Terminologies, Floor plan Representation, Floor plan Classes - Slicing Floor plan and Non-slicing Floor plan, Floor plan tree, Floor plan Wheel, Polar Graph Representation-Vertical and Horizontal, Optimization problems in floor planning, Shape functions and floor plan sizing.

UNIT IV : PLACEMENT AND ROUTING (10 Hours)

Objectives of placement, Placement at Different Levels, Circuit representation, wire length estimation, types of placement problems-Building blocks Placement and Standard cell Placement, Placement algorithms - Constructive Placement algorithms-Cluster growth and min cut, Iterative Placement.

Types of Local routing problems – Area Routing -Maze Routing algorithm by Lee's, - Channel routing –Models, Horizontal constraint graph and vertical constraint graph of routing, The Left-Edge Algorithm for channel, Global routing- Standard cell layout and Building block layout

UNIT V : LAYOUT COMPACTION AND SIMULATION (10 Hours)

Design rules, Symbolic and Geometric layout, compaction and Applications of compaction, Aspects of Compaction Problem formulation-Graph-theoretical formulation, Minimum and Maximum distance Constraint graph, Algorithms for Constraint-graph compaction- Longest-Path Algorithm for DAGs, The Liao-Wong Algorithm, The Bellman-Ford Algorithm for Longest Paths

Gate level modeling and simulation - Compiler driven simulation - Event driven simulation - Switch-level modeling and simulation

TEXT BOOKS:

1. "Algorithms for VLSI Design Automation", Sabih H.Gerez, John Wiley & Sons, 2010.
2. "Modern VLSI Design: Systems on Chip Design", WayneWolf," Pearson Education Inc., 3nd Edition, Indian Reprint, 2012.
3. "Algorithms for VLSI Physical Design Automation ", Naveed Sherwani, Springer-Verlag, 3rd Edition, 2014.

REFERENCE BOOKS:

1. 1."VLSI Physical Design Automation", Sadiq M Sait and Habib Youssef, , IEEE Press, New York. 2012.
2. "Digital Systems Testing and Testable Design"Abramovici M, Brever A and Friendman D, Jaico Publishing House, 2009.

SEM/YEAR : VI SEM
COURSE CODE : 16EC334
TITLE OF THE COURSE : RADAR ENGINEERING
L: T/A:P: C : 3 : 0 : 0 : 3

Course objectives

1. Comprehend the basic principle of operation of radar and classify radars.
2. Derive the expression for radar range equation.
3. Comprehend basic detection of radar signals in noise.
4. Recognize the tracking of radar (sequential lobing, conical scanning).
5. Introduce the concept of phased array antennas for radars.

Course Outcomes

1. Explain the operation of CW, FM-CW, MTI and Pulse Doppler radar.
2. Describe the range ambiguities and various system losses.
3. Explain parameters of radar receivers like noise figure, noise temperature.
4. Explain radar displays and types of duplexers.
5. Apply tracking techniques of radar for antennas

UNIT –I : INTRODUCION (10 Hours)

Nature of Radar, Maximum Unambiguous Range, Radar Waveforms, Radar Block Diagram and Operation, Simple form of Radar Equation, Radar Frequencies and Applications. Prediction of Range Performance, Minimum Detectable Signal, Receiver Noise and SNR, Integration of Radar Pulses, Transmitter Power, Radar Cross Section of Targets (simple targets - sphere, cone-sphere),PRF and Range Ambiguities.

UNIT- II : CW AND FREQUENCY MODULATED RADAR (10 Hours)

Doppler Effect, CW Radar – Block Diagram, Isolation between Transmitter and Receiver, Non-zero IF Receiver, Applications of CW radar.FM-CW Radar, Range and Doppler Measurement, Block Diagram and Characteristics (Approaching/ Receding Targets), FM-CW altimeter, Multiple Frequency CW Radar.

UNIT-III : MTI AND PULSE DOPPLER RADAR (10 Hours)

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

UNIT IV : TRACKING (10 Hours)

Tracking with Radar, Sequential Lobing, Conical Scan, Monopulse Tracking Radar Amplitude Comparison Monopulse (one- and two- coordinates), Phase Comparison Monopulse. Target Reflection Characteristics and Angular Accuracy. Tracking in Range, Acquisition and Scanning Patterns.

UNIT V : DETECTION OF RADAR SIGNALS IN NOISE (10 Hours)

Detection of Radar Signals in Noise, Matched Filter Receiver – Response Characteristics and Derivation, Correlation detection, Detection criteria, Detector Characteristics, Automatic Detection, Constant False Alarm Rate Receiver

Text Books:

1. Introduction to Radar Systems – Merrill I. Skolnik, THIRD EDITION, Tata McGraw-Hill, 2001.
2. Principles of Radar, J.C Toomay. 2nd Edition –PHI, 2004

Reference Books:

1. Microwave & Radar Engineering: – Gottapu Sasi Bhushanarao, Pearson Education, 2014.
2. RADAR Engineering – Dr. G.S.N. Raju, I.K. International Pvt., Ltd, 2010
3. Radar Principles, Peyton Z., Peebles Jr., New York: John Wiley & Sons, Inc, 1998.

SEM/YEAR : VI SEM
COURSE CODE : 16EC335
TITLE OF THE COURSE : INFORMATION THEORY & ERROR CONTROL CODING
L: T/A:P: C : 3 : 0 : 0 : 3

Course objectives

1. Understand the performance characteristics of an ideal and noisy communication system.
2. Interpret the encoding and decoding concepts
3. Analyze the performance of discrete communication channels
4. Analyze the rate of information transmission and channel capacity of discrete channel.
5. Propose, design and analyze suitable coding/decoding scheme for digital communication applications.

Course Outcomes

1. Examine information sources and channels based on their statistical properties.
2. Apply Shannon's theorems in information transmission systems.
3. Demonstrate applications of source coding and error coding techniques in selected fields of information and communication technology (ICT).
4. Design source coding and error coding techniques to suit prescribed requirements.
5. Evaluate the performance of various coding techniques over noisy communication channels.

UNIT -1: INFORMATION THEORY (10 hours)

Introduction, Measure of information, Average information content of symbols in long independent sequences, Average information content of symbols in long dependent sequences. Mark-off statistical model for information source, Entropy and information rate of mark-off source.

UNIT -2: SOURCE CODING (10 hours)

Encoding of the source output, properties of codes, Kraft inequality, construction of instantaneous codes, code efficiency and redundancy, Shannon's encoding algorithm, Shannon-Fano Coding, Huffman minimum redundancy code

UNIT -3 : ENTROPY FUNCTIONS (12hours)

Introduction, Discrete Communication Channels, Entropy functions and equivocation, rate of information transmission over a discrete communication channel ,capacity of discrete memory less channel, Shannon's theorem on channel's capacity, special channels
Continuous channels, Differential entropy of continuous channels, Maximization of entropy Mutual information of continuous noisy channels, Shannon-Hartley law and its implications Joint and Conditional Entropies, Mutual information, Channel Capacity, Shannon Limit.

UNIT -4 : ERROR CONTROL CODING (10 hours)

Introduction, Examples of error control coding, Methods of controlling errors, types of codes, types of errors**,** Linear block codes: matrix description of Linear block codes, Error detection and correction capabilities, single error correcting Block codes, single error correcting Hamming codes **Table** lookup for decoding using Standard array

UNIT -5 : TYPES OF CODING **(10 hours)**

Binary cyclic codes Algebraic structure of cyclic codes Encoding using (n-k) bit shift register Syndrome calculation, Error detection and correction

Convolution Codes, Time domain approach. Transform domain approach, State Diagram, tree diagram, Trellis diagram. Encoders and Decoders using Viterbi's algorithm for (n,k,l) convolutional codes

BCH codes, RS codes, golay codes, Shortened cyclic codes Burst and error correcting codes, Burst and random error correcting codes

TEXT BOOKS

1. Digital and analog communication systems, K. Sam Shanmugam, John Wiley India Pvt. Ltd, 20011.
2. Digital Communication, Simon Haykin, John Wiley India Pvt. Ltd, 2012.

REFERENCE BOOKS

1. ITC and Cryptography, Ranjan Bose, TMH, 2 nd edition, 2012
2. Digital Communications - Glover and Grant; Pearson Ed. 2nd edition 2010.
3. Digital Communications: Fundamentals & Applications, 2 nd edition, Sklar, Pearson Education India.
4. Error Control Coding-Fundamentals & Applications, Shulin, Daniel J. Costello, 2nd Edition, Prentice Hall Inc. Eagle wood Cliffs.

SEM/YEAR : VI SEM
COURSE CODE : 16EC336
TITLE OF THE COURSE : CAD FOR VLSI
L: T/A:P: C : 3 : 0 : 0 : 3

Course objectives

1. Understand the design of all VLSI circuits making extensive use Computer Aided Design (CAD) VLSI design tool.
2. Infer the levels of scaling techniques and sizing of transistor.
3. Know the operation CAD VLSI design tools as these are developed primarily for and by the VLSI design professionals.
4. Understand all important modules that go into the construction of a complete VLSI CAD tool and design ASIC chips.

Course Outcomes

1. Apply CAD techniques to design VLSI ICs.
2. Understand how CAD tools are developed and the constraints and limitation under which they can be operated successfully.
3. Apply design rules to manufacture VLSI circuits
4. Analyze the floor planning to optimize the area of VLSI circuits.
5. Gain Proficiency for prerequisites for professionals in the area of VLSI design.

UNIT -I: INTRODUCTION TO DESIGN METHODOLOGIES (08 Hours)

VLSI Design problem-The Design Domains-Design methods and Technologies, Traditional VLSI design flow, VLSI Design Styles.

UNIT- II: ALGORITHMIC GRAPH THEORY (08 Hours)

Graph terminology, Data structures for the representation of graphs, Graph Algorithms - Depth first search, Breadth First Search, Dijkstra's Shortest Path algorithm, Prim's algorithm for minimum spanning tree.

UNIT-III: PARTITIONING AND FLOORPLANNING (10 Hours)

Kernighan - Lin Partitioning algorithm Floor plan concept and Terminologies, Floor plan Representation, Floor plan Classes - Slicing Floor plan and Non-slicing Floor plan, Floor plan tree, Floor plan Wheel, Polar Graph Representation-Vertical and Horizontal, Optimization problems in floor planning, Shape functions and floor plan sizing.

UNIT IV: PLACEMENT AND ROUTING (10 Hours)

Objectives of placement, Placement at Different Levels, Circuit representation, wire length estimation, types of placement problems-Building blocks Placement and Standard cell Placement, Placement algorithms - Constructive Placement algorithms-Cluster growth and min cut, Iterative Placement.

Types of Local routing problems – Area Routing -Maze Routing algorithm by Lee's, - Channel routing –Models, Horizontal constraint graph and vertical constraint graph of routing, The Left-Edge Algorithm for channel, Global routing- Standard cell layout and Building block layout

UNIT V : LAYOUT COMPACTION AND SIMULATION (10 Hours)

Design rules, Symbolic and Geometric layout, compaction and Applications of compaction, Aspects of Compaction Problem formulation-Graph-theoretical formulation, Minimum and Maximum distance Constraint graph, Algorithms for Constraint-graph compaction- Longest-Path Algorithm for DAGs, The Liao-Wong Algorithm, The Bellman-Ford Algorithm for Longest Paths

Gate level modeling and simulation - Compiler driven simulation - Event driven simulation - Switch-level modeling and simulation

TEXT BOOKS:

1. Algorithms for VLSI Design Automation", Sabih H.Gerez, John Wiley & Sons, 2010.
2. Modern VLSI Design: Systems on Chip Design", WayneWolf," Pearson Education Inc., 3nd Edition, Indian Reprint, 2012.
3. Algorithms for VLSI Physical Design Automation ", Naveed Sherwani, Springer-Verlag, 3rd Edition, 2014.

REFERENCE BOOKS:

1. "VLSI Physical Design Automation", Sadiq M Sait and Habib Youssef, , IEEE Press, New York. 2012.
2. "Digital Systems Testing and Testable Design"Abramovici M, Brever A and Friendman D, Jaico Publishing House, 2009.

SEM/YEAR : VII SEM
COURSE CODE : 16EC401
TITLE OF THE COURSE : WIRELESS AND MOBILE COMMUNICATIONS
L: T/A:P: C : 2 : 2 : 0 : 3

Course Objectives:

1. To understand the concepts and techniques of mobile radio communication fundamentals like reflection, diffraction, scattering and fading.
2. To understand cellular design concepts and apply them in wireless communication
3. To design a 3G and 4G wireless communication system to meet desired needs within realistic constraints
4. The course provides the basic foundation of mobile communication. This course covers aspects like working principles, types, modulation methods, channeling and applications.

Course Outcomes:

1. Understand the concepts and techniques of mobile radio communication fundamentals like reflection, diffraction, scattering and fading.
2. Study various multiple access techniques and fundamentals of equalization in wireless communication
3. Understand cellular design concepts and apply them in wireless communication
4. Design GSM and CDMA and its components in mobile and wireless communication.
5. Design a 3G and 4G wireless communication system to meet desired needs within realistic constraints.

UNIT- I: (10 hours)

Evolution of mobile radio communication fundamentals, General Model of Wireless Communication Link, Types of Signals, Cellular Infrastructure, Cellular System Components, Antennas for Cellular Systems, Operation of Cellular Systems, Channel Assignment, Frequency reuse, Channel Assignment strategies, Handoff Strategies Cellular Interferences, Sectorization; Wireless Channel and Radio Communication, Free Space Propagation Model, Channel Noise and Losses, Fading in Land Mobile Systems, Multipath Fading, Fading Effects on Signal and Frequency, Shadowing; Wireless Channel Modeling: AWGN Channel, Rayleigh Channel, Rician Fading Channel, Nakagami Fading Channel, Ocumura and Hata Path Loss Model; Channel Modelling: Stochastic, Flat Fading, Wideband Time-Dispersive Channel Modelling.

UNIT – II: (10 hours)

Theory of Vocoders, Types of Vocoders; Spread Spectrum Modulation, Pseudo-Noise Codes with Properties and Code Generation Mechanisms, DSSS and FHSS Systems, Time Hopping and Hybrid Spread Systems; Multicarrier Modulation Techniques, Zero Inter Symbol Interference Communication Techniques, Detection Strategies, Diversity Combining Techniques: Selection Combining, Threshold Combining, Equal Gain Combining, Maximum Ratio Combining; Spatial Diversity and Multiplexing in MIMO Systems, Channel Estimation,

UNIT- III: (10 hours)

Equalization Techniques: Transversal Filters, Adaptive Equalizers, Zero Forcing Equalizers, Decision Feedback Equalizers, and related algorithms; Multiplexing and Multiple Access: FDMA, TDMA, CDMA, OFDMA, SC-FDMA, IDMA Schemes and Hybrid Method of Multiple

Access Schemes, RAKE Receiver; Multiple Access for Radio Packet Systems: Pure ALOHA, Slotted ALOHA, CSMA and their versions; Packet and Pooling Reservation Based Multiple Access Schemes.

UNIT –IV: **(10 hours)**

GSM system for mobile Telecommunication, General Packet Radio Service, Edge Technology; CDMA Based Standards: IS 95 to CDMA 2000, Wireless Local Loop, IMT 2000 and UMTS, Long Term Evolution (LTE), Mobile Satellite Communication.

UNIT – V: **(10 hours)**

Introduction to Mobile Adhoc Networks, Bluetooth, Wi-Fi Standards, WiMax Standards, Li-Fi Communication, Ultra-Wideband Communication, Mobile data networks, Wireless Standards IMT 2000, Introduction to 4G and concept of NGN.

Text Books:

1. T.S. Rappaport, "Wireless Communication-Principles and practice", Pearson Publications, Second Edition.
2. Upena Dalal, "Wireless Communication and Networks", Oxford Press Publications.

Reference Books:

1. Andrea Goldsmith, "Wireless Communications", Cambridge University Press.
2. S. Haykin & M. Moher, "Modern wireless communication", Pearson, 2005.
3. T L Singal, "Wireless Communications", McGraw Hill Publications

SEMESTER/YEAR : VII SEM / IV YEAR
COURSE CODE : 16EC402
TITLE OF THE COURSE : EMBEDDED SYSTEMS DESIGN
L: T/A: P: C : 2: 2: 0: 3

COURSE OBJECTIVES:

1. To introduce the fundamentals of embedded processor modeling.
2. To understand the hardware components involved in embedded system design.
3. To discuss on the software aspects required in developing an embedded system.
4. To involve in Discussions/ Practices/Exercises onto revising & familiarizing the concepts acquired with applications for improved employability skills.

COURSE OUTCOMES:

1. Describe the differences between the general computing system and the embedded system, also recognize the classification of embedded systems
2. The learning process delivers insight into design & development of computational processors & automated process with improved design strategies.
3. Improved Employability and Entrepreneurship skills due to knowledge up gradation on various aspects involved in an embedded systems design.
4. Design real time embedded system using the concepts of RTOS
5. Analyze various examples of embedded systems based on ATOM processor

MODULE 1: INTRODUCTION TO EMBEDDED SYSTEMS (10 Hours)

Introduction to Embedded Systems – The build process for embedded systems- Structural units in Embedded processor , selection of processor & memory devices- DMA – Memory management methods- Timer and Counting devices, Watchdog Timer, Real Time Clock- Software Development tools-IDE, assembler, compiler, linker, simulator, debugger, In circuit emulator, Target Hardware Debugging, need for Hardware-Software Partitioning, Co-Design.

MODULE 2: EMBEDDED HARDWARE and SYSTEM COMPONENTS (10 Hours)

Embedded Vs General computing system, Classification of Embedded systems, Major applications and purpose of ES. Core of an Embedded System including all types of processor/controller, Memory, Sensors, Actuators, LED, 7 segment LED display, Opto-coupler, relay, Piezo buzzer, Push button switch, Communication Interface , Embedded firmware.

MODULE 3 : EMBEDDED SOFTWARE (10 Hours)

Introduction to Embedded C And Applications – C looping structures, Register allocation, Function calls, Pointer aliasing, structure arrangement , bit fields, unaligned data and endianness, inline functions and inline assembly ,portability issues.

Embedded Systems programming in C – Binding & Running Embedded C program in IDE, Dissecting the program, Building the hardware. Basic techniques for reading & writing from I/O port pins, switch bounce, LED Interfacing using Embedded C.

MODULE 4: EMBEDDED OPERATING SYSTEMS (sEOS) (10 hours)

Basics of sEOS, Timer Design consideration using sEOS, Multi-state system design. Implementation of Traffic light sequencing using on chip UART for RS-232 communication-memory requirements.

MODULE 5: EMBEDDED SYSTEMS APPLICATIONS (10 hours)

Case study – Intruder alarm system. HyperTerminal based control-packet based control for LED interfacing, Discussions on Design, Development & Product Manufacturing Processes' of embedded Products like Digital Camera /Adaptive Cruise control in a Car /Mobile Phone / Automated Robonoid

Text Books:

1. Shibu K V, "Introduction to Embedded Systems", Tata McGraw Hill Education Private Limited, 2009.
2. Raj kamal, 'Embedded system-Architecture, Programming, Design', TMH.

Reference Books:

1. Tammy Noergaard, "Embedded system architecture", Elsevier.
2. Jean J. Labrosse, "Embedded Systems Building Blocks: Complete and Ready-To-Use Modules in C", The publisher, Paul Temme.
3. Peckol, "Embedded system Design", JohnWiley &Sons.
4. Lyla B Das," Embedded Systems-An Integrated Approach", Pearson.
5. Jonathan W.Valvano,"Embedded Microcomputer Systems, Real Time Interfacing", Cengage Learning.
6. Jivan S. Parab, Vinod G. Shelake, Rajanish K.Kamot, and Gourish M.Naik, "Exploring C for Microcontrollers- A Hands on Approach", Springer, 2007.
7. Michael J. Pont, "Embedded C", Addison Wesley.

SEMESTER/YEAR : VII SEM / IV YEAR
COURSE CODE : 16EC471
TITLE OF THE COURSE : VLSI Lab
L: T/A: P: C : 0 : 0 : 4 : 2

Course Objectives:

1. To educate students with the knowledge of Verilog coding and test bench, to write Verilog Code for all logic gates, flip-flops, counters and Adders etc.
2. Students will be able to compile, simulate and Synthesize the Verilog code.
3. Design and analyze VLSI integrated circuits from a system design perspective.
4. From this lab the students will be able to draw the schematic diagram and layout for the inverter and amplifiers and verify their functionality.

COURSE OUTCOMES:

1. Learn the advanced concepts of modern VLSI circuit and system design, including differences between ASICs and FPGAs, standard cells, cell libraries, IPs etc.
2. Have experience with a logic synthesis tool for mapping RTL onto a cell library.
3. To understand the back-end physical design flow, including floor-planning, placement, CTS and routing.
4. Get accustomed to VLSI CAD tools and their usability.
5. Understand the role of computer-aided design (CAD) tools in automating the design flow and provide improved productivity in VLSI systems design.

DIGITAL DESIGN

List of Experiments

Any nine experiments from the following:

1. Design and implement floor planning, routing, power planning, CTS for an inverter.
2. Design and implement floor planning, routing, power planning, CTS for NAND gate.
3. Design and implement floor planning, routing, power planning, CTS for NOR gate.
4. Design and implement floor planning, routing, power planning, CTS for Half adder.
5. Design and implement floor planning, routing, power planning, CTS for Full adder.
6. Design and implement floor planning, routing, power planning, CTS for 2X1 multiplexer.
7. Design and implement floor planning, routing, power planning, CTS for JK flip flop.
8. Design and implement floor planning, routing, power planning, CTS for SR flip flop.
9. Design and implement floor planning, routing, power planning, CTS for Parallel Adder.
10. Design and implement floor planning, routing, power planning, CTS for Synchronous Counter.
11. Design and implement floor planning, routing, power planning, CTS for Asynchronous Counter.
12. Design and implement floor planning, routing, power planning, CTS for Successive Approximation Register (SAR).

PART B

ANALOG DESIGN

Any three experiments from the following:

1. Design schematic of an inverter and perform its DC analysis and transient analysis.
2. Design schematic of a common source amplifier and perform its DC, AC and transient analysis.
3. Design schematic of a common drain amplifier and perform its DC, AC and transient analysis.
4. Design schematic of a Differential amplifier and perform its DC, AC and transient analysis.
5. Design schematic of an Operational amplifier and perform its DC, AC and transient analysis.

SEMESTER/YEAR : VII SEM / IV YEAR
COURSE CODE : 16EC421
TITLE OF THE COURSE : SATELLITE COMMUNICATION
L: T/A: P: C : 3: 0: 0: 3

Course Objectives:

1. To understand the basics and applications of satellite communications
2. To understand the satellite segment and earth segment
3. Provide an in-depth treatment of satellite communication systems operation and planning.
4. To analyze the various methods of satellite access
5. Link budgets & planning
6. Review the state of the art in new research areas such as speech and video coding, satellite networking and satellite personal communications

Course Outcomes:

1. Understand principle, working and operation of various sub systems of satellite as well as the earth station.
2. Apply various communication techniques for satellite application .
3. Analyze and design satellite communication link.
4. Learn advanced techniques and regulatory aspects of satellite communication
5. Understand role of satellite in various applications

UNIT I SATELLITE ORBITS (10 hours)

Kepler's Laws, Newton's law, orbital parameters, orbital perturbations, station keeping, geo stationary and non-Geo-stationary orbits – Look Angle Determination- Limits of visibility – eclipse-Sub satellite point –Sun transit outage-Launching Procedures - launch vehicles and propulsion.

UNIT II SPACE SEGMENT AND SATELLITE LINK DESIGN (10 hours)

Spacecraft Technology- Structure, Primary power, Attitude and Orbit control, Thermal control and Propulsion, communication Payload and supporting subsystems, Telemetry, Tracking and command. Satellite uplink and downlink Analysis and Design, link power budget, E/N calculation, performance impairments-system noise, inter modulation and interference, Propagation Characteristics and Frequency considerations-System reliability and design lifetime.

UNIT III EARTH SEGMENT (10 Hours)

Earth Station Technology-Terrestrial Interface, Transmitter and Receiver, Antenna Systems –TVRO, MATV, CATV, Test Equipment Measurements on G/T, C/No, EIRP, Transmission losses

UNIT IV SATELLITE ACCESS (10 hours)

Modulation and Multiplexing: Voice, Data, Video, Analog – digital transmission system, Digital video Broadcast, multiple access: FDMA, TDMA, CDMA, Assignment Methods, Spread Spectrum communication, compression- encryption.

UNIT V SATELLITE APPLICATIONS **(10 hours)**

INTELSAT Series, INSAT, VSAT, Mobile satellite services: GSM, GPS, INMARSAT, LEO, MEO, Satellite Navigational System. Direct Broadcast satellites (DBS)- Direct to home Broadcast (DTH), Digital audio broadcast (DAB)- World space services, Business TV(BTV), GRAMSAT, Specialized services–E –mail, Video conferencing, Internet.

Text Books:

1. Dennis Roddy, 'Satellite Communication', McGraw Hill International, 4th Edition, 2006.
2. Satellite Communications – Timothy Pratt, Charles Bostian and Jeremy Allnutt, WSE, Wiley Publications, 2nd Edition, 2003.

References:

1. Wilbur L. Pritchard, Hendri G. Suyderhoud, Robert A. Nelson, 'Satellite Communication Systems Engineering', Prentice Hall/Pearson, 2007.
2. Madhavendra Richharia, Leslie David, "Satellite Systems for Personal Applications Concepts and Technology", Wiley-Blackwell, 2010.
3. N.Agarwal, 'Design of Geosynchronous Space Craft, Prentice Hall, 1986.
4. Bruce R. Elbert, 'The Satellite Communication Applications' Hand Book, Artech House Bostan London, 1997.
5. Tri T. Ha, 'Digital Satellite Communication', II edition, 1990.

SEMESTER/YEAR : VII SEM / IV YEAR
COURSE CODE : 16EC423
TITLE OF THE COURSE : REAL TIME OPERATING SYSTEMS
L: T/A: P: C : 3: 0: 0: 3

Course Objectives:

1. Basics of real time systems, classifications of programs, languages and controls for real time applications.
2. Various aspects of operating systems, Kernels & Design Methodologies.
3. Use of RTOS for various Electronic applications.
4. About the latest Operating system, 'Raspberry PI'.

Course Outcomes:

1. Explain the various kernels and Design methodologies of RTOS.
2. Work with an OS for real time applications.
3. Develop various RTOS Applications in the Image Processing and control systems domains.
4. Use the latest operating system, 'Raspberry PI'.
5. To work on design and development of protocols related to real-time communication

Module -1 INTRODUCTION TO REAL-TIME SYSTEMS: (10 hours)

RTS Definition, Classification of Real-time Systems, Time constraints, Classification of Programs - Sequence Control, Loop control, Supervisory control, Centralized computer control, Distributed system, Human-computer interface, General purpose computer, Single chip microcontroller, Specialized processors, Process-related Interfaces, Data transfer techniques, Communications, Standard Interface.

Module -2 LANGUAGES FOR REAL-TIME APPLICATIONS: (10 hours)

Introduction, Syntax layout and readability, Declaration and Initialization of Variables and Constants, Modularity and Variables, Compilation, Data types, Control Structure, Exception Handling, Low-level facilities, Co routines, Interrupts and Device handling, Concurrency, Real-time support, Overview of real-time languages.

Module -3 OPERATING SYSTEMS: (10 hours)

Introduction, Real-time multi-tasking OS, Scheduling strategies, Priority Structures, Task management, Scheduler and real-time clock interrupt handles, Memory Management, Code sharing, Resource control, Task co-operation and communication, Mutual exclusion, Data transfer, Liveness, Minimum OS kernel, Examples.

Module -4 REAL TIME KERNEL, METHOLOGIES AND APPLICATIONS:

(10 hours)

Study of RTOS VX works and μCOS, RTS DEVELOPMENT METHODOLOGIES: Yourdon Methodology, Requirement definition for Drying Oven, Ward and Mellor Method, Hately and Pirbhai Method. Applications: RTOS for Image Processing, Embedded RTOS for voice over IP, RTOS for Control Systems.

Module -5 RASPBERRY PI **(10 hours)**

The Raspberry PI ARM Chip, Cross Compiler, The Command Line, Creating A Source File, Execution, system calls, Assembler Errors, Linking Files, Tidying Up, SWI and SVR Commands, Writing to the Screen. Reading From the Keyboard, Make-files, Frozen Cases, Assembling for GDB, The Dis-assembler, Breakpoints, Memory Dump.

Text Books:

1. C.M. Krishna, Kang, G.Shin, "Real Time Systems", McGraw Hill, 1997.
2. Raj kamal, Embedded systems: Architecture, Programming and Design TMH publisher.

Reference Books:

1. Real time systems design and analysis- Philip.A. Laplante, TMH Publisher.
2. Real Time systems- Jane W.S. Liu, Prentice Hall publisher.
3. Raspberry Pi Assembly language – Bruce Smith, British Broadcasting Corporation (Hand Book).
4. RTOS V9.0.0 Reference manual

SEMESTER/YEAR : VII SEM / IV YEAR
COURSE CODE : 16EC424
TITLE OF THE COURSE : OPTICAL COMMUNICATION
L: T/A: P: C : 3 : 0 : 0 : 3

Course Objectives:

1. To understand the optical networks and various optical components.
2. To understand various optical Equipment.
3. To understand the various wavelength routing networks.
4. To understand Virtual Topology.
5. To understand the working of access networking. Acquire fundamental concepts on multichannel system and related components

Course Outcomes:

1. Describe optical networks and to Design various optical components.
2. Design various optical Equipment and to examine transmission system engineering.
3. Discuss and understand the various wavelength routing networks.
4. Analyze the Virtual Topology design problem.
5. Describe the various access networks

UNIT -1 INTRODUCTION TO OPTICAL FIBERS: (10 hours)

Elements of Optical Fiber communication, applications of optical fiber communication, optical fiber waveguides, Optical Spectral bands, Optical fibre structure, Light Propagation in Optical fibres: Ray theory, Total Internal reflection, Skew rays, Overview of Modes: Cut-off wavelength, V number, Fiber types: SI, GI, MM, SM, Special Fibers: Polarization Maintaining fibers, Photonic Crystal fibers, Dispersion compensated Fiber.

UNIT-2 TRANSMISSION CHARACTERISTICS OF OPTICAL FIBERS: (10 hours)

Introduction, Difference between bounded and free space optical communication, Propagation characteristics of IR, Visible, UV in Atmosphere and space, Attenuation: Material Absorption, Scattering, bending and core cladding losses, Overview of Signal dispersion in Fibers, its limitations, Intermodal dispersion, Intra-Modal dispersion: Material dispersion, Waveguide dispersion and PMD, Inter-Modal dispersion, Nonlinear effects: Nonlinear scattering, Kerr effects, Fiber alignment and Joint Loss, Fiber Splices Optical Fiber connectors, Expanded Beam Connectors, Lensing schemes for coupling, Fiber couplers.

UNIT- 3 OPTICAL SOURCES, DETECTORS AND RECEIVER: (10 hours)

Optical Sources: Light source materials, LED Structures; LED Characteristics; Semiconductor Laser Diode, LASER Characteristics, Photo detectors, Photo detector noise, Response time, double hetero junction structure, Photo diodes, comparison of photo detectors, Optical receiver operation, receiver sensitivity, quantum limit, eye diagrams, coherent detection, burst mode receiver, operation, Analog receivers.

UNIT -4 WDM CONCEPTS AND COMPONENT: (10 hours)

WDM concepts, overview of WDM operation principles, WDM standards, Mach-Zehender interferometer, multiplexer, Isolators and circulators, direct thin film filters, active optical components, MEMS technology, Optical MEMS switches, variable optical attenuators, tunable optical fibers, dynamic gain equalizers, optical drop multiplexers, polarization controllers, chromatic dispersion components, tunable light sources.

UNIT-5 OPTICAL AMPLIFIERS AND NETWORKS: (10 hours)

Optical Amplifiers and networks - optical amplifiers, basic applications and types, semiconductor optical amplifiers, EDFA, Optical networks: Introduction, SONET/SDH, Optical interfaces, SONET/SDH rings, High-speed light- waveguides.

Text Books:

1. John M. Senior, " Optical fiber Communications: Principles and Practice", Pearson Education, 3rd Edition, 2009
2. Keiser G, "Optical Fiber Communication Systems", 5th Edition, 6th Reprint, McGraw Hill Education (India), 2015.

References:

1. Vivekanand Mishra, Sunita P. Ugale, "Fiber Optic Communication: Systems and Components", Wiley-India, 1st edition, 2013
2. Djafar.K. Mynbaev and Lowell and Scheiner, "Fiber Optic Communication Technology", Pearson Education Asia, 9th impression, 2013
3. R.P. Khare, "Fiber Optics and Optoelectronics", Oxford University Press, 2007.
4. Rajiv Ramaswami, Kumar N. Sivaranjan, Galen H.Sasaki "Optical Networks A practical perspective", 3nd edition, 2013

SEMESTER/YEAR : VII SEM / IV YEAR
COURSE CODE : 16EC425
TITLE OF THE COURSE : MULTIMEDIA COMMUNICATIONS
L: T/A: P: C : 3: 0: 0: 3

Course Objectives:

1. Understanding the multimedia communications systems, application and basic principles
2. Analysis of the multimedia streaming
3. Performing and establishing multimedia communication terminals
4. To focuses on topics in multimedia information representation and relevant signal processing aspects, multimedia networking and communications, and multimedia standards especially on the audio, image and video compression.

Course Outcomes:

1. To achieve a basic understanding of multimedia systems.
2. With such back ground students would be able to evaluate more advanced or future multimedia systems.
3. Motivate students towards developing their career in the area of multimedia and internet applications.
4. Choose required networks for multimedia communication.
5. Identify different standards for multimedia communication.

UNIT -1 MULTIMEDIA COMMUNICATIONS: (10 hours)

Introduction, multimedia information representation, multimedia networks, multimedia applications, media types, communication modes, network types, multipoint conferencing, network QoS, application QoS.

MULTIMEDIA INFORMATION REPRESENTATION: Introduction, digital principles, text, images, audio, video.

UNIT -2 TEXT AND IMAGE COMPRESSION: (10 hours)

Introduction, compression principles, text compression, image compression. AUDIO AND VIDEO COMPRESSION: Introduction, audio compression, DPCM, DPCM, APC, LPC, video compression, video compression principles, H.261, H.263, MPEG, MPEG-1, MPEG-2, and MPEG-4.

UNIT -3 MULTIMEDIA INFORMATION NETWORKS (10 hours)

Introduction, LANs, Ethernet, Token ring, Bridges, FDDI High-speed LANs, LAN protocol
THE INTERNET: Introduction, IP Datagrams, Fragmentation, IP Address, ARP and RARP, QoS Support, IPv8.

UNIT -4 **(10 hours)**

BROADBAND ATM NETWORKS**:** Introduction, Cell format, Switch and Protocol Architecture ATM LANs. TRANSPORT PROTOCOL: Introduction, TCP/IP, TCP, UDP, RTP and RTCP.

UNIT -5 MULTIMEDIA COMMUNICATIONS ACROSS NETWORK **(10 hours)**

Multimedia Across Wireless ,Speech transmission in GSM , Video across GSM , Mobile ATM, Mobile IP , Wireless multimedia delivery , SIP in mobile environment , Multicast routing in Cellular , Networks ,Broadband Wireless Mobile ,Digital video broadcasting , Data transmission using MPEG-2 and DVB , Broadband Multimedia Satellite Systems, Digital television infrastructure for interactive multimedia Services , Interactive broadcast data (IDB) services, Data carousel concept

Text Books

1 Multimedia Communications: Applications, Networks, Protocols and Standards, Fred Halsall, Pearson Education, Asia, Second Indian reprint 2002.

Reference Books

1. Multimedia Information Networking, Nalin K. Sharda, PHI, 2003.
2. "Multimedia Fundamentals: Vol 1 - Media Coding and Content Processing", Ralf Steinmetz, Klara Narstedt, Pearson Education, 2004.
3. "Multimedia Systems Design", Prabhat K. Andleigh, Kiran Thakrar, PHI, 2004.

SEMESTER/YEAR : VII SEM / IV YEAR
COURSE CODE : 16EC426
TITLE OF THE COURSE : DIGITAL VLSI DESIGN AND VERIFICATION
L: T/A: P: C : 3: 0: 0: 3

COURSE OBJECTIVES:

1. To get a comprehensive idea of the whole digital VLSI design flow.
2. To Understand Verification Techniques and methodologies,
3. To Understand VLSI Testing models for Combinational circuits, sequential circuits and Built in Self-test.

COURSE OUTCOMES:

1. Understand the concepts and techniques three basic phases: Design, Verification and Test.
2. Study various Verification Techniques
3. Understand VLSI Testing models
4. Use modern tools to simulate Schematic and Layout of Digital circuits
5. Architecture design of SOCs and Embedded CPUs

UNIT- I: Design **(10 hours)**
Introduction to Digital VLSI Design Flow, High Level Design Representation, Transformations for High Level Synthesis, Introduction to HLS: Scheduling, Allocation and Binding Problem, Scheduling Algorithms, Binding and Allocation Algorithms.

UNIT – II: **(10 hours)**
Logic Optimization and Synthesis Two level Boolean Logic Synthesis, Heuristic Minimization of Two-Level Circuits, Finite State Machine Synthesis, and Multilevel Implementation.

UNIT- III: Verification **(10 hours)**
Temporal Logic
Introduction to formal methods for verification, Temporal Logic: Introduction and Basic Operators, Syntax and Semantics of CTL, Equivalence between CTL Formulas.

UNIT –IV: **(10 hours)**
FLOOR PLANNING & ARCHITECTURE DESIGN: Floor planning methods, off-chip connections, High-level synthesis, Architecture for low power, SOCs and Embedded CPUs, Architecture testing.

INTRODUCTION TO CAD SYSTEMS (ALGORITHMS) AND CHIP DESIGN: Layout Synthesis and Analysis, Scheduling and printing; Hardware/Software Co-design, chip design methodologies- A simple Design example-

UNIT – V: Testing (10 hours)

Introduction to Digital VLSI Testing, Functional and Structural Testing, Fault Equivalence, Fault Simulation and Testability Measures, Combinational Circuit Test Pattern Generation Introduction to Automatic Test Pattern Generation (ATPG) ,Sequential Circuit Testing and Scan Chains, ATPG for Synchronous Sequential Circuits, Scan Chain based Sequential Circuit Testing ,Built in Self-test (BIST) Memory Testing

Text Books:

1. D. D. Gajski, N. D. Dutt, A.C.-H. Wu and S.Y.-L. Lin, High-Level Synthesis: Introduction to Chip and System Design, Springer, 1st edition, 1992.
2. S.Palnitkar, Verilog HDL:A Guide to Digital Design and Synthesis, Prentice Hall, 2nd edition, 2003.

Reference Books:

1. M. Huth and M. Ryan, Logic in Computer Science modeling and reasoning about systems, Cambridge University Press, 2nd Edition, 2004
2. Bushnell and Agrawal, Essentials of Electronic Testing for Digital, Memory & Mixed-Signal Circuits, Kluwer Academic Publishers, 2000
3. G. De Micheli.Synthesis and optimization of digital circuits, 1st edition, 1994.

SEMESTER/YEAR : VII SEM / IV YEAR
COURSE CODE : 16EC427
TITLE OF THE COURSE : MACHINE LEARNING AND DATA ANALYTICS
L: T/A: P: C : 3 : 0 : 0 : 3

COURSE OBJECTIVES:

1. To understand the science of analyzing data to convert information to useful knowledge.
2. To understand the use of empirical approaches to problem solving.
3. To understand a wide range of data analytic techniques
4. To provide a basic understanding of data analysis using statistics.

COURSE OUTCOMES:

1. Carry out data analysis/statistical analysis.
2. Effectively visualize the data.
3. Identify appropriate database technologies to meet a set of requirements and to recommend possible solution
4. Identify and evaluate appropriate data analytics techniques to be used depending on the specific information needs of the project.
5. Work both independently and in a team to solve large data analysis projects

UNIT- I: (10 hours)

Introduction to Artificial Intelligence and neural network
Descriptive Statistics: Introduction to the course Descriptive Statistics Probability Distributions. Inferential Statistics Inferential Statistics through hypothesis tests.

UNIT – II: (10 hours)

Machine Learning: Introduction and Concepts, Differentiating algorithmic and model based frameworks.
Regression: Ordinary Least Squares, Ridge Regression, Lasso Regression Nearest Neighbors Regression & Classification.

UNIT- III: (10 hours)

Supervised Learning with Regression and Classification techniques -1
Bias-Variance Dichotomy Model Validation Approaches
Logistic Regression Linear Discriminant Analysis Quadratic Discriminant Analysis
Regression and Classification Trees Support Vector Machines
Supervised Learning with Regression and Classification techniques -2
Ensemble Methods: Random Forest Neural Networks Deep learning

UNIT –IV: (10 hours)

Unsupervised Learning and Challenges for Big Data Analytics
Clustering Associative Rule Mining Challenges for big data analytics

UNIT – V: **(10 hours)**

Prescriptive analytics

Creating data for analytics through designed experiments, creating data for analytics through Active learning, Creating data for analytics through Reinforcement learning

Text Books:

[1] Hastie, Trevor, et al. The elements of statistical learning. Vol. 2. No. 1. New York: springer, 2009.

[2] Montgomery, Douglas C., and George C. Runger. Applied statistics and probability for engineers. John Wiley & Sons, 2010.

SEMESTER/YEAR : VII SEM / IV YEAR
COURSE CODE : 16EC428
TITLE OF THE COURSE : WIRELESS SENSOR NETWORKS
L: T/A: P: C : 3 : 0 : 0 : 3

COURSE OBJECTIVES:

1. To introduce the basics of Sensor Networks and their challenges.
2. To analyze the concepts and pick relevant techniques in physical and MAC layer suitable to the application.
3. To teach the different techniques which can be used for routing.
4. To understand and analyze the significance of power and time management in Sensor Networks.
5. To highlight the significance of localization and introduce different techniques for transport protocol.

COURSE OUTCOMES:

1. Understand the basic sensor network, their architectural elements and applications.
2. Analyze the sensor networks applications, their various categories and Taxonomy of WSN.
3. Analyze the Software and hardware of sensor network, operating environment and propagation impairments.
4. Analyze the Radio technology, modulation techniques, and role of MAC lay in WSN.
5. Analyze the various MAC protocols, scheduling, synchronization and applications of WAN/MAN.

UNIT -1 INTRODUCTION AND OVERVIEW OF WIRELESS SENSOR NETWORKS:
(10 Hrs)

Introduction to wireless sensor networks, Challenges and Constraints, Application of sensor networks, Node architecture, Operating System, Fundamental aspects, Historical survey.

UNIT-2 PHYSICAL LAYER AND MEDIUM ACCESS LAYER: (10 Hrs)

Basic architectural framework, Physical layer, source encoding , channel encoding, modulation, medium access control, Wireless MAC protocols, Characteristics of MAC protocols in sensor networks, Contention free MAC protocols, traffic adaptive medium access, Low-Energy Adaptive Clustering Hierarchy, Contention based protocols, Power Aware Multi-Access with Signalling, Data-Gathering MAC, Receiver-Initiated MAC.

UNIT- 3 NETWORK LAYER AND TRANSPORT LAYER: (10 Hrs)

Routing metrics, Data centric Routing, Proactive routing, OLSR, Reactive Routing, AODV, Location Based Routing, Traditional Transport Control Protocols, TCP (RFC 793), UDP (RFC 768), Mobile IP - Feasibility of Using TCP or UDP for WSNs, Transport Protocol Design Issues, Examples of Existing Transport Control Protocols, CODA (Congestion Detection and Avoidance).

UNIT -4 NETWORK MANAGEMENT: (12 Hrs)

Power Management, Local Power Management Aspects, Processor Subsystem, Communication Subsystem, Active Memory, Power Subsystem, Dynamic Power Management, Dynamic Operation Modes, Time Synchronization, Clocks and the Synchronization Problem, Time Synchronization in Wireless Sensor Networks, Reasons for Time Synchronization, Challenges for Time Synchronization, Basics of Time Synchronization, Synchronization Messages, Non determinism of Communication Latency, Time Synchronization Protocols, Lightweight Tree, Based Synchronization, Timing-sync Protocol for Sensor Networks Localization, Ranging Techniques, Time of Arrival, Time Difference of Arrival, Angle of Arrival, Received Signal Strength, Range-Based Localization, Triangulation, Range-Free Localization, Ad Hoc Positioning System (APS).

UNIT-5 MIDDLEWARE FOR WIRELESS SENSOR NETWORKS AND MOBILITY MODELING: (10 Hrs)

Introduction, WSN Middleware Principles, Middleware Architecture , Data-Related Functions, Architectures, Case study, MiLAN (Middleware Linking Applications and Networks), IrisNet (Internet-Scale Resource-Intensive Sensor Networks Services), Mobility modeling :Categorization of Mobility Models, Mobility Models, Random Walk Model, Random Waypoint Model, Random Direction Model, Gauss-Markov Model, Manhattan Model, Column Model, Pursue Model, Nomadic Community Model, Selection of Appropriate Mobility Models

TEXT BOOKS:

1. Dr.Xerenium, Shen, Dr. Yi Pan, “Fundamentals of Wireless Sensor Networks, Theory and Practice”, Wiley Series on wireless Communication and Mobile Computing, 1st Edition, 2010.
2. Bhaskar Krishnamachari, “Networking Wireless Sensors”, Cambridge university press, 2005.

REFERENCE BOOKS:

1. Kazem Sohraby, Daniel Manoli, “Wireless Sensor networks- Technology, Protocols and Applications”, Wiley Inter Science Publications, 2007.
2. Raghavendra C.S, Krishna Sivalingam M., Taieb znati, “Wireless Sensor Networks”, Springer Science, 2004.

SEMESTER/YEAR : VIII SEM / IV YEAR
COURSE CODE : 16EC430
TITLE OF THE COURSE : COGNITIVE RADIO
L: T/A: P: C : 3 : 0 : 0 : 3

COURSE OBJECTIVES:
1. Know the basics of the software defined radios.
2. Learn the design of the wireless networks based on the cognitive radios
3. Understand the concepts of wireless networks and next generation networks

COURSE OUTCOMES:
1 .Describe the basics of the software defined radios.
2. To learn the hardware and software architecture of software defined radio
3. Design the wireless networks based on the cognitive radios.
4. Gives an understanding of cognitive radio architecture
5. Explain the concepts behind the wireless networks and next generation networks
6. To have a better understanding of cognitive techniques

UNIT -1 INTRODUCTION TO SOFTWARE DEFINED RADIO (10 Hrs)
Definitions and potential benefits, software radio architecture evolution, technology tradeoffs and architecture implications.

UNIT -2 SDR ARCHITECTURE (10 Hrs)
Essential functions of the software radio, basic SDR, hardware architecture, Computational processing resources, software architecture, top level component interfaces, interface topologies among plug and play modules.

UNIT -3 INTRODUCTION TO COGNITIVE RADIOS (10 Hrs)
Marking radio self-aware, cognitive techniques – position awareness, environment awareness in cognitive radios, optimization of radio resources, Artificial Intelligence Techniques.

UNIT -4 COGNITIVE RADIO ARCHITECTURE (10 Hrs)
Cognitive Radio - functions, components and design rules, Cognition cycle - orient, plan, decide and act phases, Inference Hierarchy, Architecture maps, Building the Cognitive Radio Architecture on Software defined Radio Architecture.

UNIT -5 NEXT GENERATION WIRELESS NETWORKS (10 Hrs)
The XG Network architecture, spectrum sensing, spectrum management, spectrum mobility, spectrum sharing, upper layer issues, cross – layer design.

TEXT BOOKS:

1. Joseph Mitola III,"Software Radio Architecture: Object-Oriented Approaches to Wireless System
   Engineering", John Wiley & Sons Ltd. 2000.
2. Thomas W.Rondeau, Charles W. Bostain, "Artificial Intelligence in Wireless communication",
   ARTECH HOUSE .2009.

REFERENCE BOOKS:

1. Simon Haykin, "Cognitive Radio: Brain –Empowered Wireless Communications", IEEE Journal on selected areas in communications, Feb 2005.
2. Hasari Celebi, Huseyin Arslan, "Enabling Location and Environment Awareness in Cognitive Radios", Elsevier Computer Communications, Jan 2008.
3. Markus Dillinger, Kambiz Madani, Nancy Alonistioti, "Software Defined Radio", John Wiley, 2003.
4. Huseyin Arslan, "Cognitive Radio, SDR and Adaptive System", Springer, 2007.
5. Alexander M. Wyglinski, Maziarnekovee, Y. Thomas Hu, "Cognitive Radio Communication and Networks", Elsevier, 2010.
6. Ian F. Akyildiz, Won – Yeol Lee, Mehmet C. Vuran, Shantidev Mohanty, "Next generation / dynamic spectrum access / cognitive radio wireless networks: A Survey" Elsevier Computer Networks, May 2006.

SEMESTER/YEAR : VIII SEM / IV YEAR
COURSE CODE : 16EC431
TITLE OF THE COURSE : INDUSTRIAL AUTOMATION
L: T/A: P: C : 3: 0: 0: 3

COURSE OBJECTIVES:

1. To introduce to the architecture of automation systems.
2. To familiarize students with various measurement systems including sensors and signal conditioning.
3. To introduce students to the concepts of discrete and continuous variable control systems.
4. It gives the introductory idea about hydraulic, pneumatic and electric actuators, industrial networking system.

COURSE OUTCOMES:

1. Select appropriate control methodology for the given system.
2. Solve control Problems related to Automation.
3. Understand & design the automated systems using PLC and RLL.
4. Establish communication between automated systems.
5. Connect the field devices to the PLC to create a complete control system

Module -1 INTRODUCTION TO INDUSTRIAL AUTOMATION SYSTEMS: (10 Hrs)
Introduction, Architecture of Industrial Automation Systems, Measurement Systems, Characteristics, Data Acquisition Systems.

Module -2 CONTROL TECHNIQUES: (10 Hrs)
Introduction to Automatic Control, P-I-D Control, PID Control Tuning, Feed forward Control, Ratio Control, Time Delay Systems and Inverse Response Systems, Special Control Structures, Process control.

Module -3 SEQUENCE CONTROL: (10 Hrs)
Introduction to sequence control, PLC, RLL, Scan Cycle, Simple RLL Programs: RLL Elements, RLL Syntax, A Structured Design Approach to Sequence Control, PLC Hardware Environment.

Module -4 CATOGORIES OF CONTROL SYSTEMS: (10 Hrs)
Flow Control Valves, Overview of: Hydraulic Control Systems, Pneumatic Control Systems, Energy Savings with Variable Speed Drives.

Module -5 COMMUNICATION IN AUTOMATION: (10 Hrs)

The Field bus Networks, Higher Level Automation Systems.

TEXT BOOKS:

1. Industrial Instrumentation, Control and Automation, S. Mukhopadhyay, S.Sen and A.K. Deb, Jaico Publishing House, 2013
2. Electric Motor Drives, Modelling, Analysis and Control, R.Krishnan, Prentice Hall India, 2002

REFERENCE BOOKs:

1. Chemical Process Control, An Introduction to Theory and Practice, George Stephanopoulos, Prentice Hall India, 2012.
2. Hydraulic Control Systems, Herbert E. Merritt, Wiley, 1991

SEMESTER/YEAR : VIII SEM / IV YEAR
COURSE CODE : 16EC432
TITLE OF THE COURSE : GLOBAL TRACKING & POSITIONING
L: T/A: P: C : 3: 0: 0: 3

COURSE OBJECTIVES:

1. To explain the basic principles of various positioning techniques and introduce GPS operating principle.
2. To make the students to understand the essential features such as signal structure, errors, coordinate systems etc., and highlight the importance of integrating GPS with other systems.
3. To teach the necessity of augmentation of GPS and discuss SBAS and GBAS systems

COURSE OUTCOMES:

1. Students will be able to calculate user position for a given inputs related to various positioning methods.
2. Students will be able estimate the contribution of each error and estimate the GNSS positional accuracy.
3. Students will have clear idea what type of integration or augmentation is necessary in a particular scenario
4. Understand Local area augmentation system (LAAS) concept.
5. Understand basics of Satellite orbits and reference systems

UNIT- I: INTRODUCTION (10 Hrs)

Satellites, Introduction to Tracking and GPS System, Applications of Satellite and GPS for 3D position, Velocity, determination as function of time, Interdisciplinary applications (eg,.Crystal dynamics, gravity field mapping, reference frame, atmospheric occultation)Basic concepts of GPS. Space segment, Control segment, user segment, History of GPS constellation, GPS measurement characteristics, selective availability (AS), anti-spoofing (AS).

UNIT – II: ORBITS AND REFERENCE SYSTEMS (10 Hrs)

Basics of Satellite orbits and reference systems-Two-body problem, orbit elements, timer system and timer transfer using GPS, coordinate systems, GPS Orbit design, orbit determination problem, tracking networks, GPS force and measurement models for orbit determination, orbit broadcast ephemeris, precise GPS ephemeris. Tracking problems.

UNIT- III: GPS MEASUREMENTS (10 Hrs)

GPS Observable-Measurement types (C/A Code,P-code,L1 and L2 frequencies for navigation, pseudo ranges),atmospheric delays (tropospheric and ionospheric) data format (RINEX), data combination(narrow/wide lane combinations, ionosphere-free combinations, single, double, triple differences), undifferenced models, carrier phase Vs Integrated Doppler, integer biases, cycle slips, clock error.

UNIT –IV: PROCESSING TECHNIQUES & APPLICATIONS (10 Hrs)

Pseudo range and carrier phase processing, ambiguity removal, Least square methods for state parameter determination, relation positioning, dilution of precision. Surveying, Geophysics, Geodsey, airborne GPS, Ground-transportation, Spaceborne GPS orbit determination, attitude control, meteorological and climate research using GPS.

UNIT – V: CONSTELLATIONS AND AUGMENTATION SYSTEMS (10Hrs)

Other satellite navigation constellations GLONASS and Galileo IRNS System.: Relative advantages of SBAS and GBAS, Wide area augmentation system (WAAS) architecture, GAGAN, EGNOS and MSAS. Local area augmentation system (LAAS) concept.

Text Books:

1. GPS: Theory and Practice - B.Hofmann Wollenhof, H.Lichtenegger, and J.Collins, 5th revised edition, Springer, New york,2001
2. GPS: Theory and Applications - B.Parkinson, J.Spilker, Jr.(Eds), Amer Inst of Aeronautics &; 1st edition (January 15, 1996)

Reference Books:

1. Global Positioning System Signals, Measurements, and Performance - Pratap Misra and Per Enge, Ganga-Jamuna Press, Massachusetts, 2001
2. GPS for Geodesy- A.Kleusberg and P.Teunisen(Eds), Springer-Verlag,Berlin,1996
3. GPS Satellite Surveying, A.Leick, 2nd edition, John Wiley & Sons,NewYork,1995

SEMESTER/YEAR : 7TH SEM OR 8TH / 4TH YEAR
COURSE CODE : 16IE421
TITLE OF THE COURSE : SENSORS, NETWORKS & PROTOCOLS
L: T/A: P: C : 3 : 0 : 0 : 3

COURSE OBJECTIVES:

1. Understand the basic principles and performance issues in sensor operation.
2. Detailed discussion of communication in wired and wireless embedded system
3. Understand the wireless network communication stack, protocols and sensor network applications

COURSE OUTCOMES:

1. Grasp of the principles and practical implementation of interfacing the microcontroller with real world signals
2. Gain insight into various concepts of wireless and embedded Networks
3. Challenges with deploying sensors
4. Gain insight into Ethernet
5. Gain insight into Ethernet GSM Architecture, Protocols,

UNIT- I:

INTRODUCTION TO SENSORS (10 Hrs)

Explanation and examples of sensors, Theory on how sensors work Sensor arrays, grids and WSNs, Challenges with deploying sensors - Calibrating sensors, signal conditioning, replacement, etc. Choosing sensors -Parameters to keep in mind, survey of sensor input mechanisms & signal conditioning

UNIT- II:

EMBEDDED COMMUNICATION PROTOCOLS: (10 Hrs)

Embedded Networking: Introduction, Serial/Parallel Communication, Serial communication protocols, RS232 standard, RS485, Synchronous Serial Protocols-Serial Peripheral Interface (SPI), Inter Integrated Circuits (I2C), PC Parallel port programming, ISA/PCI Bus protocols, Fire wire.

UNIT- III:

ETHERNET BASICS: (10 Hrs)

Elements of a network, Inside Ethernet, Building a Network: Hardware options: Cables, Connections and network speed, Design choices: Selecting components, Ethernet Controllers. Using the internet in local and internet communications, Internet protocol, UDP and TCP concepts, Serving web pages with Dynamic Data, Serving web pages that respond to user Input, Email for Embedded Systems, Using FTP, Keeping Devices and Network secure.

UNIT- IV:

WIRELESS EMBEDDED NETWORKING: (10 Hrs)

Wireless sensor networks: Introduction, Applications, Network Topology, Localization ,Time Synchronization , Energy efficient MAC protocols , SMAC, Energy efficient and robust routing , Data Centric routing, Wireless LAN – IEEE 802.11 Standard-Architecture, Services – AdHoc Network , Hiper LAN, Blue Tooth.

UNIT- V:

MOBILE NETWORKS: (10 Hrs)

Cellular Wireless Networks, GSM Architecture, Protocols, Connection Establishment, Frequency Allocation, Routing, Handover, Security GPRA

TEXT BOOKS:

1. Frank Vahid, Givargis 'Embedded Systems Design: A Unified Hardware/Software Introduction', Wiley Publications, 2002
2. Robert B. Northrop: "Introduction to Instrumentation and Measurements", 2nd edition, CRC press

REFERENCES:

1. Jan Axelson, 'Parallel Port Complete' , Penram publications, 2006
2. Dogan Ibrahim, 'Advanced PIC microcontroller projects in C', Elsevier 2008
3. Bhaskar Krishnamachari, 'Networking wireless sensors', Cambridge press 2005
4. KavehPahlavan, Prasanth Krishnamoorthy, " Principles of Wireless Networks' PHI/Pearson Education, 2003

SEMESTER/YEAR : 7TH SEM OR 8TH / 4TH YEAR
COURSE CODE : 16IE424
TITLE OF THE COURSE : EVOLUTION OF TELECOMMUNICATIONS
L: T/A: P: C : 3 : 0 : 0 : 3

COURSE OBJECTIVES:
1. To study the concept of Mobile radio propagation, cellular system design.
2. To understand mobile technologies like GSM and CDMA.
3. To know the mobile communication evolution of 2G, 3G and 3 GPP in detail.
4. To have overview of immerging technologies for 4 G standards.

COURSE OUTCOMES:
1. Understand GSM concepts and architecture, frame structure, system capacity, services provided.
2. Evolution of mobile communication generations 2G, 2.5G, 3G with their characteristics and limitations.
3. Understand CDMA concepts and architecture
4. Understand emerging technologies required for fourth generation mobile systems such as SDR, MIMO etc.
5. Long Term Evolution Technologies (LTE):

UNIT- I: (08 Hrs)
Introduction: Evolution of Telecommunications, Simple Telephone Communication, Manual switching system, major telecommunication Networks, Strowger Switching System, Crossbar Switching

UNIT – II: (10 Hrs)
Introduction to wire1ess communication
Fundamentals of Mobile Communication
Frequency Division Multiple access, Time Division Multiple access, Spread Spectrum Multiple access, Space Division Multiple access, and OFDM

UNIT- III: (10 Hrs)
2G Technologies
GSM Network architecture, signaling protocol architecture, identifiers, channels, introduction frame structure, speech coder RPE-LTP.
GSM evolution in GPRS and EDGE: Architecture and services offered.
IS-95 A& B(CDMA-1): Frequency and channel specifications of forward and reverse CDMA channel

UNIT –IV: (10 Hrs)
3G Technology
Network architecture, air Interface specification, forward and reverse channels in W-CDMA and CDMA 2000
Cell search and synchronization, establishing a connection, hand off and power control in 3G system, 3GPP LTE Introduction and system overview

UNIT – V: **(10 Hrs)**

4G Technology

4G Introduction and vision, Overview of 4G research initiatives and developments.

Long Term Evolution Technologies (LTE):

OFDM, MIMO channels, Space Time Codes, LTE Advanced

Text Books:

1. Theodore S. Rappaport, —Wireless Communications, Prentice Hall of India, PTR publication

2. Andreas Molisch, Wireless Communications, Wiley, Student second Edition.

3. Vijay Garg, Wireless Network Evolution 2G-3G, Pearson Education.

4. Young Kyun Kim and Ramjee Prasad, 4 G Roadmap and Emerging Communication Technologies, Artech house.

Reference Books:

1. Raj Pandya, —Mobile And Personal Communications Systems and Services, Prentice hall.

2. Singhal, —Wireless Communication, TMH

3. C.Y Lee, —Mobile Communication, Wiley

4The evolution to 4G cellular systems: LTE-Advanced. Ian F. Akyildiz, David M. GutierrezEstevez,

Elias Chavarria Reyes. Broadband Wireless Networking Laboratory, School of Electrical and Computer Engineering, Georgia Institute of Technology.

5. Vijay K. Garg, Wireless Communications and Networking, Morgan Kaufmann Publishers, 2007, ISBN 978-0-12-373580-5

SEMESTER/YEAR : III SEMESTER /II YEAR
COURSE CODE : 19EN2301
TITLE OF THE COURSE : ENGINEERING MATHEMATICS-III

L	T	P	S/P	C
3	1	-	-	4

PREREQUITES
ENGINEERING MATHEMATICS-I
ENGINEERING MATHEMATICS-III
MODULE 1:

3-D GEOMETRY

3-D Coordinate systems, Vectors, Dot and Cross products, Lines, planes and curves in space, Tangents to curves, Normal vectors of curve.

ELEMENTARY FUNCTIONS
Exponential and logarithmic functions, Complex powers, Trigonometric and Hyperbolic Functions**.**
[8 hours]

MODULE 2:
MULTI VARIABLE CALCULUS
MULTI VARIABLE DIFFERENTIAL CALCULUS : Functions of two or more real variables, Partial derivatives of second and higher order, Euler's theorem on homogenous function, Total derivatives, Differentiation of composite and implicit functions, Change of variable, Jacobians, Maxima and minima of functions of two or more variable, Lagrange's method of undetermined multipliers, Taylor's formula for two variables
MULTI VARIABLE INTEGRAL CALCULUS : Double integrals, Triple integrals, Change of order of integration in a double integral, Change of variables in double and triple integrals,
[**14 Hours**]

MODULE 3
GREEN'S, STOKE'S AND DIVERGENCE THEOREMS

Path independence, Green's theorem, Surfaces and area, Surface Integrals, Stoke's Theorem, Divergence Theorem.

[12 hours]

MODULE 4
SERIES AND RESIDUES

Sequences and Series,Taylor Series, Laurent Series, Zeros and Poles, Residues and Residue Theorem
[10 hours]

MODULE 5
INTRODUCTION TO PROBABILITY THEORY and RANDOM VARIABLES
Axiomatic construction of the theory of probability- Independence- Conditional Probability and Bayes' Theorem- Bernoulli trials.
Random Variables- Probability Distributions, Functions of Random Variables [**8 hours]**

Text Books:

1. Thomas's Calculus, G.B.Thomas, M.Weir, J. Hass, Pearson , 12th edition
2. Advanced Engineering Mathematics, E. Kreyzsig, Wiley, 10th Edition

Reference Books:

1. Basic Multi Variable Calculus, Marsden, Tromba and Weinstein, W.H. Freeman, Third Edition

SEMESTER/YEAR : III SEMESTER /II YEAR
COURSE CODE : 19EC2302
TITLE OF THE COURSE : ANALOG CIRCUITS

L	T	P	S/P	C
3	-	2	-	4

PREREQUITES

Semiconductor Physics
Basic Electrical Laws – Ohm's law, KVL, KCL, series- parallel connection and similar
Network Analysis.
Basic differentiation/integration

Course Aim & Summary

The course 'Analog Circuits" aims to provide the basic concepts and applications of MOSFETs and Operational Amplifiers. The course focusses on the working and design of:

- MOSFET applications like oscillators and amplifiers. The course also emphasizes the stability factors and biasing of transistors.
- Operational Amplifiers for Linear and non-linear applications, Active filters and data converters, and also used as timer circuits and voltage regulators.

Students will learn the structure and working of MOSFETs and Op-Amps and their use in design and building of simple electronic circuits.

Course Objectives

The objectives of the Course are:

1. To study frequency response behaviour of BJT and hybrid parameters
2. To study biasing circuits of BJT and MOSFETs for amplification, feedback concepts
3. To study the basic principles, configurations, stability and frequency response, linear and non linear applications, signal processing and signal generation circuits.

Course Outcomes

After undergoing this course students will be able to:

	Outcomes	Blooms Taxonomy Level
CO1	**Demonstrate** the applications of Diode, BJT and FET	**2 - Understand**
CO2	**Analyze** Frequency response behaviour of amplifiers and oscillators without feedback	**4-Analysing**
CO3	**Design** rectifiers, Clippers, clampers, regulators, amplifiers and oscillators for given specifications	**6-Creating**

CO4	Analyze stability, frequency response and infer required compensation techniques	**4 - Analyzing**
CO5	Analyze the performance of OpAmp in linear ,nonlinear circuits and data convertors	**4 - Analyzing**
CO6	Analyze the working of active filters, oscillators and multivibrators using OpAmp	**4 – Analyzing**

Course Content

MODULE 1: **8 Hours**

Diode Applications: Review – PN Junction and Zener Diode, Types of Diodes – Construction and working of Schottky, Tunnel, Photo Diode. Performance Analysis and comparison of Half wave rectifier, Full wave Centre tap and Bridge rectifier. RC and LC power supply filters, Series Clipping Circuits, Shunt Clipping Circuits, Clamping Circuits.

MODULE 2 **12 Hours**

Transistors Biasing: Review-BJT Concept, DC load Line and Bias point, BJT Biasing- Voltage Divider Bias, h-parameters and Small signal analysis of CE configuration , Concept of Feedback, RC Tank Circuit, Introduction to Power Amplifiers

Field Effect Transistors: MOSFETs –Structure and types- Enhancement, Depletion, MOSFET Biasing. Application – Single Stage CS Amplifier

MODULE 3 **12 Hours**

Operational Amplifiers: IC Operational Amplifier, Voltage Follower Circuit, Non-Inverting and Inverting Amplifier, Op-Amp as DC Amplifiers – Direct coupled - voltage follower, Inverting Amplifier, Non-Inverting Amplifier, Op-Amp as AC Amplifiers – Capacitor coupled voltage follower – Inverting and Non-Inverting, High Impedance Capacitor coupled Voltage follower - Non-Inverting. OP-Amp Frequency Response and Compensation: Op-Amp circuit stability, Op-Amps and Linear Integrated Circuits, Internally Compensated Op-Amps- frequency and phase response.

MODULE 4 **10 Hours**

Op-Amp Switching Circuits- Zero Crossing Detector, Inverting Schmitt trigger, Signal Processing Circuits- Limiting Circuits and Clamping Circuits, Peak Detectors, Sample and Hold circuit, Sinusoidal oscillators: Wien Bridge and phase shift oscillators, Signal Generators- : Multivibrators, Triangular waveform generator, 555 timer monostable

MODULE 5 **10 Hours**

Instrumentation Amplifier

Active Filters: First order and second order active Low-pass and high pass filters, Bandpass Filter, Band stop Filter.

DAC and ADC convertor: DAC using R-2R, ADC- Successive approximation.

Phase locked loop: Basic Principles, Phase detector/comparator, VCO.

Text Books

1. David A.,Bell "Electronic Devices and Circuits", Oxford Higher Education Press, 5th Edition, 2010
2. David A. Bell "Operational Amplifiers and Linear ICs", 3rd edition, PHI/Pearson, 2004.

Reference Books

1. Millman.J. and Halkias C.C, "Electronic Devices and Circuits", Mc Graw Hill, 2007
2. Donald .A. Neamen, Electronic Circuit Analysis and Design –2nd Edition, Tata Mc Graw Hill,

2009.
3. Robert L.Boylestad and Louis Nashelesky,"Electronic Devices and Circuit Theory", 10 th Edition, Pearson Education/PHI, 2008
4. Linear Integrated Circuits", D. Roy Choudhury and Shail B. Jain, 4nd edition, Reprint 2006,
5. Ramakant A Gayakwad, "Op-Amps and Linear Integrated Circuits," Pearson, 4th Ed, 2015

List of experiments Using Discrete components and/or TINA/PSPICE

1. Interpretation of data sheets- Diode, transistor, Op-Amps
2. Performance Analysis of Half wave and Full wave Rectifiers, Bridge Rectifier – Discrete Components
3. Testing of Diode clipping (Single/Double ended) circuits for peak clipping, peak detection- Discrete and Simulation
4. Testing of Clamping circuits: positive clamping /negative clamping.
5. RC coupled Single stage BJT amplifier - Determination of the gain-frequency response, input and output impedances.
6. MOSFET V-I Characteristics
7. Testing for the performance of BJT – Hartley & Colpitts Oscillators for given frequency
8. Design of Summing Amplifier, Integrator, Differentiator, Voltage Follower
9. Design of Comparators, Zero crossing detector, Schmitt Trigger, triangular waveform generator.
10. IC 555 timer as Monostable and Astable Multivibrator - Discrete and Simulation
11. Design of D/A converter- Weighted resistor, R-2R type, staircase waveform generator.
12. Design of Active Filters - BPF, LPF, HPF for given frequency range
13. Design of Precision Rectifier [Half and Full wave] circuit.

SEMESTER/YEAR : III SEMESTER /II YEAR
COURSE CODE : 19EC2303
TITLE OF THE COURSE : DIGITAL SYSTEM DESIGN WITH VERILOG

L	T	P	S/P	C
3	-	2	-	4

PREREQUITES
Basic Electronics
Knowledge of Programming (Tina, C)
Introduction to Digital electronics
Knowledge of Chips/IC

Course Details
Course Aim & Summary
The course 'Digital System Design with Verilog' aims to provide the necessary background needed for the design and analysis of digital circuits. The course introduces the concepts of hardware descriptive language, an entity that forms an integral part of engineering systems in many diverse areas, including Semicustom and Full Custom Physical Design Flow. The course presents and integrates the basic concepts of Logic Design using Verilog in different modelling styles. This course builds on logic design principles and demonstrates the use of Verilog HDL has facilitated digital design and rapid prototyping. This course has a significant laboratory component involving Digital Design and Verilog HDL. Students will learn about the entities involved in building complex digital systems and practice modelling such systems using state of the art tools.

Course Objectives
The objectives of the Course are:

1. To translate the elements of digital system abstractions using digital logic to Boolean algebra.
2. To illustrate simplification of Boolean expressions using Karnaugh Maps and Quine-McClusky Techniques.
3. To model combinational logic circuits for arithmetic operations and logical operations.
4. To characterise, analyse and model bi-stable elements such as latches and flip-flops.
5. To design sequential circuits such as counters and registers using flip-flops.
6. To outline the concept of Mealy Model, Moore Model and apply FSM for digital design.

Course Outcomes
After undergoing this course, students will be able to:

	Outcomes	Blooms Taxonomy Level
CO1	**Discuss** the various elements of digital logic	**2 - Understand**
CO2	**Simplify** Boolean Expressions in digital design	**3 - Applying**
CO3	**Design** Combinational and Sequential logic circuits	**4 - Design**

CO4	**Analyse** the hardware model of a digital system at different levels of abstraction in Verilog	**4 - Analyze**
CO5	**Verify** the functionality of digital design	**4 - Evaluating**
CO6	**Design** architectures for arithmetic and logic units, registers and counters.	**6 - Creating**

Course Content

Introduction to Logic Circuits **08 Hours**

Boolean Algebra, Logic Gates, Canonical Notation - SOP & POS forms, Introduction to Verilog, Switching Expression from truth tables, Minimization of K-maps (3,4,5) variables, Strategy for Minimization, Minimization of SOP and POS forms, Incompletely specified functions (Don't care terms), Quine-McCluskey minimization technique, Quine-McCluskey using don't care terms, Reduced prime implicant table, problems

Number Representation and Arithmetic Circuits **12 Hours**

Positional Number Representation, addition of unsigned numbers, half adder, full adder, Ripple carry adder, signed numbers, adder and subtractor unit, fast adders-CLA, Design of arithmetic circuits using CAD tools, model hierarchy in Verilog, Number representation in Verilog, BCD Representation, comparator- 2 bit

Combinational Circuit Building Blocks **10 Hours**

Multiplexers, decoders, demultiplexers, encoders, code converters, Design of ALU-4 bit, Verilog for combinational circuits, if else, case-casex, casez, for loop, Verilog operators, generate, task, function, design examples

Flip Flops, Registers and Counters **12 Hours**

Basic Latch, Gated latches, Flip Flops SR, D, JK, T, master-slave flip-flops, flip flops with preset & clear capability, Characteristic equations, registers, binary counters – asynchronous and synchronous, mod-n counter using clocked T flip flop, BCD counter, ring counter, Johnson counter, Verilog constructs for storage elements, registers, counters, blocking and non-blocking, timing analysis

Synchronous Sequential Circuits **10 Hours**

Mealy Model, Moore Model, Finite State diagram- design steps for speed regulation of an automatically controlled vehicle, Verilog code for FSM specifying state assignments in Verilog code, Example of Serial Adder using FSM, Coin Operated Vending Machine, mod-n counter.

Textbook

1. Stephen Brown, Zvonko Vranesic (2014), "Fundamentals of Digital Logic with Verilog design", McGraw Hill.

Reference books

1. John M Yarbrough (2014), "Digital Logic Applications and Design", Thomson Learning.
2. M. Morris Mano Michael D. Ciletti (2014), "Digital Design with an Introduction to the Verilog HDL", Pearson Education.
3. Charles Roth, Lizy K. John, Byeong Kil Lee (2016), "Digital Systems Design Using Verilog", Cengage Learning.
4. Nazein M. Botros (2006), HDL programming (VHDL and Verilog), Dreamtech Press.
5. Donald D. Givone (2015), "Digital Principles and Design", McGraw Hill.
6. Samir Palnitkar (2016), "Verilog HDL: A Guide to Digital Design and Synthesis", Pearson Education.

List of experiments

Component -1 Experiments- Combinational and Sequential Circuit Design using Kits

1. Realize 4 variable Boolean expressions
2. Realize and design the following combinational circuits
   - **a.** Adders and Subtractors
   - **b.** Binary to Gray Conversion and vice versa- 4 Bit
   - **c.** Applications of MUX and DEMUX as function generator
3. Flip Flop: SR FF, D FF, T FF, JK FF
4. Synchronous Sequential Circuits – Binary, BCD counters, Johnson Counter and Ring Counter
5. A4-bit register with shift left and shift right Modes of operation and test its operation.

Component -2 Experiments-Sequential and combinational Circuit Design using Verilog HDL

Model, Verify and Synthesize the following

6. Combinational designs - I
   - **a.** Multiplexer: 4:1, 8:1 MUX.
   - **b.** De Multiplexer: 1:4, 1:8 DEMUX.
   - **c.** Encoder with and without Priority: 8:3 and 4:2.
   - **d.** Decoder: 3:8 and 2:4.
7. Adder – HA,FA, RCA using different modelling styles.
8. Realize and Model an ALU (4 bit)
9. Flip Flop: SR FF, D FF, T FF, JK FF and MS JK FF
10. Counters: 4 bit Binary and BCD Up/Down Counter with Synchronous reset and Asynchronous reset.
11. Serial Adder, Mod –n counter using Mealy/Moore Model.
12. Speed Regulation of an automatically controlled Vehicle
13. Coin operated Vending machine

SEMESTER/YEAR : III SEMESTER /II YEAR
COURSE CODE : 19EC2304
TITLE OF THE COURSE : NETWORK ANALYSIS

L	T	P	S/P	C
3	1	-	-	4

PREREQUITES

Basic Electronics
Basic Electrical
Fundamental knowledge of electric circuit sources and elements,
Basic mathematics (integration, differentiation, etc.)

Course Details

Course Aim and Summary

The course 'Network Analysis', aims to impart knowledge on circuit elements and their behaviour when used in different networks or circuits. Fundamental laws of electrical science and analysis techniques are used to determine the values of electrical parameters for those circuit elements. Characteristics and performance of passive elements connected to different types of active elements for static and dynamic conditions for dc and ac supplies are examined. The process of using various methods and theories to simplify complex circuits is presented in a sequential manner. Emphasis is also laid on the classification and description of usual and unusual networks, equivalent networks, filter circuits, and network functions.

Course Objectives

- To apply the knowledge of various fundamental circuital laws and simplify complex network using reduction techniques
- Analyse the circuits using network theorems and determine current, voltage and other associated electrical parameters.
- Examine and infer steady state and transient response network functions
- Evaluate two port network parameters and analyse their interdependencies
- Apply filter concepts to design various types of filters that allow particular range of frequency and attenuates the remaining based on the requirement.
- To predict the impedances in cases like high voltage electrical and low voltage transistor applications using two port network configurations

Course Outcomes

On completion of the course, the students will have the ability to:

	Outcomes	Blooms Taxonomy Level
CO1	Apply the knowledge to simplify complex networks using circuital laws and reduction techniques	3- Apply

CO2	Analyse networks using circuit theorems and determine electrical parameters	4 - Analyse
CO3	Evaluate steady state and transient response of network functions	5- Evaluate
CO4	Evaluate two port network parameters and analyse interdependencies	5-Evaluate and 4- Analyse
CO5	Solve for two port network parameters	2 – Understand and 3- Apply
CO6	Use fundamentals of network filter terminologies for designing advanced filters	1-Remember and 3-Apply

Course Content

BASICS & NETWORK TOPOLOGY **12 hours**

Passive and active components, Series and parallel circuits, source transformation, Star – Delta transformation, Delta-Star Transformations, Kirchhoff's Laws, Mesh Analysis with and without dependent source, Super mesh, Nodal Analysis with and without dependent source, Super nodes. Graph of a network, Tree, Co-tree, Sub graph, Connected graph and loop, Incidence matrix, Tie- set matrix and Cut-set matrix. Principle of duality

NETWORK THEOREMS **10 Hours**

Superposition, Thevenin's, Norton's, Maximum power transfer, Reciprocity, Tellegen's, Millman's, Compensation theorem, Substitution theorem

SINUSOIDAL STEADY STATE AND TRANSIENT ANALYSIS **12 Hours**

Steady state analysis: Phasor, RLC circuits, complex power

Transient Analysis: Time constant, RL circuits with and without source, RC circuits with and without source, AC transients, Series RLC circuits, Laplace Transform Applications

NETWORK PARAMETERS **10 Hours**

Z parameters, Y parameters, H parameters, ABCD parameters, Symmetry and reciprocity, Bartlett bisection theorem, Relation between two port parameters, Interconnection of two port networks

NETWORK FILTERS **8 Hours**

Filter fundamentals, Pass and stop bands, Characteristic impedance, Constant K- low pass filter, Constant K-high pass filter, Band pass filter, All pass filter

TEXT BOOKS

1. Hayt W. H., Kemmerly J. E. and Durbin S. M., "Engineering Circuit Analysis", 6th Ed., Tata McGraw-Hill Publishing Company Ltd.,2008.

2. Roy Choudhury, —Networks and systems , 2nd edition, New Age International Publications, 2006

REFERENCE BOOKS

1. Valkenberg V., "Network Analysis", 3rd Ed., Prentice Hall International Edition., 2007

2. Network Analysis & Synthesis By Franklin S. KUO, Wiley Publication, 2006

3. Boylestad, Robert L. Introductory circuit analysis. Pearson Education India, 2003.

SEMESTER/YEAR : III SEMESTER /II YEAR
COURSE CODE : 19EC2373
TITLE OF THE COURSE : SPECIAL INITIATIVES – I

L	T	P	S/P	C
-	-	-	4	2

PREREQUITES

Basic Electronics
Basic Electrical
Fundamental knowledge of electric circuit sources and elements,
Introduction to Digital electronics
Knowledge of Programming (Tina, C)

Course Details

Course Aim & Summary

The course 'Minor Project-I' are designed to demonstrate a fundamental knowledge of Electronics and Communication Engineering. The students would receive introductory with an emphasis on the fundamental aspects of the core subject matter which include subject areas such as Analog & Digital Electronics, Network Analysis, Signals & Systems, Analog & Digital Communication, Microcontroller, and Electro-magnetic Field Theory. The students will develop an ability to present and defend their work through learning-by-doing project work. The course provides a framework to encourage creativity and innovation along with developing teamwork and communication skills through group-based activity.

Course Objectives

The objectives of the Course are to:

1. Understand the problem and identify the modules.
2. Simulate the identified modules and check for the feasibility.
3. Outline the specifications as per the design.
4. Build and test the modules and integrate the modules.
5. Demonstrate the project work, enhance the communication skills, and report writing.
6. Learn the simulation software TINA/PSpice.

Course Outcomes

After undergoing this course, students will be able to:

	Outcomes	Blooms Taxonomy Level
CO1	Formulate the project problem and identify the feasible modules.	**2- Understanding 3- Applying**

CO2	Simulate the modules and test for functionality.	**3-Applying** **4-Analyzing** **5-Evaluating**
CO3	Choose the design specifications and interpret the data sheet by selecting the required components.	**5-Evaluating**
CO4	Develop the prototype of the simulated modules.	**6-Creating**
CO5	Demonstrate and explain the developed project.	**5-Evaluationg**
CO6	Organize the design, specifications with results of the project work in the form of document.	**3-Applying**

Course Content

List of Minor Projects to be carried out using discrete components and TINA/Pspice

1. Capture moister, temperature, fire and earth quake related information using sensors and send alerts using IoT technology.
2. Real time identification of crops, weeds, diseases and pest damage and nutrient deficiency symptoms.
3. Waste Management.
4. Monitoring of electricity at household level.
5. Developing a Prototype for Smart Traffic Management and Street Light Control System.
6. Developing Self-Powered IOT based Patient Health Monitoring System.
7. Design of ultra-low power circuits for IOT application.
8. Air and Water Quality Care System.
9. Tracking parking designated for employee in an organization.
10. Smart domestic electric energy management system.

Note: These are the indicative problem statements, faculty members shall give any other feasible problem statements as per their field of work.

SEMESTER/YEAR : IV SEMESTER /II YEAR
COURSE CODE : 19EC2401
TITLE OF THE COURSE : SIGNALS AND SYSTEMS

L	T	P	S/P	C
3	1	-	-	4

Course Details

Course Aim and Summary

The course 'Signals and Systems', aims to mathematically model the various types of signals and effect of signals on LTI systems. The course deals with definition and mathematical modelling of continuous-time and discrete-time signals, modelling the LTI systems and response of the systems in time and frequency domain.

Course Objectives

The objectives of the Course are to:

1. Understanding of signals, their classification and signal transformations
2. Develop input output relationship for linear shift invariant system and understand the convolution and correlation operator for continuous and discrete time system
3. Knowledge of Fourier Series as an important tool to analyze periodic signals for continuous and discrete time signals
4. Knowledge of Fourier Transform and Z -Transform for the frequency domain description of continuous and discrete time signals and systems
5. Basics of sampling for discretization of continuous time signal
6. Build foundation for advanced courses such as signal processing, control system and communication.

Course Outcomes

After undergoing this course students will be able to:

	Outcomes	**Blooms Taxonomy Level**
CO1	**Define** and model the continues and discrete time signals	**2 - Understanding**
CO2	**Illustrate** signals in coordinate systems.	**2 - Understanding**
CO3	**Model** the LTI system and study the response to various input signal	**4 - Analysing**
CO4	**Explain** the concept of convolution and correlation.	**2 - Understanding**
CO5	**Apply** the Fourier transform and Z- transform to continuous-time and discrete-time signals for stability analysis	**3 – Applying**
CO6	**Explain** the process of sampling to convert an analog signal into discrete signal and methods of signal reconstruction.	**3 – Applying**

Course Content

Introduction to signal **12 Hours**

Continuous and discrete time signals: Classification of Signals – Periodic aperiodic even – odd – energy and power signals – Deterministic and random signals – complex exponential and sinusoidal signals – periodicity – unit impulse – unit step – Transformation of independent variable of signals: time scaling, time shifting.

Analogy between vectors and signals, orthogonal signal space, Signal approximation using orthogonal functions, Mean square error, closed or complete set of orthogonal functions, Orthogonality in complex functions.

Introduction to Systems and Behavior of LTI systems **10 Hours**

System properties: linearity: Additivity and Homogeneity, Shift-invariance, Causality, Stability, Realizability.

Impulse response and step response, input-output behavior with aperiodic convergent inputs, cascade interconnections. Characterization of causality and stability of LTI systems. System representation through differential equations and difference equations. Periodic inputs to an LTI system, the notion of a frequency response and its relation to the impulse response.

CONVOLUTION AND CORRELATION OF SIGNALS **8 Hours**

Concept of convolution in time domain and frequency domain, Graphical representation of convolution, Convolution property.

Concept of correlation, Cross correlation and Auto correlation of functions, properties of correlation functions, Energy density spectrum, Power density spectrum, Relation between auto correlation function and energy/power spectral density function. Relation between convolution and correlation.

Fourier and z- Transforms **12Hours**

Representation of Fourier series for Continuous time periodic signals , Dirichlet's conditions, , properties of Fourier series, Exponential Fourier series, Relationship between Exponential Fourier series and trigonometric Fourier series, Complex Fourier spectrum. Fourier transformation of continuous and discrete time signals and their properties.. Parseval's theorem.

Basic principles of z-transform - z-transform definition –, Relationship between z-transform and Fourier transform, region of convergence – properties of ROC – Properties of z-transform – Poles and Zeros – inverse z-transform.

Sampling and Reconstruction **10Hours**

The Sampling Theorem and its implications. Types of sampling Spectra of sampled signals. Reconstruction: ideal interpolator, zero-order hold, first-order hold. Aliasing and its effects. Relation between continuous and discrete time systems. Sampling of band pass signals.

TEXT BOOKS:

1. Alan V Oppenheim, Alan S, Willsky and A Hamid Nawab, —Signals and Systems Pearson Education Asia / PHI, 2nd edition, 1997. Indian Reprint 2002.
2. Simon Haykins and Barry Van Veen, —Signals and Systems, 2nd Edition,2004

REFERENCE BOOKS:

1. Michael Roberts, —Fundamentals of Signals & Systems, 2nd edition,Tata McGraw-Hill, 2010, ISBN 978-0-07-070221-9.
2. Alan V Oppenheim, Alan S, Willsky and A Hamid Nawab, —Signals and Systems Pearson Education Asia PHI, 2nd edition, 1997. India Reprint 2002.
3.. H. P Hsu, R. Ranjan, —Signals and Systems||, Scham's outlines, TMH
4. B. P. Lathi, —Linear Systems and Signals||, Oxford University Press, 2005.
5. Ganesh Rao and Satish Tunga, —Signals and Systems, Pearson/SanguineTechnicalPublishers, 2004.

SEMESTER/YEAR : IV SEMESTER /II YEAR
COURSE CODE : 19EC2402
TITLE OF THE COURSE : COMPUTER SYSTEM ARCHITECTURE

L	T	P	S/P	C
3	1	-	-	4

Course Details

Course Aim and Summary

The course Computer System Architecture aims to acquire understanding and ability to analyze basic understanding of the parallel architecture and operations .It introduce the key features of high performance computers. Basic concepts of parallel computer models, SIMD computers, Multiprocessors and multi-computers, Cache Coherence Protocols, Multi computers, Pipelining computers and Multithreading.

Course Objectives

The objectives of the Course are:

1. To make students know about the Parallelism concepts in Programming
2. To give the students an elaborate idea about the memory hierarchy.
3. To introduce the advanced processor architectures to the students.
4. To make the students know about the importance of multiprocessor and multicomputers.
5. To study about data flow computer architectures

Course Outcomes

After undergoing this course students will be able to:

	Outcomes	**Blooms Taxonomy Level**
CO1	**Explain** the concept of evolution of computer systems, classification of computers on their ability to perform multiprocessing	L2- Understanding
CO2	**Explain** the study of parallel computer architecture various trends towards parallel processing	L2- Understanding
CO3	**Analyze** the advanced processor technologies **Categorize** memory organization and explain the function of each element of a memory hierarchy	L3- Applying L4- Analyze
CO4	**Explain and compare** the architectures of multiprocessors, and multicomputers, and their interconnecting mechanisms	L4- Analyze
CO5	**AnAnalyse** different message passing mechanisms Explain how pipelining is implemented in various computer architecture	L4- Analyze
CO6	**ExExplain** the advance concepts of improving the performance of multiprocessor by using different techniques	L2- Understanding L3 - Applying

Course Content

10 Hours

Parallel computer models – Evolution of Computer Architecture, System Attributes to performance, Amdahl's law for a fixed workload. Multiprocessors and Multicomputers, Multivector and SIMD computers, Architectural development tracks, Conditions of parallelism.

12 Hours

Processors and memory hierarchy – Advanced processor technology- Design Space of processors, Instruction Set Architectures, CISC Scalar Processors, RISC Scalar Processors, Superscalar and vector processors, Memory hierarchy technology.

12 Hours

Multiprocessors system interconnects - Hierarchical bus systems, Cross bar switch and multiport memory, Multistage and combining networks. Cache Coherence and Synchronization Mechanisms, Cache Coherence Problem, Snoopy Bus Protocol, Directory Based Protocol, Hardware Synchronization Problem

10 Hours

Message Passing Mechanisms-Message Routing schemes, Flow control Strategies, Multicast Routing Algorithms. Pipelining and Superscalar techniques – Linear Pipeline Processors and Nonlinear pipeline processors

08 Hours

Instruction pipeline design, Arithmetic pipeline deign - Super Scalar Pipeline Design Multithreaded and data flow architectures - Latency hiding Techniques, Principles of multithreading – Multithreading Issues and Solutions

Text Books:

1. K. Hwang and Naresh Jotwani, Advanced Computer Architecture, Parallelism, Scalability, Programmability, TMH, 2010.

Reference books:

1. H P Hayes, Computer Architecture and Organization, McGraw Hill, 1978.
2. K. Hwang & Briggs , Computer Architecture and Parallel Processing, McGraw Hill International, 1986
3. M J Flynn, Computer Architecture: Pipelined and Parallel Processor Design, Narosa Publishing House, 2012.

4. M Sasikumar, D Shikkare and P Raviprakash, Introduction to Parallel Processing, PHI, 2014.
5. P M Kogge, The Architecture of Pipelined Computer, McGraw Hill, 1981.
6. P V S Rao , Computer System Architecture, PHI, 2009.

SEMESTER/YEAR : IV SEMESTER /II YEAR
COURSE CODE : 19EC2403
TITLE OF THE COURSE : MICROCONTROLLERS

L	T	P	S/P	C
3	-	2	-	4

Course Details

Course Aim and Summary

The course 'Microcontrollers' aims to introduce architectural details and programming model. During the course interfacing of microcontroller with various peripherals and Memory structure are discussed. Interrupts handling with Clock and RESET circuits are presented. Realization of embedded system using microcontrollers for application development.

Course Objectives

The objectives of the Course are:

1. To understand the architecture of microcontroller and the basics of assembly language programming.
2. To explore the Programming model, Instruction set and Addressing modes supported by microcontroller.
3. To understand Memory Structure related to Program and Data memory.
4. To gain knowledge on Parallel and serial data transfer methods.
5. To discuss various interrupt handlers and their implementations.
6. To understand programming microcontrollers using Embedded C and interfacing logic with various peripherals.

Course Outcomes

After undergoing this course students will be able to:

	Outcomes	**Blooms Taxonomy Level**
CO1	**Outline** the architectural details of Microcontrollers and ARM Processor.	**2 - Understanding**
CO2	**Classify** the instruction sets and various addressing modes.	**4 - Analyzing**
CO3	**Understand** the Memory Organization of the PIC Microcontroller	**5 - Evaluating**
CO4	**Interpret** and configure interrupt control logic.	**2 - Understanding**
CO5	**Analyze** the timing diagram for communication Protocol	**4 – Analyzing**
CO6	**Demonstrate** interfacing logic for various Sensors and Actuators	**3 - Demonstrate**

Course Content

Introduction to Microcontroller **12 Hours**

Microprocessor and Microcontroller Characterization, Components of a Microcontroller, Microcontroller Architecture.

Main Characteristics of PIC Microcontrollers - Arithmetic and Logic Unit (ALU), Working Register in PIC Microcontrollers, Machine Cycles and Execution of Instructions, Pipelining for Instruction Execution, Oscillators, Configuration Bits, Reset Options, Low-Power Consumption Mode, Watchdog Timer, Program Counter,RISC, Compare Harvard architecture with von Neumann architecture.

Memory in Microcontrollers **12 Hours**

Memory Organization, RAM, Data Memory, EEPROM, Flash Memory.

Instruction Set and Assembler Language Programming - Arithmetic Instructions, Logic and Compare instructions, Rotate Instruction and Data Serialization, Branch Instructions and Looping, Call Instructions and Stack

Programming in C **10 Hours**

Data Types and Time Delays, bit-addressable I/O, Logic Operations, Data Serialization, ROM & RAM Allocation

Timers and Interrupts **10 Hours**

Instruction Pipeline, Timers, The CCP Module, Interrupt, Examples of Timer and Interrupt Applications.

Parallel and Serial Communication – Parallel IO, Serial IO, advantages of serial communication over parallel, Streaming Parallel Port, USART, SPI, I2C

Sensors and Actuators **08 Hours**

Interfacing LED, LCD, Keypad, ADC, DAC, Buzzer, Sensor, Relays, Stepper & DC Motor

TEXT BOOKS:

1. Fernando E. Valdes-Perez, Ramon Pallas-Areny, "Microcontrollers - Fundamentals and Applications with PIC", CRC Press, 1st Edition, 2009.

2. Mazidi M. A., McKinlay R. D., Causey D., "PIC Microcontroller And Embedded Systems.", Pearson Education International, 2008

REFERENCE BOOKS:

1. Myke Predko, "Programming and Customizing the PIC Microcontroller", Mc Graw Hill Education, 3rd Edition, 2008.
2. John B. Peatman, "Design with PIC Microcontrollers", Prentice Hall, 1997.
3. Verle Milan, "PIC Microcontrollers – Programming in C", Mikroelektronika, 1 st Edition, 2009

List of Experiments

1. Check Register and Memory with MPLAB IDE
2. Develop and Execute Programs on Arithmetic, Logic & Compare instructions.
3. Develop and Execute Programs on Rotate instructions and Data Serialization.
4. Develop and Execute Programs on BCD and ASCII code conversion.
5. Develop and Execute Programs on branching instructions and Looping.
6. Develop and Execute Programs on Call instructions and Time Delay.
7. Develop and execute programs on Timers and Counters.
8. Develop and execute programs on Different Interrupt handling.
9. Develop and execute program on I/O Port programming, Serial & Parallel Communication.
10. Interface ADC & DAC
11. Interfacing Sensors & Actuators
12. Interfacing Motors and speed control using PWM

SEMESTER/YEAR : IV SEMESTER /II YEAR
COURSE CODE : 19EC2404
TITLE OF THE COURSE : ELECTROMAGNETIC WAVES

L	T	P	S/P	C
3	-	2	-	4

Course Details
Course Aim and Summary

The course Electromagnetic Field Theory aims to acquire understanding and ability to analyze static electric and magnetic fields, time-varying electric and magnetic fields, wave propagation in different types of media. This course may also deal with static electric and magnetic fields, time-varying electric and magnetic fields the course covers basics of antenna theory and introductory concepts on application numerical techniques have also been discussed.

Course Objectives

The objectives of the Course are:
1. To introduce the basic mathematical concepts related to electromagnetic vector fields.
2. To introduce and analyse the concepts of electrostatics, electric potential, energy density and their applications.
3. To understand and apply the concepts of magnetostatics, magnetic flux density, scalar and vector potential to the engineering applications.
4. To apply the knowledge of electrostatics and magnetostatics for time varying fields.
5. To study uniform plane waves and its characteristic parameters

Course Outcomes
After undergoing this course students will be able to:

	Outcomes	**Blooms Taxonomy Level**
CO1	**Explain** the concept of vector calculus for different co-ordinate systems.	L3- Applying
CO2	**Apply** Coulomb's Law and Gauss Law for the **evaluation** of electric fields produced by different charge configurations.	L4 – analyse L5- Evaluate
CO3	**Calculate** the energy and potential due to a system of charges. **Discuss** the behavior of electric field across a boundary conditions. **Explain** the Poisson's, Laplace equations with applications	L4- Analyze
CO4	**Explain and apply** various laws involved in magneto statics	L3- Applying
CO5	**SoSolve** Maxwell's equations for time varying electric and magnetic fields	L3- Applying
CO6	**ExExplain and analyse** EM wave propagation and its properties.	L3 - Applying L4 – analyse L5- Evaluate

Course Content

ELECTROSTATICS -1 **12 Hours**

Introduction: Vector analysis, 3 Coordinate systems; Coulomb's Law and Electric Field Intensity, Electric Field due to line charge, volume Charge and Sheet Charge, Related Problems.

Gauss' Law: Electric flux, Electric Flux Density, Gauss' Law, Applications of Gauss' Law , Maxwell's first equation, Introduction to 'del' operator and Divergence Theorem, Related Problems

ELECTROSTATICS - 2 **12 Hours**

Energy and Potential: Energy and potential in a moving point charge in an Electric Field, Line Integral, Definition of Potential Difference , Potential field of a moving charge , Potential Gradient, conductor properties and boundary conditions, boundary conditions for perfect dielectric materials.

Poisson's and Laplace's Equations: Poisson's and Laplace's Equations, Uniqueness Theorem, Applications of Laplace's and Poisson's Equations, Related Problems.

THE STEADY MAGNETIC FIELD **10 Hours**

Biot-Savart Law, Applications of Biot-Savart's law, Ampere's Circuital Law, Curl, Stokes' Theorem, Magnetic Flux and Flux Density, Scalar and Vector Magnetic Potentials, Magnetic Boundary Conditions, Energy in Magnetic Field Related Problems

TIME VARYING MAGNETIC FIELD **10 Hours**

Faraday's Law of e.m.f, Inconsistency of Ampere's law, Displacement Current, Maxwell's Equation in Point and Integral Form of different media, The retarded potential, Boundary Conditions : Dielectric –Dielectric boundary. Related Problems

UNIFORM PLANE WAVES **08 Hours**

Wave propagation in free space and dielectrics, Propagation in Conductors: Skin Effect, The Poynting Vector and Power Considerations, Power loss in plane conductor, Wave Polarization, Reflection of uniform plane waves at normal Incidence, for perfect conductor-dielectric boundary & dielectric-dielectric boundary, Standing Wave Ratio, Introduction to transmission lines and waveguide.

Text Books:

1. Engineering Electromagnetics-William H. Hayt Jr. and John A. Buck, Tata McGraw Hill, 6th Edition, 2001
2. Electromagnetic Waves and Radiating systems – E. C. Jordan and K.G. Balman, PHI, 2nd Edition.

Reference books:

1.Field theory –S.P.Basavaraju, Edition 2011.

ELECTRO MAGNETIC FIELD THEORY LAB

Part-A:Software

MATLAB /MATHEMATICA/SONNET/MAGICAD/HFSS

1.Vector addition in 3 dimensional coordinate system:To understand the meaning of vectors, plotting vectors in 2 D and 3 D and rotating them in space.

2.Gradient of scalar field: With positive and negative charges.

3.Divergence of vector:To understand vector with positive and negative divergence.

4.Curl of a vector: To understand curl and rotational field.

5. To study the wave propaga

tion in conductor and dielectrics using HFSS tool.

Part-B:Hardware

6.To verify Maxwell's equations

7.Introduction to magnetometer/Gaussmeter

SEMESTER/YEAR : IV SEMESTER /II YEAR
COURSE CODE : 19EC2473
TITLE OF THE COURSE : SPECIAL INITIATIVES – II

L	T	P	S/P	C
-	-	-	4	2

Course Details

Course Aim & Summary

The course 'Minor Project-I' are designed to demonstrate a fundamental knowledge of Electronics and Communication Engineering. The students would receive introductory with an emphasis on the fundamental aspects of the core subject matter which include subject areas such as Analog & Digital Electronics, Network Analysis, Signals & Systems, Analog & Digital Communication, Microcontroller, and Electro-magnetic Field Theory. The students will develop an ability to present and defend their work through learning-by-doing project work. The course provides a framework to encourage creativity and innovation along with developing teamwork and communication skills through group-based activity.

Course Objectives

The objectives of the Course are to:

7. Understand the problem and identify the modules.
8. Simulate the identified modules and check for the feasibility.
9. Outline the specifications as per the design.
10. Build and test the modules and integrate the modules.
11. Demonstrate the project work, enhance the communication skills, and report writing.
12. Learn the simulation software TINA/PSpice.

Course Outcomes

After undergoing this course, students will be able to:

	Outcomes	**Blooms Taxonomy Level**
CO1	Formulate the project problem and identify the feasible modules.	**2-Understanding** **3-Applying**
CO2	Simulate the modules and test for functionality.	**3-Applying** **4-Analyzing** **5-Evaluating**
CO3	Choose the design specifications and interpret the data sheet by selecting the required components.	**5-Evaluating**
CO4	Develop the prototype of the simulated modules.	**6-Creating**
CO5	Demonstrate and explain the developed project.	**5-Evaluationg**
CO6	Organize the design, specifications with results of the project work in the form of document.	**3-Applying**

Course Content

List of Minor Projects to be carried out using discrete components and TINA/Pspice

1. Capture moister, temperature, fire and earth quake related information using sensors and send alerts using IoT technology.
2. Real time identification of crops, weeds, diseases and pest damage and nutrient deficiency symptoms.
3. Waste Management.
4. Monitoring of electricity at household level.
5. Developing a Prototype for Smart Traffic Management and Street Light Control System.
6. Developing Self-Powered IOT based Patient Health Monitoring System.
7. Design of ultra-low power circuits for IOT application.
8. Air and Water Quality Care System.
9. Tracking parking designated for employee in an organization.
10. Smart domestic electric energy management system.

Note: These are the indicative problem statements; faculty members shall give any other feasible problem statements as per their field of work.

SEMESTER/YEAR : V SEMESTER /III YEAR
COURSE CODE : 19EC3501
TITLE OF THE COURSE : ANALOG AND DIGITAL COMMUNICATION

L	T	P	S/P	C
3	0	2	-	4

PREREQUISITE
Electromagnetic Waves
Signals and Systems

Course Aim and Summary

The course 'Analog and Digital Communication' aims to provide the basic principles and techniques used in analog and digital communications. The course will introduce modulation techniques, transmitter and receiver design, baseband and passband communication techniques, line coding techniques, noise analysis, and multiplexing techniques. The course also emphasizes on the analytical approaches to evaluate the performance of communication systems.

Course Objectives

The objectives of the Course are:

1. To study the basic concepts of Analog and Digital communication systems.
2. To compare the various modulation and demodulation techniques.
3. To understand the trans receiver design and the effect of noise in communication system.
4. To understand the process of digitization through Sampling and Quantization.
5. To determine the performance of line codes and methods to reduce inter symbol interference.
6. To interpret the detection process using analytical methods.
7. To compute the probability of error of digital communication systems.

Course Outcomes

After undergoing this course students will be able to:

	Outcomes	Blooms Taxonomy Level
CO1	**Explain** the basic elements of a communication system.	**2 - Explain**
CO2	**Analyse** baseband signals in time domain and frequency domain.	**4 - Analyse**
CO3	**Interpret** the various modulation and demodulation techniques.	**2 - Interpret**
CO4	**Analyse** the behavior of a communication system in presence of noise.	**4 - Analyse**
CO5	**Estimate** the performance of a communication system using analytical methods.	**5 - Estimate**
CO6	**Determine** the probability of error analysis for different modulation techniques.	**5 - Determine**

Module 1

Introduction to Communication System (10 Hours)

INTRODUCTION and AMPLITUDE MODULATION - Elements of Communication System, Need of Modulation, Applications, Time and Frequency Domain Representation of AM, Modulation Index and Transmission Power Calculation, DSB-SC, SSB, VSB.

Generation of AM waves-square law Modulator, Principle of Detection of AM Wave-envelope detector.

Generation of DSBSC Waves, Balanced Modulators, Coherent detection of DSB-SC Modulated waves.

Phase discrimination method for generating AM SSB Modulated waves. Demodulation of SSB Waves using Coherent detection, Frequency Division Multiplexing.

Module 2

Angle Modulation and Noise (12 hours)

ANGLE MODULATION - Time and Frequency Domain Representation, FM, NBFM, WBFM and PM, Modulation Index of FM and PM, Transmission bandwidth of FM waves, Relation between FM and PM. Generation of FM waves: Indirect FM, Direct FM. Demodulation of FM waves: Balanced frequency discriminator, Zero-crossing detector.

TRANSMITTER, RECEIVER AND NOISE –AM Transmitter, FM Transmitter, Tuned radio frequency receiver, Superheterodyne receiver, Comparison of FM receiver with AM Receiver, Source of noise, Noise in AM using envelop detector, Noise in FM, Pre-emphasis & de-emphasis in FM.

Module 3

Sampling and Quantization (10hours)

SAMPLING PROCESS - Block diagram of Digital communication system, Sampling process, Sampling theorem, quadrature sampling of bandpass signals, multirate sampling, sampling rate conversion, Signal distortion in sampling, Practical aspects of sampling and signal recovery.

QUANTIZATION - Quantization & Coding, Quantization error, Companding in PCM systems, Differential PCM system, Delta modulation (DM) and its drawbacks, adaptive delta modulation.

Module 4

Baseband data transmission (10 hours)

BASEBAND SHAPING FOR DATA TRANSMISSION - Line Coding, Characteristics of Line coding, Discrete PAM signals, Power spectra of discrete PAM signals, Inter symbol Interference, Nyquist criterion for distortion less baseband binary transmission, Correlative coding, Eye pattern.

DETECTION OF SIGNALS - Orthogonal signals, Geometric interpretation of signals, Correlation

receiver, Matched filter, Properties of matched filter, ML detector,

Module 5

Pass Band Modulation Techniques (10 hours)

PASS BAND MODULATION AND DEMODULATION -Coherent modulation techniques-ASK, FSK, PSK, QPSK, signal representation, Generation and detection, deriving probability of error for coherent ASK, FSK, PSK, QPSK, Non coherent binary modulation techniques.

Text Books

1. Simon Haykin, Michael Moher " Introduction to analog and Digital communication 4th edition, John and Wiley & Sons

Reference Books

2. Principles of Communication Systems–Taub & Schilling, Gautam Sahe, TMH, 3rdEd
3. Communication Systems Second Edition – R.P. Singh, SP Sapre, TMH, 2007.
4. Modern Analog and Digital Communication Systems, 3rd Edition, Oxford University – B.P. Lathi,
5. Electronics & Communication System – George Kennedy and Bernard Davis, TMH

SEMESTER/YEAR : V SEMESTER /III YEAR
COURSE CODE : 19EC3502
TITLE OF THE COURSE : PROBABILITY THEORY AND STOCHASTIC PROCESSES

L	T	P	S/P	C
3	1	-	-	4

Course Aim and Summary

The course 'Probability Theory and Stochastic Processes' aims to provide the fundamental concepts of probability theory and random process. The course includes Axioms of probability theory, Probability spaces, Distributions and Densities functions, Joint and conditional probabilities. The course demonstrate the operations such as expectation, moments and central limit theorem. Topics in Inequalities and moment-generating functions are discussed to provide bounds. Joint and conditional probabilities for multiple random variable along with the concept of Random Process is discussed.

Course Objectives

The objectives of the Course are:

1. Understand probability, random variable and random process concepts and their importance in Electronics and Communication Engineering.
2. Calculate statistics related to Random variables and operation such as mean, variance etc.
3. Evaluate standard distribution functions highlighting the application scenarios.
4. Discuss inequality bounds considering the importance of moment generating function.
5. Extend the various operations to multiple random variables and apply them to analyse practical problems.
6. Explain the concept of random process and its classifications.

Course Outcomes

After undergoing this course students will be able to:

	Outcomes	**Blooms Taxonomy Level**
CO1	Understand basics of probability through set theory, the axiom formulation and the need of random variables for the analysis of random phenomena.	**2 - Understand**
CO2	Characterize the standard distributions and demonstrate various operations performed on the random variable.	**2–Demonstrate**
CO3	Compare the various inequality bounds and probabilistic limits.	**2–Compare**
CO4	Evaluate and Apply moments & characteristic functions for single and multiples random variables.	**3–Apply**
CO5	Outline the importance of Central limit theorem and the concepts of random processes.	**2- Outline**
CO6	Simplify the complex operations by approximating to standard distributions and theorems for estimating the probable value.	**5 - Estimate**

Module 1

PROBABILITY THEORY AND DENSITY FUNCTIONS (08 Hours)

Probability introduced through Sets and Relative Frequency: Experiments and Sample Spaces, Discrete and Continuous Sample Spaces, Events, Probability Definitions and Axioms, Mathematical Model of Experiments, Probability as a Relative Frequency, Joint Probability, Conditional Probability, Total Probability, Bayes' Theorem and Independent Events, Engineering application- probability of error in optical communication system.

Module 2

RANDOM VARIABLES (08 hours)

Definition of a Random Variable, Conditions for a Function to be a Random Variable, Discrete and Continuous random variables, Mixed Random Variable, Distribution and Density functions, Properties, Binomial, Poisson, Uniform, Gaussian, Exponential, Rayleigh, distributions, Conditional Distribution and density functions, properties. Engineering application- study of system reliability and failure rates.

Module 3

OPERATIONS ON SINGLE RANDOM VARIABLE (08 hours)

Functions of a Random Variable, Expected Value of a Random Variable, Moments about the Origin, Central Moments, Variance and Skew, Markov Inequality, Chebychev's Inequality, Chernoff Inequality, Characteristic Function, Moment Generating Function. Engineering application- scalar quantization, Entropy and source coding.

Module 4

MULTIPLE RANDOM VARIABLES (08 hours)

Introduction, Vector Random variables, Joint Distribution and its properties, Marginal Distribution Functions, Joint density and its properties, Conditional Distribution and Density, Statistical independence, Sum of Two Random Variables, Sum of Several Random Variables Central limit theorem, Operations on multiple random variables-Expected Value of a Function of Random Variables: Joint Moments about the Origin, Joint Central Moments. Engineering application- concept of mutual information, channel capacity and channel coding in a digital communication system.

Module 5

RANDOM PROCESSES (08hours)

Random process concepts, Classification of Random process, Deterministic and Nondeterministic Processes, concept of Stationary and Statistical Independence. First-Order Stationary Processes, Second- Order Wide-Sense Stationary, (N-Order) and Strict-Sense Stationary, AutoCorrelation, Cross correlation and Covariance Functions, Gaussian Random process, Time Averages and Ergodicity, Random signal response of linear systems, noise in an amplitude modulation communication system, noise in a simple control system.

TEXT BOOKS:

1. Probability, Random Variables & Random Signal Principles - Peyton Z. Peebles, TMH, 4th Edition, 2001.
2. Probability and Random Processes- Scott Miller and Donald Childers, AP, 2nd Edition, 2012.

REFERENCE BOOKS:

1. Probability, Random Variables and Stochastic Processes – Athanasios Papoulis and S. Unni krishna Pillai, PHI, 4th Edition, 2002.
2. Probability and Random Processes with Application to Signal Processing – Henry Stark and John W. Woods, Pearson Education, 3rd Edition.
3. Probability Methods of Signal and System Analysis. George R. Cooper, Clave D. MC Gillem, Oxford, 3rd Edition, 1999.
4. Statistical Theory of Communication - S.P. Eugene Xavier, New Age Publications.

SEMESTER/YEAR : V SEMESTER /III YEAR
COURSE CODE : 19EC3503
TITLE OF THE COURSE : CMOS VLSI DESIGN

L	T	P	S/P	C
3	-	2	-	4

PREREQUISITE
Analog Circuits
Digital System Design with Verilog

Course objectives
1. Study the IC Fabrication process and to define the rules governing the process
2. Analyze MOS device properties and short channel effects.
3. Illustrate stick diagrams, layouts for various CMOS circuits and other MOS logic structures.
4. Analyse Sequential MOS logic structures.
5. Study advanced VLSI Circuits.

Course Outcomes
1. Understand the basic Physics and Modelling of MOSFETs.
2. Learn the basics of Fabrication and Layout of CMOS Integrated Circuits.
3. Study and analyze the performance of different CMOS circuits on the basis of their operation and working.
4. Analysis of advanced MOS logic structures.
5. Demonstration of DC, AC and transient responses of the CMOS logic gates.

Module 1 **(12 Hours)**
CMOS Technologies: Wafer Formation, Photolithography, Well and Channel Formation, Silicon Dioxide (SiO2), Isolation, Gate Oxide, Gate and Source/Drain Formations, Contacts and Metallization, Passivation, Metrology
MOS layers, Stick diagrams- NMOS and CMOS Design Rules and Layout, Fabrication- NWELL, PWELL, Twin-Tub, BiCMOS.
Scaling Of MOS Circuits: Scaling models and factors.

Module 2 **(12 Hours)**
MOS Transistor: Introduction, Ideal I-V characteristics, C-V Characteristics, Simple MOS Capacitance Models, MOS Device Parameters, Detailed MOS Gate Capacitance Model, Non-ideal I-V Effects, Mobility Degradation and Velocity Saturation, Channel Length Modulation, Threshold Voltage Effects, Junction Leakage, Body effect, Tunneling, CMOS Inverter, DC Characteristics, Transient Response, Beta Ratio Effect, Noise Margin. NAND NOR DC characteristics, Inverter Switching Characteristics

Module 3 **(10 Hours)**
Combinational Circuit Design: Introduction : CMOS Logic, Inverter, NAND Gate, NOR Gate, Combinational Logic, Compound Gates, Pass Transistors and Transmission Gates, Tristates, Multiplexers.
Circuit Families, Static CMOS, Ratioed Circuits, Cascode Voltage Switch Logic, Dynamic Circuits,

Complementary Pass-Transistor Logic Circuits, BICMOS Circuits

Module 4 **(12 Hours)**

Sequential Circuit Design: Behavior of Bistable Elements, SR Latch Circuit, Clocked Latch Flip-Flop Circuits, CMOS D-latch and Edge Triggered Flipflop, Semiconductor Memories,DRAM Cells -1T, 2T, 3T, 4T, 6T, SRAM-Resistive Load, Depletion Load

Module 5 **(6 hours)**

Advances in VLSI Design – Introduction to FINFET, Memristors

Details of Experiments

Schematic Entry, Simulation, DC, AC, Transient Analysis, Layout Design, DRC, LVS and QRC extraction, and verification using post layout simulation of

a. All Basic logic gates using various circuit families
b. Flip flops using MOS
c. Simple memory design.

Text Books

1. CMOS VLSI Design, Neil H.E. Weste, David Harris, Ayan Banerjee, 3rd Edition, 2006, Pearson Education, ISBN: 0321149017.
2. CMOS Digital Integrated Circuits, Sung MO Kang, Yousf Leblebici, 3rd Edition, Tata McGrawHill, ISBN: 0-7923-7246-8.

Reference

1. Basic VLSI Design, Douglas.A.Pucknell, Kamaran Eshraghian, 3rd Edition 2010 ,PHI, ISBN: 0-321-26977-2.
2. Fundamentals of Ultra-Thin-Body MOSFETs and FinFETs, Jerry G. Fossum , Vishal P. Trivedi , 1St Edition 2013, Cambridge University Press, ISBN-13: 978-1107030411.

SEMESTER/YEAR : V SEMESTER /III YEAR
COURSE CODE : 19EC3504
TITLE OF THE COURSE : DIGITAL SIGNAL PROCESSING

L	T	P	S/P	C
3	0	2	-	4

PREREQUISITE
SIGNALS AND SYSTEMS

Course objectives

1. Familiarize with the behavior of a system in terms of both its time domain and frequency domain representations.
2. Understand the importance of FFT algorithms.
3. Identify the correct type of filter required for a given problem and be able to demonstrate the design and implementation of such a digital filter.
4. Explain the concept of aliasing and its effect on the design and use of practical systems.

Course Outcomes

1. Apply transform methods to analyze the analog and digital linear time-invariant systems.
2. Convert between time and frequency domain representations of signals and systems.
3. Infer the practical aspects of sampling, reconstruction and select a suitable sampling rate for a given signal processing problem.
4. Analyze and design analog and digital filters for a given Specification.
5. Interpret and demonstrate the applications of the discrete Fourier transform and implement the digital filters.

Module 1
DISCRETE FOURIER TRANSFORMS (DFT) (12 Hours)
Frequency domain sampling and reconstruction of discrete time signals. DFT as a linear transformation, its relationship with other transforms.
Properties of DFT, multiplication of two DFTs- the circular convolution, additional DFT properties.

Module 2
FFT ALGORITHMS (10 Hours)
Use of DFT in linear filtering, overlap-save and overlap-add method. Direct computation of DFT, need for efficient computation of the DFT (FFT algorithms) Radix-2 FFT algorithm for the computation of DFT and IDFT–decimation-in-time and decimation-in-frequency algorithms. Goertzel algorithm, and chirp-z transform.

Module 3
IIR FILTER DESIGN (10 Hours)
Characteristics of commonly used analog filters –Butterworth and Chebysheve filters, analog to analog frequency transformations. Design of digital IIR filters from analog filters (Butterworth and Chebyshev) - impulse invariance method. Mapping of transfer functions: Approximation of derivative (backward difference and bilinear transformation) method, Matched z transforms

Module 4

FIR FILTER DESIGN **(10 Hours)**

Introduction to FIR filters, design of FIR filters using - Rectangular, Hamming, Bartlet and Kaiser Windows, FIR filter design using frequency sampling technique.

Module 5

DIGITAL SIGNAL PROCESSOR **(10 Hours)**

Elementary idea about the architecture and important instruction sets of TMS320C 6XXX processor, writing of small programs in Assembly Language

TEXT BOOKS:

1. Digital signal processing – Principles Algorithms &Applications, Proakis & Monalakis, Pearson education, 4th Edition, New Delhi, 2007.
2. Digital Signal processing – A Computer Based Approach, S. K. Mitra, TMH Publishing Co.
3. Digital Signal Processing Signals using MATLAB, Vinay K. Ingle, III edition, Cengage Learning.

REFERENCE BOOKS:

1. Digital Signal Processing, P. Rameshbabu, Scitech Publications (India).
2. Digital Signal Processing, S.Salivahanan, A.Vallabraj & C. Gnanapriya, TMH Publishing Co.
3. Digital Signal Processing; A Hands on Approach, C. Schuler & M.Chugani, TMH Publishing Co.
4. Texas Instruments DSP Processor user manuals and application notes

SEMESTER/YEAR : V SEMESTER /III YEAR COURSE
CODE : 19EC3506
TITLE OF THE COURSE : INFORMATION THEORY & ERROR CONTROL CODING

L	T	P	S/P	C
3	0	0	-	3

Course objectives

1. Understand the performance characteristics of an ideal and noisy communication system.
2. Interpret the encoding and decoding concepts
3. Analyze the performance of discrete communication channels and measure the rate of information transmission and channel capacity of discrete channel.
4. Apply suitable coding /decoding scheme for digital communication applications.
5. Understand the concept of error control coding.

Course Outcomes

1. Examine information sources and channels based on their statistical properties.
2. Apply Shannon's theorems in information transmission systems.
3. Demonstrate applications of source coding and error coding techniques in selected fields of information and communication technology (ICT).
4. Design source coding and error coding techniques to suit prescribed requirements.
5. Evaluate the performance of various coding techniques over noisy communication channels.

Module 1
INFORMATION THEORY (10hours)
Introduction, Measure of information, Average information content of symbols in long independent sequences, Average information content of symbols in long dependent sequences. Mark-off statistical model for information source, Entropy and information rate of mark-off source.

Module 2
SOURCE CODING (10hours)
Encoding of the source output, properties of codes, Kraft inequality, construction of instantaneous codes, code efficiency and redundancy, Shannon’s encoding algorithm, Shannon-Fano Coding, Huffman minimum redundancy code, Extended Huffman coding, Arithmetic Coding

Module 3
INFORMATION CHANNELS (12hours)
Communication Channels: Channel Models, Channel Matrix, Joint probability Matrix, System Entropies, Mutual Information, Properties of Mutual information, Channel Capacity, Special Channels, Channel Capacity of : Binary Symmetric Channel, Binary Erasure Channel, Muroga,s Theorem, Continuous Channels: Maximization of entropy Mutual information of continuous noisy channels, Shannon-Hartley law and its implications Joint and Conditional Entropies, Shannon Limit.

Module 4

ERRORCONTROLCODING **(10hours)**

Introduction, Examples of error control coding, Methods of controlling errors, types of codes, types of errors, Linear block codes matrix description of, minimum distance consideration Error detection and correction capabilities, single error correcting Block codes, single error correcting Hamming codes Table lookup for decoding using Standard array

Module 5

TYPESOFCODING **(10hours)**

Binary cyclic codes Algebraic structure of cyclic codes Encoding using (n-k) bit shift register Syndrome calculation, Error detection and correction Convolution Codes, Time domain approach. Transform domain approach, State Diagram, tree diagram, Trellis diagram. Encoders and Decoders using Viterbi's algorithm for (n,k,l) convolutional codes

TEXT BOOKS

1. Digital and analog communication systems, K.SamShanmugam, JohnWiley India Pvt. Ltd,20011.
2. Digital Communication, Simon Haykin, John Wiley India Pvt. Ltd,2012.
3. Information Theory and Coding, Muralidhar Kulkarni, K.S. Shivaprakasha, Wiley India Pvt. Ltd, 2015, ISBN:978-81-265-5305-1.

REFERENCE BOOKS

1. ITC and Cryptography, Ranjan Bose, TMH, 2 ndedition,2012
2. Digital Communications - Glover and Grant; Pearson Ed. 2nd edition2010.
3. Digital Communications: Fundamentals & Applications, 2nd edition, Sklar, Pearson Education India.
4. Error Control Coding-Fundamentals & Applications, Shulin, Daniel J. Costello, 2ndEdition, Prentice Hall Inc. Eagle wood Cliffs.

SEMESTER/YEAR : V SEMESTER /III YEAR
COURSE CODE : 19EC3507
TITLE OF THE COURSE : MICRO ELECTRO MECHANICAL SYSTEMS (MEMS)

L	T	P	S/P	C
3	0	0	-	3

Course Aim and Summary

The aim of this course is to explore the world of microelectromechanical systems (MEMS). This requires an awareness of design, fabrication, and materials issues involved in microsystems. The course will cover General concepts of MEMS, microfabrication technologies, material properties, structural mechanics, basic sensing and actuation principles, chemical/biological sensors/sensing mechanisms and MEMS applications. In particular, this course concentrates on basics of MEMS, different processes involved and principles of sensing. The course will also emphasize on the fabrication of MEMS devices and understanding the fundamentals of sensors and systems approaches in order to identify the constraints and limitations in developing real world sensor solutions

Course Objectives

The objectives of the Course are:

1. To introduce the fundamental concept of MEMS & Microsystem and their relevance to current industry/scientific needs
2. To introduce and demonstrate processes which are used in MEMS fabrication
3. To apply basic sensing principles of chemical/biological systems to develop novel sensors
4. To discuss the limitations and challenges in the design and fabrication of micro sensors, sensing modalities to build the desired microsystem
5. To introduce students to apply general micromachining principles to build novel devices.

	Outcomes	**Blooms Taxonomy Level**
CO1	Students will be able to know about the basics of MEMS	Level 1
CO2	Explain about various materials and technology of MEMS	Level 1 & 2
CO3	Study about micromachining processing and fabrication techniques	Level 2,3
CO4	Explore about MEMS sensors and MEMS novel devices	Level 1,2
CO5	Identify problems and suggest suitable MEMS material/ Devices/Process to get the Requisite Solution for a given application.	Level 3,4
CO6	Apply advanced MEMS techniques to solve future engineering problems	Level 5,6

MODULE I (08 Hours)

Definition - development- fundamentals of MEMS, Micro fluidics, microelectronics, micro systems- design and fabrication, working principles and applications. Integrated circuit processes, potential of MEMS in industry.

MODULE II **(10 Hours)**

Materials substrates and wafers, silicon substrate- properties of silicon, silicon compounds, silicon piezo resistors. Galium Arsenide, quartz, polymer for MEMS, conductive polymer. Shape memory alloys.

MODULE Ill **(14 Hours)**

Photolithography, photo resist applications, light sources, X-ray lithography, electron beam lithography, ion implantation, thin film deposition, diffusion process, Chemical and physical vapour deposition, bulk and surface machining, LIGA, DRIE, RIE, laser ablation process, Micro sterio lithography for 3D fabrication and nanolithography.

MODULE IV **(10 Hours)**

Micro sensors, classification of physical sensors, integrated, intelligent or smart sensors, sensors principle, thermal sensors, electrical sensors, mechanical sensors, chemical and biosensors.

MODULE V **(10 Hours)**

Electromagnetic and thermal micro actuation, mechanical design of micro actuators, micro actuator, micro valves, micro pumps, micro motors. Micro actuator systems: Ink jet printers, micro-mirror TV projectors. Micro-opto-electromechanical systems, metal oxide semiconductor field effect transistor, multi-disciplinary applications.

Text Books

1. Tai-Ran Hsu, MEMS and Microsystems Design and Manufacture, Tata McGraw Hill, New Delhi, 2002.
2. Nitaigour Premchand Mahalik, Micro Electro Mechanical Systems, Tata McGraw Hill, New Delhi, 2007.
3. Mohamed Gad-El-Hak, The Micro Electro Mechanical SystemsHandbook, CRC Press, New York, 2002.

Reference Books

1. Kalpakjian, Manufacturing Engineering and Technology, 4'edition, Addison Wesley Congmen Pvt. Ltd., Singapore, 2009.
2. Mark Madou, Fundamentald of Microfabrication, CRC Press, New York, 1997. Maluf.N, An Introduction to Microelectro mechanical Sytems Engineering, Artech House, Boston, 2000.
3. Rai Choudhury, Micro Electro Mechanical Systems and _ Micro-opto-electromechanical systems Technology and Applications, PHI Learning, 2009.

SEMESTER/YEAR : V SEMESTER /III YEAR

COURSE CODE : 19EC3508

TITLE OF THE COURSE : C PROGRAMMING FOR EMBEDDED SYSTEMS

L	T	P	S/P	C
3	0	0	-	3

Course Objectives

The objectives of the Course are:

1. Setting the required background in embedded system concepts
2. Understanding the C Programming Language in the context of embedded systems
3. Familiarizing the students in advanced topics in 'C' such as Memory management, Pointers, Data structures which are of high relevance in embedded software is considered in depth.

Course Outcomes

After undergoing this course students will be able to:

	Outcomes	Blooms Taxonomy Level
CO1	To understand the technologies and development platforms behind the embedded systems.	Understand - 2
CO2	To define and manage Data structures, Functions and Operators based on problem subject domain.	Define - 1
CO3	To apply the method of writing program using Interrupts	Apply - 3
CO4	To construct the program logic using the Arrays, Strings, Pointers and Structures.	Construct -3
CO5	To understand various debugging techniques required during embedded software development	Evaluate - 4

Module 1

Introduction (10 Hours)

Introduction to the embedded target for the course, various constraints in an embedded device. Your First Embedded Program , The role of Infinite Loop, Build Process : Scatter File(loader/linker script), Scatter File to ElF mapping, make file, using standard and external libraries,

Module 2

Embedded C basics (8 Hours)

Type Qualifiers: Volatile, Static(how it is compiled??), little endian and big endian, Macros, bitwise operations: set, clear, creating masks, Structure padding, packing & bit fields, Union, size of structures and unions, stack(main stack, ISR stack, thread stack), malloc/memory management using memory pools, thread management: creation, priority, watchdog and idle thread, Pointer to pointer, function pointers, dynamic memory allocation, memory leakage.

Module 3

Interrupts (12 Hours)

Interrupts: Interrupt Vector Table, FIQ, IRQ, Exceptions, watchdog, Reset Interrupt handling, Nesting of Interrupts, context switching(thread to thread, thread to interrupt, interrupt to interrupt: (IRQ to FIQ,

IRQ-IRQ), interrupt to exception.

Module 4

Optimization and Pre-Processor directives in C (10 Hours)

Optimization: Increasing Code Efficiency, Decreasing Code Size, Reducing Memory Usage, Compiler Optimization and Flags. Pre-Processor directives: File Inclusion, Conditional Compilation, #error & #pragma directive

Module 5

Debugging Techniques (12 Hours)

During development GDB, Runtime debugging: register dumps, persistent data, stack dump, types of error: stack corruption(magic words on stack boundaries, check stack on thread switching)

TEXT BOOKS:

1. Programming Embedded Systems in C and C++, Micheal Barr

REFERENCE BOOKS:

1. Programming With STM32 Getting Started With the Nucleo Board and CC++, Donald Norris

SEMESTER/YEAR : V SEMESTER /III YEAR
COURSE CODE : 19EC3509
TITLE OF THE COURSE : PLC and SCADA

L	T	P	S/P	C
3	0	0	-	3

Course objectives:

1. To understand basic concept of PLC and to describe the hardware components, program scan sequence, the communication of information to the PLC using different languages, internal relay instruction, writing and entering the ladder logic programs.
2. To impart knowledge about the working of timers, counters, sequencers, describe the function of selectable timed interrupt, define the functions of Relays, Contactors, Motor Starters, Switches, Sensors, Output Control Devices, Seal-In Circuits and Latching Relays and fault routine files and use of temporary end instruction and the about PLC program flow instructions.
3. To Understand the basic concepts and overview of applications of PLC, SCADA and DCS Systems and their interfacing. To understand the basic concept of Industry 4.0
4. To develop an Industrial Automation applications using PLC and understand how Internet of Things plays major role in various process in industrial Setup.

Course Outcomes:

1. Understand the basic concepts of PLC's and SCADA techniques.
2. Apply the programming concepts to interface peripheral and to Analyze and evaluate the automation techniques for industrial applications.
3. Describe the hardware components of PLC: I/O modules, CPU, memory devices, other support devices, operating modes and PLC programming.
4. Describe field devices Relays, Contactors, Motor Starters, Switches, Sensors, Output Control Devices, Seal-In Circuits, and Latching Relays commonly used with I/O module.
5. Understand the opportunities, challenges brought about by Industry 4.0 for benefits of organizations and individuals

Module 1: 9 Hours

Introduction:

Definition of Automation, Types &Application of Automation to Industry processors, Basic Concepts of PLC, PLC in industry, Components, I/O Configuration, Introduction to PLC operation, Binary Data Representation, The input and output status files, Sixteen point I/O modules.

PLC Hardware:

Input modules: Discrete input modules, Discrete AC and DC input & Output Modules: Discrete & solid state output module switching, relay output modules. PLC memory

Module 2: 9 Hours

Basics of PLC Programming:

Processor memory organization, The Program Scan, PLC Programming languages, Bit or Relay Instruction, OSR Instruction, Output latching instructions, Negated output Instruction, Internal Bit type Instruction, Modes of PLC operation interfacing start/stop Push button switch and Motor to PLC.

Special programming Instructions: Timer and Counter Instructions: On delay and off delay and retentive timer instructions, PLC Counter up and down instructions, combining counters and timers.

Module 3: **9 Hours**

Special programming Instructions: Timer and Counter Instructions: On delay and Off delay and retentive timer instructions, PLC Counter up and down instructions, combining counters and timers.
Program Control &Data manipulation Instructions: Data handling instructions, Sequencer instructions, Programming sequence output instructions.

Module 4: **9 Hours**

Case Studies: Temperature control, Valve Sequencing, Conveyor Belt control, Control of a Process, Material Sorting, and Elevator System Problems
SCADA & DCS: Introduction to Supervisory Control and Data Acquisition (SCADA), SCADA Hardware and Software, Introduction to Distributed control system (DCS), DCS Software.

Module 5: **9 Hours**

Introduction: Fundamentals of IIOT

The Concept of the IIoT: Modern Communication Protocols, Wireless Communication Technologies, Proximity Network Communication Protocols, TCP/IP, API: A Technical Perspective, Middleware Architecture.

Text Book:

1. Garry Dunning, "Introduction to Programmable Logic Controllers", CENGAGE Learning, 3rd edition, 2006. ISBN- 9-781-4018-8426-0
2. Bolton W., "Industrial Control and Instrumentation", Universities Press, 4th Edition, 2006. ISBN9-780-7506-8112-4.

Reference Book:

1. Krishna Kant, "Computer Based Industrial control", PHI Publishers, 2nd Edition, 2006. ISBN-9-788-1203-3994-1
2. John W. Webb. Ronald A Reis "Programmable logic controllers" PHI Publishers,5ndEdition,2007, ISBN 9-788-1203-2308-7
3. Industry 4.0 the industrial Internet of Things , Alasdair Gilchrist, 1stedition, Apress Publisher,2017,ISBN-13: 978-1-4842-2046-7

SEMESTER/YEAR : VI SEMESTER /III YEAR
COURSE CODE : 19EC3601
TITLE OF THE COURSE : RF AND MICROWAVE COMMUNICATION

L	T	P	S/P	C
3	0	2	-	4

PREREQUISITE
ELECTROMAGNETIC WAVES

Course Objectives:
This course enables students:
1. To familiarize students with the importance of Microwaves in the present scenario.
2. To use the concept of Electromagnetic field theory and network analysis to analyze the microwave transmission line and waveguides.
3. To make the students learn about microwave passive and active devices, SWR and Impedance Matching
4. To design an impedance matching circuit at microwave frequency using transmission lines.
5. Make the students to know S-matrix and S-parameters
6. To familiarize students with the various network parameters and analyze microwave networks

Course Outcomes
The student after undergoing this course will be able to:
1. Explain different types of waveguides and their respective modes of propagation.
2. Analyze typical microwave networks using impedance, admittance, transmission and scattering matrix representations.
3. Design microwave matching networks using L section, single and double stub and quarter wave transformer.
4. Explain working of microwave passive circuits such as isolator, circulator, Directional couplers, attenuators etc.
5. Describe and explain working of microwave tubes and solid-state devices.
6. Perform measurements on microwave devices and networks using power meter and VNA.
7. Explain the basics of RF and RF mixers.

MODULE 1
INTRODUCTION TO RF AND TRANSMISSION LINE THEORY (10 hours)
Microwave frequencies, Microwave devices and Microwave Systems, Transmission Line Equations and Solutions, Reflection Co-efficient and Transmission Co-efficient, standing wave and standing-wave ratio, Line Impedance and Admittance, Smith Chart and Impedance Matching

MODULE 2:
PLANAR TRANSMISSION LINES (12 hours)
Planer transmission lines such as strip line, micro-strip line, slot line and coplanar waveguides. Characteristics of planar transmission lines. Losses in Micro-strip Lines- Quality Factor Q of Micro-strip Lines: - Properties of materials (Substrate, Conductor, Dielectric and Resistive). Introduction

to MIC's:-Technology of hybrid MICs, monolithic MICs, comparison of both MICs.

MODULE 3:
MICROWAVE NETWORK CHARACTERIZATION AND PASSIVE DEVICES (10 hours)
The scattering Matrix – Reciprocity Theorem- Lossless networks and unitary conditions- ABCD parameters- Cascaded networks-Relations between S- Y and ABCD parameters. Properties and s-matrices for typical network such as section of uniform transmission line, 3-port networks (reciprocal and nonreciprocal), T-junctions directional coupler, magic tee, ferrite devices, isolator, circulators.

MODULE 4:
MICROWAVE DEVICES (10 hours)
Klystron, Multicavity Klystron, Reflex klystron, velocity modulation, transit time, density modulation, beam spreading/ debunching, power output and efficiency, Travelling Wave Tube, Magnetron. Gunn diode and its applications, PIN diode, schottky barrier diodes. (For all the devices: only constructions, operation, definition with explanation and end equations are included. Derivations are excluded).

MODULE 5
RF/MICROWAVE CIRCUITS AND MEASUREMENTS (10 hours)
A brief overview of microwave circuits like LNAs, RF mixers. Introduction, tunable detector, Slotted line carriage, VSWR meter, Spectrum Analyzer, Power Measurements, Insertion loss and attenuation measurements, VSWR Measurements, Return loss measurements by reflectometer, Impedance measurement, frequency measurements.

List of experiments Using Discrete components and/or HFSS/

1. Study of Reflex Klystron Oscillator Mode Characteristics / Gunn diode characteristics.
2. Study of Circulator/Isolator. Extraction of S-Parameters. (Waveguide/stripline component)
3. Study of Directional coupler. Extraction of S-Parameters. (Waveguide/stripline component)
4. Study of E-plane, H-plane & Magic Tee. Extraction of S-Parameters. (Waveguide Tees)
5. Measurement of Frequency and wavelength measurement using slotted Line Assembly.
6. Plot Radiation Pattern of an Antenna. (Horn/Parabolic)
7. Measurement of Reflection coefficient using Smith chart (Magnitude and phase)
8. Measurement of input impedance of the line using smith chart.

Text Books

1. Samuel Y.Liao, "Microwave Devices and Circuits" ,PHI/Pearson Education, Third Edition, 2003.
2. Annapurna Das and Sisir K Das, "Microwave Engineering", Tata McGraw Hill, Second Edition, 2009.
3. Ali A Behagi, "RF and Microwave Circuit Design: A Design Approach using (ADS)", ISBN-13: 978-0996446617

Reference Books

1. David M Pozar, "Microwave Engineering", John Wiley & Sons, Inc., Fourth Edition, 2011.
2. John D Ryder, "Networks, Lines and Fields", PHI, Second Edition, 2002

SEMESTER/YEAR : VI SEMESTER /III YEAR
COURSE CODE : 19EC3602
TITLE OF THE COURSE : NETWORKING AND COMMUNICATION

L	T	P	S/P	C
3	0	2	-	4

PREREQUISITE
ANALOG AND DIGITAL COMMUNICATION

Course Aim & Summary
The aim of this course is to provide students with an overview of the concepts and fundamentals of data communication and computer networks. Topics to be covered include: data communication concepts and techniques in layered network architecture, communications switching and routing, types of communication, network congestion, network topologies, network configuration and management, network model components, layered network models (OSI reference model, TCP/IP networking architecture) and their protocols.

Course Objectives
- To understand the protocol layering and physical level communication.
- To analyze the performance of a network.
- To understand the various components required to build different networks.
- To learn the functions of network layer and the various routing protocols.
- To familiarize the functions and protocols of the Transport layer.

Course Outcomes
- Independently understand basic computer network technology.
- Understand and explain Data Communications System and its components.
- Identify the different types of network topologies and protocols.
- Enumerate the layers of the OSI model and TCP/IP. Explain the functions of each layer.
- Understand and building the skills of subnetting and routing mechanisms.
- Familiarity with the basic protocols of computer networks, and how they can be used to assist in network design and implementation.

MODULE 1
INTRODUCTION **(10 hours)**
Data communications (Components, Data Representation, and Dataflow), Networks (Distributed Processing, Network Criteria, Physical Structures, Network Models, and Categories of Networks), Reference Models: OSI, TCP/IP
Physical Layer: Transmission media: Magnetic Media, Twisted pair, Base band Coaxial Cable, Fiber optics, Wireless Transmission: Electromagnetic Spectrum, Radio Transmission, Microwave Transmission

MODULE 2:
DATA LINK LAYER **(10 hours)**
Data link layer: Design issues: framing, error detection and correction, Elementary Data

link Protocols: Stop and wait, Sliding Window protocols: Go-back-N, Selective Repeat, **Medium Access sub layer:** Channel allocation methods, Multiple Access protocols: ALOHA, CSMA, Ethernet and Wireless LAN.

MODULE 3:
NETWORK LAYER **(12 hours)**

Network Layer design issues, Virtual circuit and Datagram subnets, Routing algorithms: Shortest path routing, Flooding, Distance vector routing, Hierarchical routing, Broad cast and Multi cast routing, Congestion Control: Congestion prevention policies. **The Network layer in the internet:** The IP Protocol, IP Addresses, and Internet Control Protocols, IPv6.

MODULE 4:
TRANSPORT LAYER **(10 hours)**

Transport Services, Elements of Transport Protocols: Addressing, Connection establishment, Connection Release, Flow control and Buffering, Internet Transport Protocols: UDP and TCP.
Session layer: Dialog Control and Synchronization.

MODULE 5
APPLICATION LAYER **(10 hours)**

Presentation Layer: Translation, Encryption and Compression Domain Name System, Electronic Mail, World Wide Web, Hyper Text Transfer Protocol, **Network Security** : Cryptography, Symmetric key algorithms, Public key algorithms, Digital signatures.

List of experiments using C/C++/Python and NS2/NS3

1. Simulate three nodes point-to-point networks with duplex links between them. Set the queue size and vary the bandwidth and find the number of packets dropped.
2. Implement transmission of ping messages/trace route over a network topology consisting of 6 nodes and find the number of packets dropped due to congestion.
3. Implement an Ethernet LAN using n nodes and set multiple traffic nodes and plot congestion window for different source / destination.
4. Write a program for error detecting code using CRC-CCITT (16- bits).
5. Write a program to find the shortest path between vertices using Dijkstra algorithm.
6. Write a program for a HDLC frame to perform the following.
   i. Bit Stuffing
   ii. Character Stuffing
7. Implementation of Stop and Wait protocol, Sliding Window Protocol.
8. Write a program for simple RSA algorithm to encrypt and decrypt the data.
9. Using TCP/IP sockets, write a client – server program to make the client send the file name and to make the server send back the contents of the requested file if present. Implement the above program using as message queues or FIFOs as IPC channels.
10. Implement and study the performance of CDMA.

Text Books

1. Data Communications and Networking – Behrouz A. Forouzan, Fourth Edition TMH, 2006.
2. Computer Networks -- Andrew S Tanenbaum, 4th Edition, Pearson Education.

Reference Books

1. Understanding communications and Networks, 3rd Edition, W.A. Shay, Thomson

SEMESTER/YEAR : VI SEMESTER /III YEAR
COURSE CODE : 19EC3603
TITLE OF THE COURSE : POWER ELECTRONICS

L	T	P	S/P	C
3	0	2	-	4

Course objectives

1. Study the semiconductors devices as switches suitable for power circuits.
2. Select and design the converters for various forms of power conversions.
3. Understand the operations of various motor drives
4. Design and implement the control circuits for various power electronics Applications
5. Understanding power electronic circuits for EV applications

Course Outcomes

1. Compare the different semiconductors devices as switches suitable for power circuits.
2. Selection and design of suitable converters for various forms of power conversions.
3. Analyse various drive circuits suitable for different motors.
4. Design and implementation of control circuits for EV applications

Module -1

INTRODUCTION TO POWER ELECTRONICS (10 hours)

INTRODUCTION: Need for power electronics, power semiconductor devices, Types of power electronic circuits. Power BJTs, switching characteristics, Power MOSFET Switching characteristics, Power IGBTs, switching characteristics, gate and base drives.

Module -2

THYRISTORS (10 hours)

Introduction, VI characteristics, two transistor models, switching characteristics, di/dt and dv/dt protection, thyristor types, series and parallel operation of thyristors, thyristor firing circuits. COMMUTATION TECHNIQUES: Natural commutation, Forced commutation: self-commutation, impulse commutation, resonant pulse commutation and complementary commutation.

Module -3

CONTROLLED RECTIFIERS AND CONTROLLERS (10 hours)

Introduction, Principle of phase controlled converter, Operation of single-phase semi converters, full converters and dual converters with parameter analysis. Principle of Three phase half wave converter.

AC VOLTAGE CONTROLLERS: Introduction, principle of ON-OFF and phase control, Operation of single phase, Bi-directional controllers with resistive and inductive loads. Single phase Cyclo converters.

Module -4

DC CHOPPERS (10 hours)

Introduction, principle of step-down operation, step-down chopper with RL loads, Principle of step-up operation, step-up chopper with Resistive load, performance parameters, Chopper classification (Class A

to Class E).

Module -5

DC DRIVES AND INVERTERS **(12 hours)**

DC DRIVES: Introduction, Basic Characteristics of DC Motors, Operating modes, Single phase Drives. Stepper motor characteristics, Permanent Magnet stepper motors (bipolar and unipolar motor drive sequence), Stepper Motor Drives

INVERTERS: Introduction, principle of operation, performance parameters, single phase bridge inverters, Three phase inverters, voltage control of single phase inverters, current source inverter, variable DC link inverter,

Introduction to Hybrid Electric Vehicles, Basics of Conventional Vehicles. Hybrid Electric Drive-trains and Electric Drive-trains: Basic concept of electric traction, introduction to various electric drive-train topologies, power flow control in electric drive-train topologies,

Text Books:

1. Power Electronics - M. H. Rashid, Prentice Hall of India Pvt. Ltd., (Pearson (Singapore –Asia)) New Delhi, 2002.
2. Modern Power Electronics – P.C. Sen, 2nd Edition S.Chand, 2000.
3. Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press , 2004

Reference Books:

1. Power Electronics- M. D. Sing and Khanchandani K. B., Tata McGraw Hill Publishing Company Limited, Reprint 2001.
2. Power Electronics - Cyril W.Lander, 3rd Edition, McGraw Hill, 1993.
3. Power Electronics, Converters, Applications and Design – Ned Mohan, Undeland, Riobbins
4. Chris Mi, M. Abul Masrur, David Wenzhong Gao, Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives, John Wiley & Sons Ltd. , 2011
5. Power Electronics Lab Manual, SOE DSU , 2018

SEMESTER/YEAR : VI SEMESTER /III YEAR
COURSE CODE : 19EC3604
TITLE OF THE COURSE : Analog VLSI Design

L	T	P	S/P	C
3	0	0	-	3

PREREQUISITE
CMOS VLSI DESIGN

Course objectives

1. Analyse small signal and large signal model of MOSFETS
2. Analyse characteristics of single-stage amplifiers and differential amplifiers.
3. Understand and Analyse Op-Amp parameters.
4. Study Analog Comparators.
5. Infer VCO and PLL Characteristics.

Course Outcomes

1. Acquire knowledge about physics involved in modelling of semiconductor device.
2. To study key analog circuits for signal processing, conditioning and detection in system
3. Apply knowledge of mathematics, science, and engineering to design and analysis of analog integrated circuits.
4. Identify, formulates, and solves engineering problems in the area of analog integrated circuits.
5. Use the techniques, skills, and modern programming tools, necessary for engineering practice.

Module 1 **(10Hours)**
CMOS Device Modelling: MOS large Signal Model, Small Signal Model. Analog CMOS Subcircuits: MOS Switch, MOS Diode, Current Sinks and Sources, Current Mirrors, Basic Current Mirror, Cascode Current Mirror.

Module 2 **(10 Hours)**
Single Stage Amplifiers: Common Source with Resistive load, Diode connected Load, Current Source load, Triode Load, Source degradation, Source follower, Common Gate

Module 3 **(10 Hours)**
Differential Amplifiers and Operational Amplifiers: Single Ended Differential operation, Basic differential Pair, Common Mode Response, Differential Pair with MOS Load.
OP- AMPS: General Consideration and Performance Parameters, One/Single Stage OP-AMP, Two stage Op-amp, Gain Boosting, Slew Rate and Power Supply Rejection Ratio

Module 4 **(10 Hours)**

Other Analog Circuits: Comparators, Characterization of a Comparator, Two Stage Open Loop Comparator, Voltage Controlled Oscillator, Basic PLL Topology

Text Books

1. Design of Analog CMOS Integrated Circuits, Behzad Razavi, 3rd Edition, 2002, Tata McGrawHill

Reference

1. CMOS Analog Circuit Design, Phillip E Allen, Douglas R Holberg, 2rd Edition, 2006, Oxford University Press.
2. Analysis and Design of Analog Integrated Circuits, Gray, Hurst, Lewis, and Meyer, John Wiley & Sons, 5th edition, 2009
3. Analog Integrated Circuit Design, Carusone, Johns, and Martin, 2nd edition, John Wiley, 2012
4. Analog Design for CMOS VLSI Systems, Franco Maloberti, Kluwer Academic Publishers, 2001

SEMESTER/YEAR : VI SEMESTER /III YEAR
COURSE CODE : 19EC3605
TITLE OF THE COURSE : Wireless and Mobile Communication

L	T	P	S/P	C
3	0	0	-	3

PREREQUISITE
ANALOG AND DIGITAL COMMUNICATION

Course Aim and Summary
The course Wireless and Mobile communication provides an insight for communication technique covering from short range to long distance communication. Analysis of the geometry and the signal will ensure smooth transmission of the signal in mobile communication. The use of appropriate modulation and multiple access technique will ensure the efficient use of the channel and increase the data transmission capacity. Emphasis is also laid on the various equalization and the 4G techniques. The course also coves short distance, mid-range and long range communication techniques and the concept of 5G technology.

COURSE OBJECTIVES:

1. To understand the concepts and techniques of mobile radio communication fundamentals like reflection, diffraction, scattering and fading.
2. The course provides the basic foundation of mobile communication. This course covers aspects like working principles, types, modulation methods, channeling and applications.
3. To understand equalization techniques and the analysis of same to improve the signal strength
4. To analyze the modulation and multiple access techniques to increase the channel efficiency
5. To understand cellular design concepts and apply them in wireless communication
6. To understand the short distance communication and the concept of 5G wireless communication and analyses the pros and cons of technology

Course Outcomes
On completion of the course, the students will have the ability to:

	Outcomes	**Blooms Taxonomy Level**
CO1	Understand the concepts and techniques of mobile radio communication fundamentals like reflection, diffraction, scattering and fading	2- Understand
CO2	Understand working principles, types, modulation methods, channeling and applications.	1-Remember and 2 - Understand
CO3	Understand equalization techniques and the analysis of the same to improve the signal strength	2- Understand and 4- Analyse
CO4	Analyse the modulation and multiple access techniques to increase the channel efficiency	4- Analyse 5 - Evaluate
CO5	Understand cellular design concepts and apply them in wireless communication	2 – Understand and 3- Apply

CO6	Understand the short distance communication and the concept of 5G wireless communication and analyses the pros and cons of technology	2 – Understand and 4 - Analyse

Module 1 **(10 hours)**

Evolution of mobile radio communication fundamentals, General Model of Wireless Communication Link, Types of Signals, Cellular Infrastructure, Cellular System Components, Antennas for Cellular Systems, Operation of Cellular Systems, Channel Assignment, Frequency reuse, Channel Assignment strategies, Handoff Strategies Cellular Interferences, Sectorization; Wireless Channel and Radio Communication, Free Space Propagation Model, Channel Noise and Losses, Fading in Land Mobile Systems, Multipath Fading, Fading Effects on Signal and Frequency, Shadowing

Module 2 **(10 hours)**

Theory of Vocoders, Types of Vocoders; Spread Spectrum Modulation, Pseudo-Noise Codes with Properties and Code Generation Mechanisms, DSSS and FHSS Systems, Time Hopping and Hybrid Spread Systems; Multicarrier Modulation Techniques, Zero Inter Symbol Interference Communication Techniques, Detection Strategies, Diversity Combining Techniques: Selection Combining, Threshold Combining, Equal Gain Combining, Maximum Ratio Combining; Spatial Diversity and Multiplexing in MIMO Systems, Channel Estimation,

Module 3 **(10 hours)**

Equalization Techniques: Transversal Filters, Adaptive Equalizers, Zero Forcing Equalizers, Decision Feedback Equalizers, and related algorithms; Multiplexing and Multiple Access: FDMA, TDMA, CDMA, OFDMA, SC-FDMA, IDMA Schemes and Hybrid Method of Multiple Access Schemes, RAKE Receiver; Multiple Access for Radio Packet Systems: Pure ALOHA, Slotted ALOHA, CSMA and their versions; Packet and Pooling Reservation Based Multiple Access Schemes.

Module 4 **(10 hours)**

GSM system for mobile Telecommunication, General Packet Radio Service, Edge Technology; CDMA Based Standards: IS 95 to CDMA 2000, Wireless Local Loop, IMT 2000 and UMTS, Long Term Evolution (LTE), Mobile Satellite Communication.

Module 5 **(10 hours)**

Introduction to Mobile Adhoc Networks, Bluetooth, Wi-Fi Standards, WiMax Standards, Li-Fi Communication, Ultra-Wideband Communication, Mobile data networks, Wireless Standards IMT 2000, Introduction to 5G concept

Text Books:

1. T.S. Rappaport, "Wireless Communication-Principles and practice", Pearson Publications, Second Edition.
2. Upena Dalal, "Wireless Communication and Networks", Oxford Press Publications.

Reference Books:

1. Andrea Goldsmith, "Wireless Communications", Cambridge University Press.
2. S. Haykin & M. Moher, "Modern wireless communication", Pearson, 2005.
3. T L Singal, "Wireless Communications", McGraw Hill Publications

SEMESTER/YEAR : VI SEMESTER /III YEAR
COURSE CODE : 19EC3606
TITLE OF THE COURSE : EMBEDDED SYSTEMS DESIGN

L	T	P	S/P	C
3	0	0	-	3

PREREQUISITE
MICROCONTROLLERS

COURSE OBJECTIVES:

1. To introduce the fundamentals of embedded processor modeling.
2. To understand the hardware components involved in embedded system design.
3. To discuss on the software aspects required in developing an embedded system.
4. To involve in Discussions/ Practices/Exercises onto revising & familiarizing the concepts acquired with applications for improved employability skills.

COURSE OUTCOMES:

	Outcomes	Blooms Taxonomy Level
CO1	To identify various functional and structural modules within an embedded processor.	Identify -1
CO2	Describe the differences between the general computing system and the embedded system, also recognize the classification of embedded systems.	Describe - 2
CO3	To demonstrate automated process with improved design strategies.	Demonstrate - 2
CO4	To Understand the implementation of operating systems for Embedded applications.	Understand -2
CO5	Analyze various examples of embedded systems.	Analyze - 4

MODULE 1
INTRODUCTION TO EMBEDDED SYSTEMS (10 Hours)
Introduction to Embedded Systems – The build process for embedded systems- Structural units in Embedded processor , selection of processor & memory devices- DMA – Memory management methods- Timer and Counting devices, Watchdog Timer, Real Time Clock- Software Development tools-IDE, assembler, compiler, linker, simulator, debugger, In circuit emulator, Target Hardware Debugging, need for Hardware-Software Partitioning, Co-Design.

MODULE 2
EMBEDDED HARDWARE and SYSTEM COMPONENTS (12 Hours)
Embedded Vs General computing system, Classification of Embedded systems, Major applications and purpose of ES. Core of an Embedded System including all types of processor/controller, Memory, Sensors, Actuators, LED, Opto-coupler, Relay, Piezo buzzer, Push button switch, Communication Interface , Embedded firmware.

MODULE 3

EMBEDDED SOFTWARE **(10 Hours)**

Embedded Systems programming in C – Binding & Running Embedded C program in IDE, Dissecting the program, Building the hardware, Basic techniques for reading & writing from I/O port pins, Examples fo r switches, LED Interfacing using Embedded C. Firmware : Firmware and Bootloader, Example: Sandstone

MODULE 4

EMBEDDED OPERATING SYSTEMS (sEOS) **(10 hours)**

Basic OS Concepts : Process Management, Memory Management, I/O and File Management. Basics of sEOS, Timer Design consideration using sEOS, Multi-state system design.

MODULE 5

EMBEDDED SYSTEMS APPLICATIONS **(10 hours)**

Case study – Intruder alarm system. HyperTerminal based control-packet based control for LED interfacing, Discussions on Design, Development & Product Manufacturing Processes' of embedded Products like Digital Camera /Adaptive Cruise control in a Car /Mobile Phone / Automated Robonoid Implementation of Traffic light sequencing using on chip UART for RS-232 communication- memory requirements.

Text Books:

1. Shibu K V, "Introduction to Embedded Systems", Tata McGraw Hill Education Private Limited, 2009.
2. Andrew N. Sloss ,Dominic Symes,Chris Wright, "ARM System Developer's Guide Designing and Optimizing System Software", Elsevier, 2004

Reference Books:

1. Tammy Noergaard, "Embedded system architecture", Elsevier.
2. Jean J. Labrosse, "Embedded Systems Building Blocks: Complete and Ready-To-Use Modules in C", The publisher, Paul Temme.
3. Peckol, "Embedded system Design", JohnWiley &Sons.
4. Lyla B Das," Embedded Systems-An Integrated Approach", Pearson.
5. Jonathan W.Valvano,"Embedded Microcomputer Systems, Real Time Interfacing", Cengage Learning.
6. Jivan S. Parab, Vinod G. Shelake, Rajanish K.Kamot, and Gourish M.Naik, "Exploring C for Microcontrollers- A Hands on Approach", Springer, 2007.
7. Michael J. Pont, "Embedded C", Addison Wesley.

SEMESTER/YEAR : VI SEMESTER /III YEAR
COURSE CODE : 19EC3607
TITLE OF THE COURSE : Digital IC Design

L	T	P	S/P	C
3	0	0	-	3

PREREQUISITE

DIGITAL SYSTEM DESIGN WITH VERILOG
CMOS VLSI DESIGN

Course objectives

1. Analyse small signal and large signal model of MOSFETS
2. Analyse characteristics of single-stage amplifiers and differential amplifiers.
3. Understand and Analyse Op-Amp parameters.
4. Study Analog Comparators.
5. Infer VCO and PLL Characteristics.

Course Outcomes

1. To impart the knowledge about various VLSI digital design flow
2. Acquire knowledge about timing issues in digital circuits.
3. Acquire knowledge about RAM, ROM and High-Performance Subsystem Memories
4. Solve engineering problems for feasible and optimal solutions in the core area of CMOS Digital ICs.
5. Apply the CMOS Digital IC concepts for usage of modern CAD tools and their Limitations.

Module 1 **(10Hours)**

IMPLEMENTATION STRATEGIES FOR DIGITAL ICS: Introduction, From Custom to Semicustom and Structured Array Design Approaches, Custom Circuit Design, Cell-Based Design, Methodology Standard Cell, Compiled Cells, Macrocells, Megacells and Intellectual Property, Semi-Custom Design Flow, Array-Based Implementation Approaches, Pre-diffused (or Mask-Programmable) Arrays, Pre-wired Arrays.

Module 2 **(10 Hours)**

TIMING ISSUES IN DIGITAL CIRCUITS: Introduction, Timing Classification of Digital Systems, Synchronous Interconnect, Mesochronous interconnect, Plesiochronous Interconnect, Asynchronous Interconnect, Synchronous Design — An In-depth Perspective, Synchronous Timing Basics Sources of Skew and Jitter, Clock-Distribution Techniques, Latch-Based Clocking, Self-Timed Circuit Design, Self-Timed Logic - An Asynchronous Technique , Completion-Signal Generation, Self-Timed Signaling, Practical Examples of Self-Timed Logic, Synchronizers and Arbiters, Synchronizers—Concept and Implementation, Arbiters, Metastability

Module 3 **(10 Hours)**

DESIGNING ARITHMETIC BUILDING BLOCKS: Introduction, Datapaths in Digital Processor Architectures, The Adder, The Binary Adder: Definitions, The Full Adder: Circuit Design Considerations, The Binary Adder: Logic Design Considerations, The Multiplier: Definitions, Partial-Product Generation, Partial Product Accumulation, Final Addition, Multiplier Summary, The Shifter Barrel Shifter, Logarithmic Shifter

Module 4 **(10 Hours)**

DESIGNING MEMORY AND ARRAY STRUCTURES: Introduction, Memory Classification, Memory Architectures and Building Blocks, The Memory Core, Read-Only Memories, Nonvolatile, Read-Write Memories , Read-Write Memories (RAM), Contents-Addressable or Associative Memory (CAM), Memory Peripheral Circuitry ,The Address Decoders, Sense Amplifiers, Voltage References Drivers/Buffers, Timing and Control, Memory Reliability and Yield, Signal-To-Noise Ratio, Memory yield.

Text Books

1. Design of Analog CMOS Integrated Circuits, Behzad Razavi, 3rd Edition, 2002, Tata McGrawHill

Reference

1. CMOS Analog Circuit Design, Phillip E Allen, Douglas R Holberg, 2rd Edition, 2006, Oxford University Press.
2. Analysis and Design of Analog Integrated Circuits, Gray, Hurst, Lewis, and Meyer, John Wiley & Sons, 5th edition, 2009
3. Analog Integrated Circuit Design, Carusone, Johns, and Martin, 2nd edition, John Wiley, 2012
4. Analog Design for CMOS VLSI Systems, Franco Maloberti, Kluwer Academic Publishers, 2001

SEMESTER/YEAR : VI SEMESTER /III YEAR
COURSE CODE : 19EC3609
TITLE OF THE COURSE : REAL TIME EMBEDDED SYSTEMS

L	T	P	S/P	C
3	0	0	-	3

PREREQUISITE
MICROCONTROLLERS

COURSE OBJECTIVES:

1. To acquire knowledge about concepts related to OS such as Scheduling techniques, threads, inter-thread communications, memory management.
2. To understand the architecture and programming model of STM 32 microcontroller.
3. To gain knowledge on UML and resource modelling
4. To study about Free RTOS and incorporate in projects

COURSE OUTCOME:
On completion of this course the students will be able to:

	Outcomes	Blooms Taxonomy Level
CO1	Describe the fundamental concepts of RTOS	Describe
CO2	Describe STM 32 processor architecture and Programming model	Describe
CO3	Analyze different scheduling and multitasking approaches	Analyze
CO4	Develop programs for real time services, firmware and RTOS.	Develop

MODULE 1
INTRODUCTION TO REAL TIME SYSTEMS (10 hours)
Introduction to Embedded Systems, Real time Embedded Systems, characteristics, Hard and Soft Real-Time Embedded Systems, Examples, Cross platform development process, Hardware architecture, Software development, build target images, Memory mapping, integrated testing on target, system production.

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MODULE 2
ARM FOR REAL TIME SYSTEMS (10 hours)
ARM STM32, Architecture, Memory organization, Process instructions, General Purpose Input Output pin hardware, Interrupts, External & Software Interrupts, Timers, Case Study

MODULE 3
SOFTWARE ARCHITECTURE FOR REAL TIME EMBEDDED SYSTEMS (12 hours)
Real time tasks, Periodic and Aperiodic tasks, Task specification, Clock driven scheduling, Round Robin Architecture, Priority driven scheduling algorithms, Round Robin Architecture with interrupts, Queue based architecture, Case study.

MODULE 4

REAL TIME OPERATING SYSTEMS (10 hours)

Operating system basics, Tasks, Process, Threads, Process Management, Memory Management, Multitasking, Real time scheduling, Non Pre-emptive Scheduling, Pre-emptive scheduling, Inter-task Communication, Resource sharing, Introduction to OSEK standards OS, Architecture of OSEK OS

MODULE 5

EMBEDDED SYSTEM DESIGN WITH FREERTOS (10 hours)

Fundamental of UML, Structural modelling: UML, class diagram & class modelling, object diagram, Real time UML, General resource modelling, Resource modelling, concurrency modelling, Getting started with Free RTOS – Task Management, Queue Management, Interrupt & Resource Management. Incorporating Free RTOS in projects.

Text Books:

1. Jiacun Wang, Real Time Embedded Systems, Wiley Publications, 2017.
2. Xiaocong Fan, Real Time Embedded Systems: Design Principles & Engineering Practices, Elsevier, 2014.
3. Shibu K V, Introduction to Embedded Systems, McGraw Hill Education(India) Private Limited, 2017.
4. Lemieux Joseph. Programming in the OSEK/VDX Environment, R & D.(2001)

Reference books:

1. Jim Cooling, Real Time Operating Systems: Book 2 - The practice -Using STM Cube, FreeRTOS and the STM32F4 Discovery boards, Lindentree Associates Publications 2017.
2. Donald Norris, Programming with STM32: Getting started with Nucleo board and C/C++, McGraw Hill Education Publications, 2018.

SEMESTER/YEAR : **VI SEMESTER /III YEAR**
COURSE CODE : 19EC3610
TITLE OF THE COURSE : **Industrial Internet of things (IIoT)**

L	T	P	S/P	C
3	0	0	-	3

Course Aim and Summary

Industry 4.0 concerns the transformation of industrial processes through the integration of modern technologies such as sensors, communication, and computational processing. Technologies such as Cyber Physical Systems (CPS), Internet of Things (IoT), Cloud Computing, Machine Learning, and Data Analytics are considered to be the different drivers necessary for the transformation. Industrial Internet of Things (IIoT) is an application of IoT in industries to modify the various existing industrial systems. IIoT links the automation system with enterprise, planning and product lifecycle. This course has been organized into the following modules**.**

The objectives of the Course are:

1. To introduce the fundamental concept Industry 4.0 and IoT
2. To introduce and demonstrate role of sensors and actuators in industries
3. To apply basic knowledge of data analytics to analyses data obtained from machines
4. To understand Role of AR and VR
5. To introduce students to what role IIoT will play in healthcare, power plant industries as case study

Course Outcomes

After undergoing this course students will be able to:

	Outcomes	**Blooms Taxonomy Level**
CO1	Students will able know the basic of 4th industrial Revolution	Level 1
CO2	Explain about Sensors and Actuators	**Level 1 & 2**
CO3	Explore Various Technologies used in Industrial IoT	**Level 2,3**
CO4	Analyzing the data obtained from the machines and host them in cloud	Level 1,2
CO5	IIoT links the automation system with enterprise, planning and product lifecycle.	**Level 3,4**
CO6	Apply the Industrial 4.0 concepts in a manufacturing plant to improve productivity and profits	Level 5,6

Module 1: Introduction **08 hours**

Sensing & actuation, Communication-Part I, Part II, Networking-Part I, Part II Industry 4.0: Globalization and Emerging Issues, The Fourth Revolution, LEAN Production Systems, Smart and Connected Business Perspective, Smart Factories.

Module 2: IIoT Technologies **08 hours**

Cyber Physical Systems and Next Generation Sensors, Collaborative Platform and Product Lifecycle Management, Augmented Reality and Virtual Reality, Artificial Intelligence, Big Data and Advanced Analysis Cybersecurity in Industry 4.0, Basics of Industrial IoT: Industrial Processes-Part I, Part II, Industrial Sensing & Actuation, Industrial Internet Systems. Industrial Sensing & Actuation.

Module 3: IIoT Communication **08 hours**

IIoT-Introduction, Industrial IoT: Business Model and Reference Architecture: IIoT-Business Models-Part I, Part II, IIoT Reference Architecture-Part I, Part II. Industrial IoT- Layers: IIoT Sensing, IIoT Processing. Communication-Part I. Industrial IoT- Layers: IIoT Communication, IIoT Networking-Part I, Part II, Part III.

Module 4: IIoT Analytics **10 hours**

Introduction, Machine Learning and Data Science in Industrial IoT: Big Data Analytics and Software Defined Networks: IIoT Machine Learning and Data Science - R and Julia Programming, Data Management with Hadoop Data Center Networks, Industrial IoT Security and Fog Computing - Fog Computing in IIoT, Industrial IoT- Application Domains.

Module 5: Application Domains **08 hours**

Healthcare, Power Plants Industrial IoT- Application Domains: Oil, chemical and pharmaceutical industry, Applications of UAVs in Industries, Real case studies

Text Books

1. Introduction to industrial internet of things and industry 4.0 by Sudip Misra, Chandan Roy, Anandarup Mukarjee, 1st edition , CRC Press publisher,2021, ISBN 9781003020905

Reference Books

1. Industry 4.0 the industrial Internet of Things , Alasdair Gilchrist, 1st edition, Apress Publisher,2017, ISBN-13: 978-1-4842-2046-7
2. Industry 4.0: Managing The Digital Transformation, Alp Ustundag, EmreCevikcan, 1st edition, Springer, 2018, ISBN 978-3-319-57869-9.
3. Designing the Industry - Internet of things connecting the physical, digital and virtual worlds, OvidiuVermesan and Peer Friess,1st edition, Rivers Publishers, 2016, ISBN 978-87-93379-81-7

SEMESTER/YEAR : I SEM
COURSE CODE : 20ESE5101
TITLE OF THE COURSE : LINEAR ALGEBRA AND OPTIMIZATION TECHNIQUES
L: T/A: P: C : 3: 1: 0: 4

COURSE OBJECTIVE:

1. To understand matrix algebra and determinants.
2. To familiarize about vector spaces, Orthonormal sets.
3. To know about graph theory and optimization problems.

COURSE OUTCOME:

1. To solve problems on matrix algebra.
2. Gain in-depth knowledge of vector spaces and Gram Schmidt orthogonalization procedure.
3. Get insight OS graph theory and understanding optimization techniques.

MATRICES AND SYSTEMS OF EQUATIONS, DETERMINANTS (09 Hours)

Systems of linear equations – Row echelon form – Matrix algebra – Elementary matrices Partitioned matrices – The Determinant of a Matrix – Properties of Determinants – Cramer's rule.

VECTOR SPACES AND LINEAR TRANSFORMATIONS (09 Hours)

Definition and examples – Subspaces – Linear independence – Basis and dimensions – Change of basis – Row space and Column space – Linear transformations: Definition – Matrix representations.

ORTHOGONALITY AND EIGENVALUES (12 Hours)

The Scalar product in R – Orthogonal subspace – Least squares problem – Inner product space – Orthonormal sets – The Gram-Schmidt Orthogonalization procedure – Orthogonal polynomials – Eigenvalues and Eigenvectors – Systems of Linear differential equations – Diagonalization – Hermitian matrices – The Singular Value Decomposition – Quadratic forms – Positive definite matrices – Non-negative matrices.

GRAPH THEORY (10 Hours)

Vertex cover, matching, path cover, connectivity, hamiltonicity, edge colouring, vertex colouring, list colouring; Planarity, Perfect graphs; other special classes of graphs; Random graphs, Network flows, Introduction to Graph minor theory.

INTRODUCTION TO OPTIMIZATION (10 Hours)

Statement of an optimization problem, Classification of optimization problem. Classical optimization techniques- single variable optimization, multivariable optimization with no constraints, with equality constraints, with inequality constraints and convex programming problem.

TEXT BOOKS:

1. Gilbert Strang, Introduction to Linear Algebra, 4th Edition Wellesley-Cambridge Press.

2. Reinhard Diestel, "Graph Theory", Springer (2010).

REFERENCES:

1. Artin,M., Algebra, Prentice-Hall ofIndia,1994.
2. S.S Rao, Optimization: Theory and Practices, New Age Int. (P) Ltd. Publishers, New Delhi.

SEMESTER/YEAR : I SEM
COURSE CODE : 20ESE5102
TITLE OF THE COURSE : MODERN AUTOMOTIVE SYSTEMS
L: T/A: P: C : 3: 0: 0: 3

COURSE OBJECTIVE

1. To prepare the students to critically evaluate the challenges and identify the role of electronics and software systems in a modern automobile.
2. To understand automotive systems, underlying principles of construction and working, limitations of the conventional systems, the needs for electronic controls to improve the performance, safety and meet regulatory requirements.
3. To explore potential new functions and applications by studying the physical systems, interacting with experts and users.

COURSE OUTCOME

1. Explain and specify the function of electronic systems in modern automobiles.
2. Evaluate the use of modern electronics technology to improve the performance, safety, comfort and related issues.
3. Synthesize and specify the addition of new features in existing electronic automotive subsystems for enhanced functionality.

INTRODUCTION TO MODERN AUTOMOTIVE SYSTEMS AND INDUSTRY (08 Hours)
Automotive systems -Automotive Tools and Technology -Model Based Software Engineering -A novel approach -Key drivers of growth and Trend

AUTOMOTIVE SENSORS AND ACTUATORS (10 Hours)
Basic and Overview – Automotive applications Details of the sensor market - Feature of the vehicle sensors- Sensor classification - Error types and tolerance - Automotive Electrical Architecture

VEHICLE NETWORK (12 Hours)
CAN –LIN – FlexRay –MOST - In Vehicle Network Diagnostics: Process of Automotive Fault Diagnostics - Fault Codes - Vehicle Systems (open-loop and closed-loop) - On- and Off- Board Diagnostics - OBD-I - OBD-II – Engine -Steps taken to diagnose a fault - Diagnostics Protocol-KWP2000 - SAE-J1587 - SAE-J1708.

AUTOMOTIVE APPLICATION (10 Hours)
Comfort and Convenience -Power train and Hybrid Systems -Safety systems –Infotainment: Instrument cluster -Advance Driver Assistant systems (ADAS) and Autonomous driving - Smart vehicle

AUTOMOTIVE ORGANIZATION **(10 Hours)**

SAE -SAE India –AUTOSAR -ISO26262- FISITA -Automotive Technology Organization

TEXT BOOK:

1. Denton., *Automotive Electrical and Electronic Systems*, Elsevier Butterworth-Heinemann (2004)
2. Jack Erjavec., *Automotive Technology – A System Approach*, 3rdedition. (2004)

REFERENCES:

1. http:// www.sae.org
2. http://www.delphi.com
3. http://www.bosch.com

SEMESTER/YEAR : I SEM
COURSE CODE : 20ESE5103
TITLE OF THE COURSE : AUTOMOTIVE EMBEDDED SYSTEM
L: T/A: P: C : 3: 0: 0: 3

COURSE OBJECTIVE

1. To provide the students the requisite skill to design and implement automotive embedded applications using micro-controllers.
2. To develop automotive applications using microcontrollers.
3. To understand typical embedded microcontroller used in automotive industries, hardware interfacing and microcontroller programming in C and assembly languages are taught in detail.

COURSE OUTCOME

1. Explain real-time system principles, issues involved in the development of real-time.
2. Analyze different features, architecture, peripheral interfacing and programming of embedded microcontrollers for automotive applications.
3. Design, develop and implement automotive embedded systems by interfacing required peripherals with embedded microcontroller

INTRODUCTION TO AUTOMOTIVE ECU SOFTWARE DEVELOPMENT USING ADVANCE MICROCONTROLLER (03 Hours)

Basics of ECU HW -Microcontroller/microprocessor -Signal conditioning circuits (input/output circuits) - Memory Layouts (RAM/ROM/Flash) -Understanding schematics of an ECU

ARCHITECTURE OF 16-BIT EMBEDDED MICRO-CONTROLLERS (12 Hours)

Introduction to 68HC12 Family of Micro controllers -68HC12 in automotive applications – Architecture – Registers - 68HC12/68HCS12 - assembly language programming - 16-bit HCS12 CPU -SIM (System Integration module) -Clocks and Reset Generator (CRG) -Memory, Peripheral -On-chip Voltage Regulator

PERIPHERAL INTERFACING WITH 16-BIT MICRO-CONTROLLER (16 Hours)

Timer -parallel port programming -Stepper motors – LCD – Keyboard - Serial Port – ADC – DAC - Sensor Interfacing - Interrupt handling - PWM generation - DC motor control - automotive embedded system Application development using IO and related programming –UART – SPI - I2C - Various ways to use the CAN module in HCS12 - Micro-controller based system development using IO related programming

TIMERS, ALARMS, COUNTERS, EVENTS, INTERRUPTS, EXCEPTIONS (06 Hours)

Implementation of Timer – Alarms – Counters – Events - Interrupts and Exceptions in a Microcontroller

EMBEDDED SOFTWARE DEVELOPMENT LIFE CYCLE (SDLC) (13 Hours)

V Model Water fall - Requirement Engineering - Requirement gathering - Requirement analysis - Software Architecture - Software Prototyping - Software design - High level -Low level -Software Implementation - Software verification and validation -Software Development Practices - Basics of Project/Product Management -Software estimation - Resource planning and management - Risk Management - Software Quality processes - Requirement change management - Software Configuration management.

TEXT BOOK:

1. Frank Vahid and Tony Givargis, Embedded System Design: A Unified hardware/Software Introduction, John Wiley &Sons. (2002)
2. Muhammad Ali Mazidi, Danny Causey and Janice Mazidi. HCS12 Microcontrollers and Embedded Systems, Prentice Hall. (2008)

REFERENCES:

1. International Journal for Automotive Technology
2. IEEE Transactions on Vehicular Technologies
3. David E. Simon, (1999), an Embedded Software Primer, Pearson Education

SEMESTER/YEAR : II SEM
COURSE CODE : 20ESE5201
TITLE OF THE COURSE : AUTOMOTIVE CONTROL AND SIMULATION
L: T/A: P: C : 3: 0: 0: 3

COURSE OBJECTIVE

1. To design controllers for controlling the dynamic behavior of automotive systems.
2. To introduce control systems engineering terminology and learn modelling of physical systems.
3. To introduce nonlinear control theory and digital control systems.

COURSE OUTCOME

1. Develop mathematical models for automotive subsystems.
2. Explain and carry out time response, frequency response and stability analysis of control systems.
3. Proficiently use Matlab / Simulink software and perform time response and frequency response analysis of systems.

INTRODUCTION TO AUTOMOTIVE CONTROL AND SIMULATION (05 Hours)
Introduction to Control Systems and its classification, Control system applications in automotive engineering

MATHEMATICAL MODELLING OF PHYSICAL SYSTEMS (17 Hours)
Fundamentals of modelling using transfer function approach, Modelling of Suspension System, Power steering System, Fuel injection system and Antilock braking system, Introduction to Block Diagrams &Signal Flow Graphs, Time domain analysis, First Order, second Order, higher order control system response for typical inputs like Step, Ramp and Impulse inputs, Time response specifications, Error Analysis - Type number, Characteristic Equation, Poles and Zeroes concept, Error Analysis and Performance criterion, Controllers and their characteristics, Demonstration on the use of Simulink tools for solving mathematical models for time response of analysis

STABILITY ANALYSIS AND COMPENSATION TECHNIQUES (10 Hours)
Routh -Hurwitz stability criteria, Root Locus Method, Frequency response analysis, Types of compensators and compensator design, State Space Analysis of Control Systems, State variables, State Space representation, State Models, Solution of time invariant state equations

DISCRETE TIME SYSTEMS AND Z - TRANSFORM METHOD (10 Hours)

Introduction to z-transformation, Solving difference equations by the z-transform method, Inverse z transformation, Pulse transfer function and Stability analysis in the z-plane, Digital control systems, Introduction, Controllers, Modelling of digital control systems and implementation on controllers

HARDWARE IN-THE-LOOP TESTING (08 Hours)

Experimental setup for HIL, HIL testing, Introduction to LabCar, building scenarios and vehicle analysis using Labcar.

TEXT BOOK:

1. Norman S. Nise. *Control Systems Engineering,* 6th Edition, Wiley.(2010)

2. Richard C. Dorf and Robert H. Bishop. *Modern Control Systems*, 12th Edition, Prentice Hall.(2010)

REFERENCES:

1. www.engin.umich.edu/group/ctm

2. UweKiencke and Lars Nielsen. *Automotive Control Systems: For Engine, Driveline, and Vehicle*, 2nd Edition, Springer.(2010)

3. FaridGolnaraghi and Benjamin C. Kuo. *Automatic Control Systems,* 9th Edition, Wiley.(2009)

SEMESTER/YEAR : II SEM
COURSE CODE : 20ESE5202
TITLE OF THE COURSE : AUTOMOTIVE POWER ELECTRONICS AND DRIVES
L: T/A: P: C : 3: 0: 0: 3

COURSE OBJECTIVE

1. To develop maximum power point algorithms.
2. To analyze, design and simulate different power converters and dynamics of electrical machine.

COURSE OUTCOME

1. Able to understand and design power electronics and drive systems for different applications and conduct experiments, analyze and interpret data.
2. Able to understand and integrate new technology and use of modern engineering tools.

INTRODUCTION AUTOMOTIVE POWER ELECTRONICS AND DRIVES (03 Hours)
Need for Automotive Power Electronics, Power Electronic Vehicle Architecture, Future Trends.

AUTOMOTIVE POWER SEMICONDUCTOR DEVICES (08 Hours)
Introduction, Diodes, Power MOSFET's, IGBT, Power Integrated Circuits, Emerging Device Technologies: Super-Junction and SIC Devices, Power Losses and Thermal Management

AUTOMOTIVE POWER ELECTRONIC CONVERTERS (08 Hours)
DC-DC Converters, AC-DC Rectifiers, DC-AC Inverters, Alternators, Electrical power generation in the Vehicle, voltage protection, Power losses, EMC, EMC Ranges

AUTOMOTIVE MOTOR DRIVES (19 Hours)
Brushed-DC Electric Machinery for Automotive Applications, Induction Motor Drives, Power Electronics and Control for Hybrid and Fuel Cell Vehicles, Introduction, Power Electronics Requirements, Propulsion Motor Control Strategies-Slip Frequency Control Vector Control of Propulsion Motion, Sensor less Operation, APU Control System in Series Hybrid Vehicles, Fuel Cell for APU Applications

POWER ELECTRONICS APPLICATIONS IN-VEHICLE AND PASSENGER SAFETY (12 Hours)
Introduction, Power Electronics in Vehicle Safety, Power Electronics in Passenger Safety, Thermal Management, Introduction, Thermal Model of Electronic Devices, Maximum Power Ratings of Semiconductor Devices, Extruded Heat Sinks, and Multiple Devices on a Common Heat sink

TEXT BOOK:

1. Randall Shaffer. *Fundamentals of Power Electronics with MATLAB*, River Media.(2007)

2. Ali Emadi. *Handbook of Automotive Power Electronics and Motor Drives*, Taylor and Francis.(2005)

REFERENCES:

1. M. H. Rashid. *Power Electronics*, 3rd Edition, Prentice Hall.(2004)

2. N. Mohan, J. M. Undelan and W. Robbins. *Power Electronics: Converters, Applications and Design*, 3rd Edition, John Wiley and Sons.(2002)

3. Billings. *Switched Mode Power Supply Handbook*, 2nd Edition, McGraw Hill.(1999)

SEMESTER/YEAR : II SEM
COURSE CODE : 20ESE5203
TITLE OF THE COURSE : AUTOMOTIVE SOFTWARE ARCHITECTURE
L: T/A: P: C : 3: 0: 2: 4

COURSE OBJECTIVE

1. To understand the challenges of advanced software design and the issues associated with large-scale software architectures, frameworks, patterns and components.
2. To develop the understanding of the tools and techniques that may be used for the automatic analysis and evaluation of software.

PATTERNS AND COMPONENTS.

1. To develop the understanding of the tools and techniques that may be used for the automatic analysis and evaluation of software.

COURSE OUTCOME

1. Understand the principles behind software patterns and be able to apply a number of the fundamental patterns.
2. Understand the major approaches to automated software analysis achievable through static and dynamic analysis.

INTRODUCTION AUTOMOTIVE SW ARCHITECTURE (10 Hours)
Introduction to Automotive architecture and layered architecture, Need of open architecture, Introduction to AUTOSAR & history.

AUTOSAR Architecture Overview (10 Hours)
Microcontroller Abstraction layer, ECU abstraction layer, Service layer, AUTOSAR libraries.

AUTOSAR Interfaces and Interaction layers (10 Hours)
Type of Interfaces in AUTOSAR, General Interfacing Rules, Interfacing with Complex Drivers, Implementation of Memory Abstraction Interface, Communication, Data Transformation.

AUTOSAR Configuration (12 Hours)
Overview, Pre-compile time, Post-build time, variants.

AUTOSAR Integration and Runtime Aspects (08 Hours)
Mapping of Runnable, Partitioning, Scheduling, Mode Management, Error Handling, Reporting and Diagnostic, Debugging, Measurement and Calibration.

TEXT BOOK:

1. Tammy Noergaard, Embedded System Architecture, Second Edition, 2014
2. Kevin Roebuck, AUTOSAR, Emereo Pty Ltd, 2011

REFERENCES:

1. **http://www.autosar.org**

SEMESTER/YEAR : I SEM
COURSE CODE : 20ESE5131
TITLE OF THE COURSE : AUTOMOTIVE VEHICLE NETWORK
L: T/A: P: C : 3: 0: 2: 4

COURSE OBJECTIVE

1. This module enables the students to interface sensors in modern automotive electronic systems.
2. The students will be taught automotive sensors, characterization, sensor selection, interfacing, sensing, data logging.
3. Data processing for specified applications.

COURSE OUTCOME

1. To explain automotive sensors and interfacing techniques
2. To Design, model and simulate interfacing systems with sensors
3. To Develop and demonstrate interfacing systems

INTRODUCTION TO AUTOMOTIVE VEHICLE NETWORK (10 Hours)

Networks, Need for networks, Types of networks, Need for standards, TCP/IP model, Topologies, Error detection and correction mechanisms, Encoding schemes, Serial/parallel transmission, Bits, Baud and bandwidth Synchronous and asynchronous, Need and benefits of IVN, Classes of IVN protocols, Multiplexed electrical systems, Vehicle multiplexing, Bitwise contention, Network elasticity, Error processing and management

CONTROLLED AREA NETWORK (CAN) PROTOCOL (10 Hours)

Controller Area Network (CAN) Protocol, Main characteristics of CAN, CAN Applications, CAN in OSI Reference Model, CAN Data Link Layer, Principles of data exchange in CAN, Arbitration, Data Frame, Remote Frame, Error detection and management in CAN, CAN physical Layer, Bit encoding, Bit timing and synchronization, Relationship between data rate and bus length, Single wire and twin wire media, CAN repeaters, Medium-to-medium gateway, Protocol handlers, Micro-controllers and line drivers, Time-Triggered CAN (TTCAN), Comparison with other IVN protocols.

LOCAL INTERCONNECT NETWORK (LIN) PROTOCOL (05 Hours)

LIN consortium, LIN specification, LIN features, Technical overview, LIN operation, LIN frame format, Scheduling table, Network management of LIN cluster, IN Transport Layer, LIN node configuration and identification, LIN diagnostics, LIN physical layer, Comparison with other IVN protocols and Case Study

FLEXRAY PROTOCOL **(13 Hours)**

Future on board systems, Need for FlexRay, Origin of FlexRay, FlexRay consortium, FlexRay Objectives, FlexRay Features, Application requirements, Working of FlexRay, Network topologies, ECU architecture, Segment Configuration, Communication Cycles, FlexRay frame format, Timing of configuration protocol, Error control, and FlexRay core mechanisms, Coding and Decoding, Medium Access Control, Frame and Symbol Processing, Clock Synchronization, FlexRay Components, Comparison with other IVN protocols.

MEDIA ORIENTED SYSTEM TRANSPORT (MOST) PROTOCOL **(12 Hours)**

Emerging in car systems, Introduction to MOST, MOST goals, Features, Cables and Connectors, Data Types, Topology, Frame Format, Application Areas, System Description, Specification, Device Model, Device Implementation, Diagnostics and Comparison with other IVN.

TEXT BOOK:

1. Aswin Goel., *Fleet Management*, Springer.(2008)
2. Gilbert Held., *Inter- and Intra-Vehicle Communications*, CRC Press.. (2007)

REFERENCES:

1. Ronald W. Cox, Local Area Network Technology Applied to Automotive Electronics Communications, IEEE Transactions on Industrial Electronics, VOL. IE-32, No. 4, November 1985.
2. http://cache.freescale.com/files/microcontrollers/doc/brochure/BRINVEHICLENET.pdf
3. BehrouzForouzan., *Data Communications and Networking*, McGraw-Hill.(2003)
4. Dennis Foy., *Automotive Telematics*, Red Hat.(2002)
5. Ronald k. Jurgen. *Automotive Electronics Handbook*, McGraw-Hill.(1999)

SEMESTER/YEAR : I SEM
COURSE CODE : 20ESE5132
TITLE OF THE COURSE : REAL TIME EMBEDDED SYSTEMS
L: T/A: P: C : 3: 0: 2: 4

COURSE OBJECTIVE

1. To work on the principles of real time systems, concepts of RTOS and OSEK Standards.
2. To apply OSEK RTOS for developing real-time software for automotive applications.
3. To porting OSEK RTOS on embedded target and fault tolerance will be discussed.

COURSE OUTCOME

1. Design and implement time critical applications using OSEK RTOS.

INTRODUCTION TO REAL TIME EMBEDDED SYSTEMS (15 Hours)
Soft and Hard Real Time Systems, Real Time Operating Systems, Difference between general purpose and Real Time Operating System, Introduction to RTOS, Need of Embedded Systems, Need for RTOS in embedded applications, RTOS in automotive applications, Study of ECU using RTOS

OSEK STANDARD SPECIFICATIONS (07 Hours)
Introduction to OSEK Standards, OSEK OS, OSEK COM, OSEK NM, OSEK Implementation Language (OIL), OSEK/VDX time triggered operating system, OSEK/VDX fault tolerant communication

MULTITASKING, INTER PROCESS COMMUNICATION, TASK, THREAD, PROCESS, NEEDS, PURPOSE, ADVANTAGES AGAINST EACH OTHER, PCB, STATES, FLOW OF PROGRAM EXECUTIONS (20 Hours)
Implementation of Multitasking , Inter Process communication in an Airbag ECU using, OSEK RTOS, programming concepts, efficient software development for ECUs, Implementation of multitasking, flow of executions, different states realization, Binary Semaphore, Mutex semaphores, Shared memory, Pipe, Message Queues, Mail Box, sockets

OSEK NM (06 Hours)
Scope of NM,-Direct Network Management-Indirect Network Management, Booting, Board Support Packages (BSP) for RTOS and Reconfiguration-making kernel-image & porting OSEK RTOS on the embedded target with an automotive application

RTOS INITIALIZATION AND STARTING (08 Hours)
Booting, Board Support Packages (BSP) for RTOS and Reconfiguration, making kernel Using OSEK RTOS, demonstration of RTOS for various applications

TEXT BOOK:

1. Frank Vahid and Tony Givargis. Embedded System Design(2002)
2. Lemieux Joseph. *Programming in the OSEK/VDX Environment*, R & D.(2001)

REFERENCES:

1. Phillip A. Laplante. *Real-Time Systems Design and Analysis- An Engineers Handbook*, IEEE Press, PHI.(2001)
2. Alan C. Shaw. *Real-Time Systems and Software*, John Wiley.(2001)
3. Jane W.S. Liu. *Real – Time Systems*, Prentice-Hall.(2000)
4. Gordon Doughman. *Programming the Motorola M68HC12 Family*, Anna books/Rtc.(2000)

SEMESTER/YEAR : II SEM
COURSE CODE : 20ESE5231
TITLE OF THE COURSE : EMBEDDED ARCHITECTURES AND TECHNOLOGY
L: T/A: P: C : 3: 0: 2: 4

COURSE OBJECTIVE

1. Explain Hardware and software architecture in detail.
2. Exposure to operating system based design.
3. Exposure to Real world design, Application -level techniques.

COURSE OUTCOME

1. Understanding of embedded processor architecture and programming, I/O and device driver interfaces to embedded processer, OS primitives.
2. Ability to design hardware and software layers of a typical embedded system.

INTRODUCTION TO EMBEDDED SYSTEMS ARCHITECTURE: **(06 Hours)**
The Embedded Systems Model, An Overview of Programming Languages and Examples of Their Standards, Standards and Networking, Multiple Standards-Based Device Examples: Digital Television (DTV)

EMBEDDED HARDWARE ARCHITECTURE: **(12 Hours)**
ISAs for Embedded Systems, Board Memory, Board I/O and Board Buses, GPP Microarchitectures, ARM ISA, FPGA Architectures, Reconfigurable Logic, DSP Microarchitectures, Networks-on-Chips.

EMBEDDED SOFTWARE ARCHITECTURE: **(14 Hours)**
Device Drivers: Device drivers for interrupt handling, Memory device drivers, on-board bus device drivers, Middleware and Application Software: Middleware examples, Application layer software examples.

EMBEDDED OPERATING SYSTEM: **(09 Hours)**
Introduction, multitasking and process management, memory management, I/O and file system management, IoT OS examples: TinyOS, contikiOS, Programming model, Memory management, communication protocol stack.

DESIGN AND DEVELOPMENT: **(09 Hours)**
Creating an Embedded System Architecture, Implementing the Design, Quality Assurance and Testing of the Design.

TEXT BOOKS:

1. Tammy Noergaard , "Embedded Systems Architecture, A Comprehensive Guide for Engineers and Programmers ",Second Edition,2012

REFERENCES:

1. www.arm.com
2. C. Maxfield, “The Design Warrior's Guide to FPGAs: Devices, Tools and flows”, Newnes, 2004.
3. Phil Lapsley, Jeff Bier, Amit Shoham, Edward A. Lee, “DSP Processor Fundamentals: Architectures and Features” , Wiley India Pvt Ltd,2009

SEMESTER/YEAR : II SEM
COURSE CODE : 20ESE5232
TITLE OF THE COURSE : ADVANCED EMBEDDED SYSTEMS
L: T/A: P: C : 3: 0: 2: 4

COURSE OBJECTIVE

1. Provide an overview of Advanced Embedded system
2. Provide the knowledge and hands-on ARM cortex based microcontrollers, Raspberry PI and Arduino Platforms.
3. Provide understanding of Linux environment and Python
4. Programming language

COURSE OUTCOME

1. Able to prototype Embedded system Applications on Arduino, Raspberry Pi.
2. Able to use ARM Cortex M based microcontrollers for Application Design and development
3. Familiarity with Linux environment and able to develop simple web applications using Python.

ARM CORTEX PROCESSORS: (10 Hours)

Introduction to ARM CORTEX series, improvement over classical series and advantages for embedded system design. CORTEX A, CORTEX M, CORTEX R processors series, versions, features and applications. Need of operating system in embedded system, desired features of operating system & hardware support from processor, Firmware development using CMSIS standard for ARM Cortex. Survey of CORTEX based controllers, its features, comparison.

REAL TIME INTERFACING WITH ARM CORTEX BASED MICROCONTROLLER: **(12 Hours)**

Features, Architecture, System control block (PLL and VPB divider), Memory Map, GPIO, Pin Connect Block, timer, interfacing with LED, LCD, GLCD, KEYPAD. Interfacing the peripherals to microcontroller: UART Applications, on-chip ADC using Interrupt (VIC), EEPROM using I2C, SDCARD using SPI

RAPID PROTOTYPING FOR EMBEDDED SYSTEM WITH RASPBERRY PI: (07 Hours)

Introduction to Rapid Prototyping using Raspberry Pi, Configuration of Raspberry Pi, Linux on Raspberry Pi: Using the Command Line, Files and the File system, More Linux Commands.

SCRIPTING LANGUAGE FOR EMBEDDED SYSTEMS: **(09 Hours)**

Python-basic: Basic Syntax, variable types, basic operators, decision making, loops, tuples, dictionary, modules, files I/O, Exceptions. Python-Advanced: Classes/Objects, Regular expressions, CGI Programming, Database access, Networking, Multithreading, XML processing, GUI programming, Flask: Introduction, Creating folders, database schema, Creating the database, the View functions, The Templates, Testing the application.

REAL TIME INTERFACING WITH RASPBERRY PI AND ARDUINO: (12 Hours)

Basic interfacing With Pi: Interfacing of Sensors and Actuators, Remote Access using Putty. Basic Interfacing with Arduino Uno: Control LEDS from GPIO Pins, Input-Switch Buttons, DC Motor, Servo Motor, Stepper motor, GSM Interface, IOT/Web Development using Raspberry pi: Introduction to Web Framework: GPIO-Control, Webcam Installation, Custom Webpage on Raspberry Pi, Integrating Webcam+ Custom Page.

TEXT BOOKS:

1. Shibu K V. "Introduction to Embedded systems", 2009 McGraw Hill Education
2. Matt Rachidson"Getting started with Raspberry Pi " 2013, O'Reilly publisher
3. Andrew Sloss, Dominic Symes, Chris Wright, "ARM System Developer's Guide – Designing and Optimizing System Software", 2004, Morgan Kaufmann Publishers

REFERENCES:

1. https://www.raspberrypi.org/,
2. http://www.arduino.cc/
3. ARM architecture reference manual
4. www.arm.com,
5. http://www.freescale.com

SEMESTER/YEAR : III SEM
COURSE CODE : 20ESE5331
TITLE OF THE COURSE : SAFETY CRITICAL SYSTEMS
L: T/A: P: C : 3: 0: 2: 4

COURSE OBJECTIVE

1. Equip you with an appreciation of the various phases of the safety life cycles in a schematic manner
2. Help to analyze risk based approaches to the development of the safety requirements

COURSE OUTCOME

1. Able to take project management responsibility and wish to ensure that they are aware of most recent developments in safety systems
2. Have an understanding in specific areas of safety related systems, technology

INTRODUCTION TO SAFTEY SYSTEMS (12 Hours)

ASIL, Functional Safety Management, why Functional Safety Management-Basic standard of Functional Safety-management of Functional Safety- Functional Safety plan,-concept phase-Risk analysis and Hazard analysis, Product Development system level

ACTIVE SAFETY SYSTEMS (13 Hours)

Antilock Braking systems (ABS), Traction Control Systems (TCS), Electronic Stability Program (ESP) of Bosch, Adaptive Cruise Control (ACC),Radar Systems, Vision Systems, Night Vision Systems, Brake Controller

PASSIVE SAFETY SYSTEMS (13 Hours)

Airbag systems, Seat belt tensioners, Pedestrian Protection, Intelligent Speed Adaptation (ISA),Intelligent Speed Adaptation (ISA),Crash Testing

SAFTEY STANDARDS (12 Hours)

Introduction to ISO26262, ISO26262 and challenges, ISI26262 adaptation, IEC61508, ISO26262 principles, ISO26262 safety life cycle, SO26262 Structure, Vocabulary Important ,ISO analysis

TEXT BOOK:

1. Developing Safety-Critical Software: A Practical Guide By Leanna Rierson
2. Embedded Systems Security: Practical Methods for Safe and Secure Software By David Kleidermacher

REFERENCES:

1. "ISO 26262 Software Compliance: Achieving Functional Safety in the Automotive Industry" white paper by Parasoft
2. "Automated Defect Prevention for Embedded Software Quality" white paper by VDC Research

SEMESTER/YEAR : III SEM
COURSE CODE : 20ESE5332
TITLE OF THE COURSE : INSTRUMENT CLUSTER AND INFOTAINMENT SYSTEMS
L: T/A: P: C : 3: 0: 2: 4

COURSE OBJECTIVE

1. Integration of our digital life into cars due to customer demand and integrate some of the best ergonomically best designed visual and audio components to give you the feel of home.
2. To give highly dynamic innovations that can ensure various applications on the road.

COURSE OUTCOME

1. Understand the User experience critically realistically and are able to deliver great looking solutions.

INTRODUCTION TO INFOTAINMENT SYSTEMS (10 Hours)
Introduction to Infotainment Systems, In-car entertainment (ICE), or in-vehicle infotainment (IVI), Car audio, Carputers, Internet, Safety concerns, HMI

INSTRUMENT CLUSTER SYSTEMS (10 Hours)
Display systems, Personalized screen, Electronic instrument cluster, Digital instrument panel, Automotive, LCD, Speedometer, Tachometer, lamp, High

NAVIGATION SYSTEMS (10 Hours)
Global Positioning Systems (GPS), Inertial Navigation Systems (INS), Vehicle Location and Navigation

INFOTAINMENT SYSTEMS (08 Hours)
Real-time management and planning of commercial vehicle operation, Satellite Radio (XM-Radio and SIRIUS), Fleet Management

MOBILE APPLICATIONS (12 Hours)
Mobile communication antennas (cellular antennas) for the automotive and commercial vehicle industry as well as for M2M markets, Types of Cellular antennas: - External Cellular Antennas, Integrated Cellular Antennas, and Future.

TEXT BOOK:

1. Embedded Android: Porting, Extending, By Karim Yaghmour
2. Clusters in Automotive and Information & Communication Technology: Innovation, Multinationalization and Networking Dynamics By Paul J.J. Welfens (Editor)

REFERENCES:

1. Embedded Security in Cars: Securing Current and Future Automotive IT Applications Hardcover – Import, by Kerstin Lemke (Editor), Christ of Paar (Editor) , Marko Wolf (Editor) (2005)

SEMESTER/YEAR : IV SEM
COURSE CODE : 20ESE5431
TITLE OF THE COURSE : PROTOCOL NETWORKS AND WIRELESS COMMUNICATION
L: T/A: P: C : 3: 0: 2: 4

COURSE OBJECTIVE

1. Detailed discussion of communication in wired and wireless embedded system.
2. Understand the wireless network communication stack, protocols and sensor network applications.

COURSE OUTCOME

1. Gain in-depth knowledge of packet flow in the wireless communication network
2. Gain insight into various concepts of wireless and embedded networks

EMBEDDED COMMUNICATION PROTOCOLS: (07 Hours)

Embedded Networking: Introduction, Serial/Parallel Communication, Serial communication protocols, RS232 standard, RS485, Synchronous Serial Protocols-Serial Peripheral Interface (SPI), Inter Integrated Circuits (I2C), PC Parallel port programming, ISA/PCI Bus protocols, Fire wire.

ETHERNET BASICS: (13 Hours)

Elements of a network, Inside Ethernet, Building a Network: Hardware options: Cables, Connections and network speed, Design choices: Selecting components, Ethernet Controllers. Using the internet in local and internet communications, Internet protocol, UDP and TCP concepts, Serving web pages with Dynamic Data, Serving web pages that respond to user Input, Email for Embedded Systems, Using FTP, Keeping Devices and Network secure.

WIRELESS EMBEDDED NETWORKING: (12 Hours)

Wireless sensor networks: Introduction, Applications, Network Topology, Localization ,Time Synchronization , Energy efficient MAC protocols , SMAC, Energy efficient and robust routing , Data Centric routing, Wireless LAN – IEEE 802.11 Standard-Architecture, Services – AdHoc Network , Hiper LAN, Blue Tooth.

MOBILE NETWORKS: (08 Hours)

Cellular Wireless Networks, GSM Architecture, Protocols, Connection Establishment, Frequency Allocation, Routing, Handover, Security GPRA

ROUTING, TRANSPORT AND APPLICATION LAYERS: (10 Hours)

Mobile IP , DHCP, AdHoc Networks , Proactive and Reactive Routing Protocols, Multicast Routing, TCP over Adhoc Networks, WAP Architecture ,WWW Programming Model , WDP ,WTLS , WTP , WSP ,WAE , WTA Architecture ,WML , WML scripts.

TEXT BOOKS:

1. Frank Vahid, Givargis 'Embedded Systems Design: A Unified Hardware/Software Introduction', Wiley Publications, 2002
2. Bhaskar Krishnamachari, 'Networking wireless sensors', Cambridge press 2005
3. KavehPahlavan, Prasanth Krishnamoorthy, " Principles of Wireless Networks' PHI/Pearson Education, 2003

REFERENCES:

1. Jan Axelson, 'Parallel Port Complete' , Penram publications, 2006
2. Dogan Ibrahim, 'Advanced PIC microcontroller projects in C', Elsevier 2008

SEMESTER/YEAR : IV SEM
COURSE CODE : 20ESE5432
TITLE OF THE COURSE : PRODUCT MANAGEMENT
L: T/A: P: C : 3: 0: 2: 4

COURSE OBJECTIVE

1. To make students learn management issues relevant to product design and development
2. To explain about product development process, design management, analysis of customers and competitors, cost management and value analysis, quality processes, total quality management, PLM and PDM with suitable case studies.

COURSE OUTCOME

1. To explain management issues relevant to product design and development
2. To develop benchmarking/QFD/PDS for products
3. To explain importance and application of TQM, PLM and PDM

INTRODUCTION TO PRODUCT DEVELOPMENT MANAGEMENT (07 Hours)

Overview, New product development process, Concept and best practice, Organizational structures, Marketing organizations, Role of sales forces, Global marketing, Product Management - Fact versus fiction, Factors affecting product management

DESIGN MANAGEMENT (13 Hours)

Design management systems, Legal implications, Phases of design process, Production planning and feasibility, Design specification, Conceptual design, Embodiment design, Detailed design Post-design release, Role of the corporate design manager, Customer and Competitor Analysis, Understanding customers and market, Need to know about customers, Response of customers to a marketing program, Creation of product feature matrix, Assessment of competitor's current product, Comparison of value chain, Assessment of strategies, Differential advantage analysis

QUALITY PRODUCTS AND PROCESSES (08 Hours)

Design process in concurrent engineering, Quality function deployment and its process, Quality inspection and statistical sampling, Statistical process control Systems for eliminating defects, Fundamentals of TQM, Some important philosophies and their impact on quality (Deming, Juran, Crossby), Features of Malcolm Baldridge quality award, Identification and measurement of quality costs, Issues related to products, Processes, Organization, Leadership, and Commitment for total quality achievement

TOOLS AND TECHNIQUES USED IN TQM (12 Hours)

Seven tools, essential features of QCC, ZD, Kaizen and JIT programmes, Fundamental concepts about Quality Function Deployment (QFD), Components of Total Quality System

(TQS) in organizations, Quality Auditing - Introduction to ISO 9000 and 14000 standards, case studies, Product Life cycle Management (PLM), Different phases of product lifecycle and corresponding technologies, Product development processes and methodologies, Foundation technologies and standards (e.g. visualisation, collaboration and enterprise application integration), Information authoring tools (e.g., MCAD, ECAD, and technical publishing), Core functions (e.g., data vaults, document and content management, workflow and program management), Functional applications (e.g., configuration management)

PRODUCT DATA MANAGEMENT (PDM) (10 Hours)

Introduction to PDM, Advantages and disadvantages of PDM, Engineering data, Engineering workflow, PDM implementation, Cost Management and Value Analysis, Basics of project cost management, Introduction to estimating and budgeting, Procurement management processes, Principles and skills to the management of a project, Planning and scheduling in the pre-phase of a project, Worth and value, current day customer needs, Data collection, FAST diagram, Case studies

TEXT BOOK:

1. Brigitte Borja De Mozota. *Design Management: Using Design to Build Brand Value and Corporate Innovation*, Allworth Press (2004)

2. S. Thomas Foster and Jr., Prentice. *Managing Quality – An Integrative Approach* 2nd edition, Hall Publishing Co. (2003)

REFERENCES:

1. Karl Ulrich and Steven Eppinger. *Product Design and Development* 4th edition, McGraw-Hill/Irwin (2004)

2. Stephen C. Armstrong. *Engineering and Product Development Management,* Cambridge University Press (2005)

3. Donald R. Lehmann and Russell S. Winer. *Product Management* 4th edition, Tata McGraw-Hill Publishing Company Limited (2007)

SEMESTER/YEAR : IV SEM
COURSE CODE : 20ESE5433
TITLE OF THE COURSE : INTERNET OF THINGS AND SMART VEHICLE
L: T/A: P: C : 3: 0: 2: 4

COURSE OBJECTIVE

1. To provide better understanding of Societal, Business Perspective and Technical knowledge of IOT domain
2. Understanding of IOT characteristics, IOT use cases
3. Applications of IOT in different domains

COURSE OUTCOME

1. Understand Societal, Business Perspective and Technical knowledge of IOT domain
2. Able to Perform concept design, product design and development of embedded systems in IOT domain

INTRODUCTION TO IOT: (09 Hours)
Introduction, IOT Messages, History of IOT, IOT domains, landscape, ecosystem, business models

IOT CHARACTERISTICS: (08 Hours)
IOT use cases – consumer and enterprise, Consumer Electronics

IOT APPLICATIONS: (10 Hours)
IOT in Telecommunications, Smart Manufacturing, Smart Vehicles, IOT in Enterprises, Smart Transportation, Smart Energy, Smart Retail and logistics

IOT AUTOMOTIVE APPLICATIONS: (15 Hours)
Run apps in the in-vehicle entertainment systems, Use a link to a Smartphone, Remote access to the vehicle through an API, Access to data through the On Board Diagnostics port called OBD-II, New and emerging initiatives

SMART VEHICLE: (08 Hours)
Origins, History, Models: Production Models, Future Models, Concept and Unproduced Models, Electric Versions: Smart Electric Drive and Electric Vehicle Conversions, Safety, Modifications, Marketing

TEXT BOOK:

1. S. S. Manvi, M. S. Kakkasageri, “Wireless and Mobile Network concepts and protocols”, Wiley, First edition, (2010)

2. P. Kaveh, Krishnamurthy, “Principles of wireless networks: A unified approach”, PHI, (2006)

REFERENCES:

1. ItiSaha Mishra, “Wireless communication and networks 3G and beyond “, MGH (2009)

SEMESTER/YEAR : IV SEM
COURSE CODE : 20ESE5434
TITLE OF THE COURSE : WEB AND MOBILE APPLICATIONS
L: T/A: P: C : 3: 0: 2: 4

COURSE OBJECTIVE

1. The course harnesses the skills of student in developing mobile application development using the Android platform.

COURSE OUTCOME

1. Students will be able to understand object-oriented concepts,
2. Design user interfaces for mobile devices,
3. Develop mobile applications, and create and consume web services.

WEB BASICS: (15 Hours)

Basic anatomy of Web, Embedded Web Server and Thin Clients, Differences between Embedded System and large Web Sites, Web Contents: Static, Dynamic, Common Web Content Types: Plain text, Images, XML, JSON, HTML, JavaScript, CSS, Web Technologies: Service-oriented Architecture, REST Services, SOAP and WSDL, Node.js

JAVA AND SPRING: (17 Hours)

Basic Java: Overview, Environment setup, syntax, Objects, Classes, data-types, Variable types, Modifier types, operators, loop control, decision making, numbers, characters, strings, arrays, regular expressions, methods, Files I/O, exceptions. Advanced Java: Object oriented properties, Interfaces, Packages, data structure, collection, generics, serialization, networking, multithreading, applet basics. Spring: Overview, architecture, environment setup, IoC containers, Bean definition, Bean scopes, Bean life-cycle, Bean post-processors, Bean definition inheritance, Dependency injection, Event handling, JDBC Framework, Transaction management.

CONTROLLING EMBEDDED SYSTEM THROUGH SMART PHONE: (12 Hours)

Smart Phone technology, Smart Phone Interaction Models: As a Remote Control (Connecting through Bluetooth), Dual Connectivity (Bluetooth and Internet), Gateway Connectivity, Ad-hoc mobile phone networks (peer-to-peer), System Architecture Related tools and frameworks

BUILDING THE SMARTPHONE APPLICATION USING ANDROID: (06 Hours)

Android architecture, Adapters and Widgets, UI design, Application components, Different security levels, Create Android application.

TEXT BOOKS:

1. Herbert Schildt: Java The Complete Reference, 7th Edition, Tata McGraw Hill, 2007
2. Wei-Meng Lee, “Beginning Android 4 Application Development” Wrox Publications, 2012.
3. Paul Deital and Harvey Deital, ”Android How to Program” , Detial associates publishers, 2013

REFERENCES:

1. Y. Daniel Liang: Introduction to JAVA Programming, 7th Edition, Pearson Education, 2007.
2. http://developer.android.com
3. ZigurdMednieks, Laird Dornin, G. Blake Meike, Masumi Nakamura, ”Programming Android Java Programming for the New Generation of Mobile Devices”, O'Reilly Media, July 2011.

SEMESTER/YEAR : I SEM
COURSE CODE : 20ESE5104
TITLE OF THE COURSE : AUTOMOTIVE SYSTEM LAB
L: T/A: P: C : 0: 0: 4: 2

1. Demonstration and discussion on the following physical automotive systems to understand the Construction, working and integration with other systems:
    - Comfort and Convenience System
    - Engine Management Systems
    - Safety
    - Infotainment and Cluster
    - Autonomous Driving Vehicle
2. Demonstration and discussion on the following automotive electronic systems and components:
    - Automotive sensors and actuators
        - Pressure sensor module
        - Speed sensor module
        - Temperature sensor module
        - Injectors, solenoids, DC and Stepper motors
        - CAN demo module
    - Fuel injection system demo setup
    - Connect Engine Test Bench with EFI
3. Group tasks

SEMESTER/YEAR : I SEM
COURSE CODE : 20ESE5105
TITLE OF THE COURSE : AUTOMOTIVE EMBEDDED SYSTEMS LAB
L: T/A: P: C : 0: 0: 4: 2

- Learning IDE for embedded micro-controller (Freescale codewarrior)
- Simple C/assembly language programming using IDE for micro-controller
- Switches, LED, seven segment, LCD and key pad interfacing with micro-controller
- Motor control (PWM) & sensor (ADC) interfacing and Serial communication with microcontroller
- Embedded programming by using Freescale codewarrior for HCS12
- Parallel port interfacing for HCS12
- Configuring the timers/counter and interrupt handling
- Configuring PWM module for DC motor control
- Use of ADC for sensor interfacing
- Working with SCI, SPI and I2C module
- Configuring HCS12 for CAN and LIN communication

SEMESTER/YEAR : II SEM
COURSE CODE : 20ESE5204
TITLE OF THE COURSE : CONTROL AND SIMULATION LAB
L: T/A: P: C : 0: 0: 4: 2

- Mathematical Modeling in Simulink
- I/O Modeling in Simulink-PWM
- Mathematical model of DC electric motor in Simulink
- Development of a speed control application
- HIL simulation of plant and controller
- Vehicle analysis using labcar

SEMESTER/YEAR : II SEM
COURSE CODE : 20ESE5205
TITLE OF THE COURSE : AUTOMOTIVE POWER ELECTRONICS LAB
L: T/A: P: C : 0: 0: 4: 2

- Introduction to MATLAB
- Modeling and Simulation of DC-DC converters
- Modeling and Simulation of AC-DC Rectifiers
- Modeling and Simulation of DC-AC Inverters
- Building and testing of power converter circuits
- Modeling and Simulation of DC Motor Drives
- Modeling and Simulation of Induction Motor Drives
- Building and testing of power electronic control circuits for DC motors for speed control
- Study of power electronics in hybrid and electrical vehicles

SEMESTER/YEAR : III SEM
COURSE CODE :20ESE5301
TITLE OF THE COURSE : DISSERTATION PHASE 1

L: T/A: P: C : 0: 0: 0: 3

COURSE OBJECTIVES:

1. To develop the work practice in students to apply theoretical and practical tools/techniques
2. To improve the professional competency
3. To improve research aptitude by touching the areas which otherwise not covered by theory or laboratory classes.
4. To solve real life problems related to industry and current research.

COURSE OUTCOMES:

1. Solving of real time problems not necessarily new line of enquiry, but shows that student has mastered research and synthesizing skills in producing a contribution to knowledge.
2. Builds competency and research aptitude.

The thesis shall consist of research work done by the candidate or a comprehensive and critical review of any recent development in the subject of specialization or a detailed report of project work consisting of experimentation/numerical work, design and or development work that the candidate has executed.

SEMESTER/YEAR : IV SEM
COURSE CODE :20ESE5401
TITLE OF THE COURSE : DISSERTATION PHASE 2

L: T/A: P: C : 0: 0: 0: 6

COURSE OBJECTIVES:

The dissertation demonstrates the student's mastery of relevant resources and methods.

1. An ordered, critical exposition of knowledge gained through student's own effort.
2. Demonstrates sound under-standing of research process.
3. Demonstrates knowledge of appropriate methodology.
4. Demonstrates ability to present study in a disciplined way in scholarly conventions of the discipline.
5. Ability to make critical use of published work.

COURSE OUTCOMES:

1. Improves the professional competency and research.
2. Develops the work to apply theoretical and practical tools/techniques
3. Solve problems related to industry and current research.
4. Possible publication in journal or conferences.

THE REPORT GENERALLY CONTAINS:

1. Cover
2. Title page
3. Certificate(s)
4. Acknowledgements
5. Abstract
6. Contents page
7. List of figures or Tables
8. Introduction
9. Literature survey
10. Methodology
11. Results and Discussion
12. Conclusion and scope of future work.
13. Reference list / Bibliography
14. Appendices.

Course code: 18VM102 Total Hours : 30 hrs	MATHEMATICS-I	L	T	P	C
		2	-	-	2

Course Objectives	The objective of this course is to make the students : 1. Exposed to fundamentals of Mathematics including fractions, Logarithms, Matrices & Determinants 2. Understand concepts of Complex Numbers & Trigonometry and their applications in engineering 3. Understand the basics of differentiation and differential calculus and solve application 4. Apply the concepts of mathematics to engineering problems.
Course Outcomes	Upon successful completion of this course, the trainee will be able to: 1. Analyze and apply mathematical equations 2. Solve mathematically technical problems 3. Apply the concepts of mathematics to engineering problems.

MODULE-1

Fundamentals of Mathematics- Fractions-Definition, Types of fractions, Algebra of fractions (Addition,Subtraction, Multiplication and Division), Use of Logarithmic table, Simple problems, Logarithmic laws, Indices and Laws of Indices, Solution of linear equations, Solutions of Quadratic equations-Factorization, Using formula. **[05 Hrs]**

MODULE-2

Matrices and determinants-Definition of matrix and its types and matrix algebra, Problems on matrices addition, subtractions and multiplication, Transpose of a Matrix, Definition of determinant and its Evaluation, Properties of determinants.(Without Proof), Minors, Co-factors and Adjoint of a matrix, Inverse of a matrix, Solution of linear simultaneous equations using determinant method (Cramer's Rule). **[05 Hrs]**

MODULE-3

Complex numbers-Introduction of complex numbers, Representation of complex numbers, Algebra of complex numbers, Polar form of complex numbers, Exponential form of complex, Exercises on polar and exponential forms. **[04 Hrs]**

MODULE-4

Trigonometry-Defining the trigonometric functions, finding trigonometric values, Values of the trigonometric functions of 30°, 45°, 60° and 90°, Trigonometric functions of any angle and signs of trigonometric functions, Exercises on signs of trigonometric functions, Trigonometric identities, Exercises on trigonometric identities, Compound angles (sum or difference of two angles without proof), Exercises on compound angles, Multiple and Sub-Multiple angles, Exercises on multiple and sub multiple angles, Product formulae (No Problems), Heights and distances, Exercises on heights and distances(Simple Problems), Graphs of Trigonometric functions(Only Sin and Cos). **[08 Hrs]**

MODULE-5

Differential calculus- Limits definition and evaluation of limits (No derivations), Types of functions (only odd and even functions), Definition of derivative of a function and slope of tangent of the curve, Differentiation of algebraic and exponential funtions(Without Proof), Differentiation of trigonometric functions (Without Proof), Differentiation of sum, difference, product quotient of functions, Exercises on derivations of sum, difference, product, quotient of functions, Exercises on derivative of trigonometric functions, Derivatives functions of functions rule,Derivatives of inverse function, Differentiation of parametric equations, Successive differentiation, Application of differentiation-velocity and acceleration. **[08 Hrs]**

Text Books:

1. Technical mathematics - Rice and Knight,Mc-Graw Hill Book he.
2. Applied mathematics for Polytechnics-H.K.Dass

Reference Books:

1. Higher Engineering mathematics-B.S.Grewal
2. Higher Secondary Mathematics.

Course code: 18VM103 Total Hours: 30 Hrs	APPLIED SCIENCE	L	T	P	C
		2	-	-	2
Course Objectives	The objective of this course is to make the students understand : 1. Usages of SI units and laws of motion 2. Composition and resolution of forces and condition of equilibrium 3. Understand properties of solids and fluids 4. Understand physics of heat transfer 5. acidic, basic and neutral nature of solutions 6. Basics of Industrial and Organic Chemistry 7. Fundamentals of Modern Physics, Wave motion and Laser technology				
Course Outcomes	After successful completion of the course, the students should be able to : 1. Understand fundamentals of Force, Motion & Energy and Laws governing them 2. Apply concepts of resolution of forces and Principles of Equilibrium 3. Understand properties of solids & fluid and physics of heat 4. Understand basics of industrial & organic chemistry and their applications 5. Understand fundamentals of Modern Physics, Wave motion and Laser technology				

MODULE-1

Physical World: Physical quantities, Types of systems of units, Fundamentals and derived quantities, S.I. Units, Dimensions.

Force, Motion and Energy: Linear motion, Displacement, velocity, acceleration, Equations of motion, Problems, Newton's law of motion, Momentum, Law of conservation of momentum, Force, inertia, Work, power, energy, Law of conservation of energy, Circular motion, Angular displacement, angular velocity angular acceleration. **[06 Hrs]**

MODULE-2

Composition and resolution of Forces: Definition of composition, resultant, equilibrant, Law of parallelogram of forces, Triangle law of forces, Polygon law of forces.

Equilibrium of forces: Introduction, System of forces, Principal of equilibrium, Lamis theorem, Problems, Moments and its applications, Couple.

Center of gravity & Moment of Inertia: Introduction, Centroid of plane figures, Methods of finding out centre of gravity of plane, Axis of reference, Problems, Center of gravity of solid bodies, Moment of inertia of an irregular plane area. **[06 Hrs]**

MODULE-3

PROPERTIES OF SOLIDS AND FLUIDS: Plasticity, Elasticity, Stress, Strain, Hooke's Law, Young's modulus, Bulk modulus, Rigidity modulus, Surface tension, Capillarity, Viscosity.

Heat: Definition of heat, Thermometry, Platinum resistance thermometer, Thermocouple, Pyrometer, Calorimetry, Specific heat capacity, Heat transfer, Expansion of gas. **[06 Hrs]**

MODULE-4

Theory of Acids and Bases: Introduction, Hydrogen ion Concentration (pH Value)

Industrial Chemistry: Corrosion, Types of corrosion, Industrial Water, Disadvantages of using hard water in industry

ORGANIC CHEMISTRY: Introduction, Aliphatic hydrocarbons, Aromatic hydrocarbons (Benzene hydrocarbons), Nuclear Fission - Phenomenon of fission with example, Nuclear fusion - Phenomenon of fusion with example. **[06 Hrs]**

MODULE-5

MODERN PHYSICS: Structure of atom with schematic diagram, Radio activity, Nuclear Fission, Nuclear Fusion.

WAVE MOTION: Simple Harmonic Motion, Relation between wave velocity, frequency and wave length, Newton's Laplace equation for velocity of sound.

LASER: Meaning, materials used, types, Working principle, Application, Reflection, Refraction, Optical fiber, types, Working principle, Application. **[06 Hrs]**

Text Books:

1. Applied Science (Physics and Chemistry) - TTTI, Madras
2. Applied Mechanics and Strength of Material - R.S. Khurmi
3. Text book of Applied Mechanics – Ramamrutham

Reference Books:

1. Engineering Mechanics (Statics & Dynamics) - Irving H.Shames
2. Engineering Mechanics - S.Timoshinko & Young

Course Code: 18VM104 Total Hours :45 Hrs	ELECTRONICS - I	L	T	P	C
		3	-	-	3
Course Objectives	The objective of this course is to make the students : 1. Effectively use digital multi-meter, function generator and oscilloscope. 2. Analyze the working of dc circuits of a diode, transistor and field effect transistor. 3. Understand the characteristics of different electronic devices. 4. Test the different electronic devices for its condition				
Course Outcomes	Students after the completion of this course will be able to : 1. Identify the unique vocabulary associated with electronics and explain the basic concepts of Semiconductor diodes such as p-n junction diode, characteristics and ammeters, DC loadline, Zener diode. 2. To apply the basics of diode to describe the working of rectifier circuits such as Full and half wave rectifiers. 3. To solve examples on rectifiers for parameters such as Capacitance, load and source effect, line and load regulations, and circuit current				

MODULE-1

Fundamentals of Electronics: History & development of electronics, Structure of an atom, electric charge, Movement of Electrons [Current] And Potential Difference (voltage)

Resistance & resistivity Types of Resistors Colour coding of resistors. ohm's law problems based on ohm's law resistors in series combination-simple problems resistors in parallel combination-simple problems resistors in series and parallel combination-simple problems Kirchhoff's voltage law Kirchhoff's current law. Problems based on KVL Problems based on KCL **[08 Hrs]**

MODULE-2

Capacitor and Inductor
Capacitor, capacitance
Types of Capacitor Capacitor in series Capacitor in Parallel

Inductor, inductance Types of Inductors
Alternating current, Direct current
Continuous Waveform terms and definition-Waveform, cycle, frequency, period
Instantaneous value,rms value, peak value, peak to peak value, amplitude
Relationship between frequency and time.
Revision [**08 Hrs]**

MODULE-3

Introduction to Semiconductors

Introduction to matter and its classification

Energy level Diagram, Importance of energy band in solids classification of solids on the basis of energy bands Temperature co-efficient and its classifications Intrinsic semiconductor Doping Extrinsic semiconductor extrinsic semiconductors N—type extrinsic semiconductors P-type majority and minority carriers Revision **[10 hrs]**

MODULE-4

Semiconductor Diode and Applications

Introduction to PN -Junction theory, Barrier potential PN junction under Forward bias PN junction under Reverse bias Diode, Forward and Reverse bias characteristics Ideal diode and practical diode Temperature effect on diode characteristics Application of diodes as Half wave Rectifier Application of diodes as Full wave rectifier Application of diodes as Bridge rectifier rectifiers with filters peak detector voltage multiplier-half wave doubler voltage multiplier-full wave doubler Clipper Circuits Clamper Circuits Revision **[10 hrs]**

MODULE-5

Special Diodes

Zener diode and its characteristics, Zener diode as voltage regulator

Zener and avalanche breakdown, Light emitting diode, Photodiode

Revision

Text Books:

1. Electronic principles - Malvino
2. Linear Integrated Circuits - D.RoyChoudhury&Shail Jain
3. OP-AMPS and Linear Integrated Circuits - RamakantA.Gayakwad

Reference Books:

1. Electronic devices and circuit - Allan Mottershed.
2. Electronic devices and circuit theory - Boylested & Nashelsky.

Course code: 18VM105 Total hours: 30	BASICS OF COMPUTER -I	L	T	P	C
		2	--	--	2
Course Objectives	At end of the semester the trainee would be able to understand about 1. Computer generations and architecture 2. Computer Components 3. Classification of Computers 4. Input / Output devices 5. Printers and its types 6. Secondary storage devices 7. Operating Systems and user Interfaces				
Course Outcomes	Students after the completion of this course will be able to : 1. Understand the fundamental hardware components that make up a computer's hardware and the role of each of these components 2. Understand the difference between an operating system and an application program, and what each is used for in a computer 3. Describe some examples of computers and state the effect that the use of computer technology has had on some common products				

MODULE-1

Introduction to Computers, Computer Definition

Early History Types of Computer, Computer Architecture

Components of Computer

Essential Computer hardware Essential Computer Software Firmware

Classification of Computers **[10 Hrs]**

MODULE-2

Classification of Computers

Classification based on Size Classification based on Function Mobile Computers

Instruction to Computer Representing Data Processing Data Factors affecting the speed **[08 Hrs]**

MODULE-3

Input and Output Devices

Basic Input/output devices

Inputting and outputting data in other ways

Classification of Monitors Projectors Sound Systems **[10 Hrs]**

MODULE-4

Printer and its Types

Characteristics of Printers

Types of Printers

Other high quality printers

Plotters

Computer memory & Data Storage devices

Types of storage devices

Magnetic storage device types

Optical storage device types

Measuring Performance **[10 Hrs]**

MODULE-5

Operating System and User Interfaces

Types of User Interfaces

Operating System and functions

Example Operating Systems

Text Books:

1. Basics of Information Technology by Priti Srivastava, North Publication
2. Fundamentals of Computer by E Balagurusamy,Tata McGraw Hill Education Pvt. Ltd, New Delhi
3. Fundamentals of Computer by V Rajaraman; Prentice Hall of India Pvt. Ltd., New Delhi
4. Internet for Every One by Alexis Leon and Mathews Leon; Vikas Publishing House Pvt. Ltd. Jungpura, New Delhi

Reference Books:

1. MS Office by BPB Publications, New Delhi

Course Code: 18VM106 Total Hours: 45	Applied Science Lab	L	T	P	C
			--	6	3
Course Objectives	The objective of this course is to make the students: Understanding the basic instruments				
Course Outcomes	Students after the completion of this course will be able to: Familiarize and use of basic instruments				

1. Venire Callipers: Determination of volume of solid cylinder and Sphere.
2. Screw Gauge: Determination of the thickness of a thin wire and glass plate.
3. Parallelogram law: Verification of the law of parallelogram of forces.
4. Verification of the converse of the law of triangle of forces
5. Verification of Lami's theorem
6. Determination of focal length of a convex lens by u-v method
7. Determination of acceleration due to gravity by using Simple pendulum
8. Determination of spring constant of the given helical spring

Course Code: 18VM107 Total Hours: 45	Basics of Computer Lab	L	T	P	C
			--	6	3
Course Objectives	The objective of this course is to make the students : 1. Identify and list functions of various components and peripherals of given Computer 2. Exercises on entering text and data 3. Understandings of Internet				
Course Outcomes	Students after the completion of this course will be able to : 1. Familiarize with computer and peripherals 2. Familiarize with Internet and MS office.				

Exercise 1: DOS Commands

Write the syntax and definition of following commands: cls, cd, copy, copycon, Mem, Tree, ver, exit, find, sort, time, edit, erase, date,del, dir, md, rd,type.
Write the syntax for appending the content of two files, copy the output of dir command to file, listing of files and directories: dir/b, dir/l, dir/on, dir/w, definition of following commands: dir/ad, dir/oe, dir/p, dir/ar.

Exercise 2: Typing Tutorial

Familiarize typing in standard QWERTY keyboards.
Touch Typing Course: In this course, Trainee will learn the positions of the letter keys and common punctuation by heart, after completing the course you will be able to type with all ten finger without looking at the keyboard
Speed Building course: This course is designed to increase your typing Speed and confidences. The Trainee will focus on the keys for each finger, type longer texts and train with some of the most common English words
Numbers, Special marks and 10-key pad

Exercise 3: Creating Document

Create the document in word pad with following information Name, qualification, city, date of birth, phone number, and increase the size of Font to 24, make it bold, put the heading as information and align it centre.
Create your bio data in note pad with suitable formats.
Demonstrate procedure for creating, naming, renaming of a folder in computer and familiarize properties like changing the icon, hiding a folder

Exercise 4: Applications

How to open DOS, NOTEPAD, PAINT, CALCULATOR, WORDPAD THROUGH RUN. ?
How to create shortcuts, disappearing the desktop items, auto hide the Task bar?
What is Status bar, Menu bar, Taskbar, Standard Toolbar, and specify Their locations.
What is the extension of the following application: WordPad, Notepad,Paint?

Exercise 5: MS-Office

Create your CV (Bio Data) in MS-word with suitable alignments.
Create the paint file insert the picture in it by choosing from different place and modify it in WordPad. What is Border and Shading? Write the steps for applying Border & Shading to a Paragraph in WordPad.
What is Bullets and Numbering? Write the steps for applying Bullets and Numbering, and its different types in WordPad.
What is spelling and grammar check? Write the steps for this and Different option present in it in WordPad.
What is the use of Find and Replace and Goto option? Write the steps for that with example in WordPad.
Write the steps for inserting Symbols and special characters and inserting Date and Time, File, Object with example in WordPad.
Type the invitation for calling your friends on the occasion of your birthday Using mail merge, WordArt, select the field names yourself.
Write the steps for creating a table. Explain merge cells and split cells Options.
Open Ms-Excel and insert 10 sheets, apply different backgrounds to Different sheets, fill different colours in different cells.
Open Ms-Excel insert 4 sheets hide the sheet 2 and 3 and apply different Colour to sheet tabs.
Demonstrate mathematical function in MS-Excel.
How to insert Rows, Columns, Cells and Worksheet in MS-Excel?
Create the presentation about you daily activity
Create the presentation of your organization company with suitable Diagrams.
Create the presentation to explain any technology with suitable diagrams.
Create the presentation for any educational organization which should consist of hyperlinks, custom animation, slide transition
Create the DATABASES for the Company consisting of the tables:
EMPLOYEE, DEPARTMENT, DESIGNATION, ACCOUNTS. And the fields are as follows EMP: Name, City, Add, Phnoe, Place, and Id.
DEPARTMENT: Id, Dep Name, and Location. DESIGNATION: Id, Qualification, Experience, Skills. ACCOUNTS: Id, Basics , DA, HRA, PF.(MAKE ID AS PRIMARYKEY)
and create the query to select the fields as: EMP=ID, NAME, PHNO, PALCE. DEP=DEPNAME, LOCATION. DESIG=QUALIFOCATION, EXP.ACCOU=TOTAL, BASICS, DA, PF.

Exercise 6: Internet

Write the steps to create the email.
Write the steps to search the details about historical places in internet.
Write the steps to create a mail and send it your friend.
Write the steps to create a mail which should attach some data and send it to your friend.

Reference Books:

1. Fundamentals of Computer by V Rajaraman; Prentice Hall of India Pvt. Ltd., New Delhi
2. Internet for Every One by Alexis Leon and Mathews Leon; Vikas Publishing House Pvt. Ltd. Jungpura, New Delhi
3. MS Office by BPB Publications, New Delhi

Course Code: 18VM108 Total Hours: 60	Electronics Lab – I	L	T	P	C
			--	8	4
Course Objectives	The objective of this course is to make the students: 1. Aware of Lab safety procedure 2. Study and use of C.R.O. (single trace & Dual trace) for measuring frequency and amplitude 3. Study and use MULTIMETER,Diodes				
Course Outcomes	Students after the completion of this course will be able to: 1. Get familiarized to use of various soldering tools, Components & different cables. 2. Familiarise with the symbols of electronic circuit components by drawing				

1. Introduction to lab safety, procedure, rules and regulations
2. Color coding of Resistors
3. Familiarization of Function generator
4. Familiarization of CRO
5. Calculation of amplitude, time-period, frequency, using CRO
6. Familiarization of MULTIMETER
7. Familiarization of power supply
8. Active and passive components- value identification& polarity checking
9. Familiarization of Tool kit and basics of bread board connections
10. Soldering Basics
11. Ohm's law
12. Kirchhoff's current law
13. Kirchhoff's voltage law
14. PN junction characteristics of diode
15. Temperature dependence of diode
16. Half wave rectifier with and without filter
17. Full wave Centre tap rectifier with and without filter
18. Bridge full wave rectifier with and without filter
19. Clipper and clamper circuits
20. Peak Detector

Reference Lab Manual:

1. Electronic Devices and Circuits by David A Bell 4 Edition PHI
2. Hand soldering and circuit board repair by H.(Ted)Smith, Thomas Delmar.
3. Electronic instruments and systems – principles, maintenance and Troubleshooting. by R.G. Gupta.

Course Code: 18VM109 Total Hours: 60	Work Shop Practice - I	L	T	P	C
			--	8	4
Course Objectives	The objective of this course is to make the students : 1. Aware of safety aspects in handling of fitting tools and equipment and create different fitting joints 2. Fabricate various metal joining process including soldering, brazing and welding joints 3. Learn basics of development and create sheet metal models				
Course Outcomes	Students after the completion of this course will be able to : 1. Demonstrate fitting skills and create fitting joints 2. Exhibit welding, soldering & brazing skills and create models				

1. U – Channel
2. Angle Iron
3. Rod Hammering
4. Marking & Dot Punching
5. Number & Letter Punching
6. Drill Plate
7. Store Box
8. Cylinder Pipe

Text Books:

1. DSU Work shop manual.

Course Code18VM110 Total Hours : 60 hrs	Engineering Drawing	L	T	P	C
		2	-	8	6
Course Objectives	The objective of this course is to make the students : 1. Understand the importance of engineering drawing and application of computer. 2. use engineering drawing instruments competently 3. Competency to write engineering script. Understand the importance of SP46 standards 4. Ability to construct &understand standard geometrical shapes. 5. In depth practice of pictorial projection with example. & in depth practice of orthographic projection with example. 6. Understand the Importance dimensioning in engineering drawing practice with examples				
Course Outcomes	Students after the completion of this course will be able to: 1. Analyze and design the basic electronic circuits containing semiconductor devices. 2. Identify the need of Integrated Circuits and use the mineralizing circuit applications. 3. Analyze and implement basic Digital Electronic circuits for a given application. 4. Identify the applications and significance of electronics in interdisciplinary engineering domains.				

MODULE -1

Introduction - Engineering drawing: Importance of engineering drawing & role of drawing in engineering education, engineering drawing equipment's, Basic drawing instruments T-square, Set Square. Compass, dividers, mini drafter pro-circles, Drawing board & pencil. Introduction to computer aided drafting Importance of computer aided drafting, menu selection, begin new drawing editing existing menu selection practice on computers.

Basics of Engineering drawing: Features' of lettering (Selection of suitable size of letters & numbers as per SP 46). Introduction to CAD. By using screen menu, tool bar &cursor menu, button menu Practice on computer.

Exercises: Writing notes in engineering script. Introduction & explanation on utility commands, Help, End, Quit, Save, Limits, Units, function key & Drafting setting practice. Drawing sheet sizes, (as per SP 46).Scale, full scale, reduced scale, Enlarged scale (as per SP 46) lines (As per SP 46). Introduction to entity draw commands Line, absolute, relative, polar co-ordinates, direct distance entry, Points, Undo, redo, and Move. Practice on computers Title block & sheet layout, (As per SP 46) **[30 Hrs]**

MODULE -2

Dimensioning: Importance of dimensioning, Elements of dimensioning &general rules of dimensioning size of arrowhead , placing of dimension line ,projection line , value of dimension &leader lines, System &method of indicating dimensions, Arrangement of dimensions chain dimensioning, parallel dimensioning, superimposed dimensioning, combined dimensioning, superimposed dimensioning & co-ordinate dimensioning, Special indication for dimensions (dimensioning practice). **[15 Hrs]**

MODULE -3

Geometric construction: Arc joints, by using compasses, exercises, Line joints. [Circle, arc, polygon ellipse hatch Practice on computers. 1 h for computers], Terminology of different shape, Bisecting an angle ,bisecting a line, finding a center of given circle &divide a line equal and un equal Conic section Construction of ellipse. Arc intersecting method, understand about parabola& hyperbola, cycloid construction, helix construction &understand about involute, [layers, line type properties modify command erase , copy mirror ,offset Practice. **[15 Hrs]**

MODULE-4

Projection: Introduction about projections. Practice on computers. [Array, rotate, scale, trim, extend, break2 h for computer] Isometric drawings, steps involved in preparing, construction of circle in isometric view isometric drawings. Practice on computer [chamfer, fillet, stretch, explode2 h for computer] Exercise on Isometric drawings. From the reference of direct isometric view Practice on computer [edit and display command, isometric snap, object snap, iso plane. **[15 Hrs]**

MODULE-5

Ortho graphic projections, planes of projections, first angle projection and third angle projection, why second angle and fourth angle not used in engineering drawing, construction details of front view top view and side view in first angle projection Exercise on orthographic projection. Practice on computer, Exercise on Isometric drawings. From the reference of orthographic view, Identification of view & missing view. **[15 Hrs]**

Note: All the drawing exercises are performed using AutoCAD.

Text Books:

1. Machine drawing - P I Varghese and K.C John
2. SP46 - BIS
3. Engineering Drawing - N.D. Bhatt
4. IS 696 - BIS
5. IS 8000 - BIS

Reference books:

1. PSG Hand book - PSG
2. CMTI Hand book

Course code: 18VM202 Total Hours : 30Hrs	Mathematics-II	L	T	P	C
		2	-	-	2
Course Objectives	The objective of this course is to make the students : 1. Exposed to fundamentals of Mathematics including fractions, Logarithms, Matrices & Determinants 2. Understand concepts of Complex Numbers & Trigonometry and their applications in engineering 3. Understand the basics of differentiation and differential calculus and solve application 4. Apply the concepts of mathematics to engineering problems.				
Course Outcomes	Upon successful completion of this course, the trainee will be able to: 1. Analyze and apply mathematical equations 2. Solve mathematically technical problems 3. Apply the concepts of mathematics to engineering problems.				

MODULE-1

PERCENTAGE, RATIOS AND PROPORTIONS, Simple Problems (like if percentage is given find the number and vice versa) **[03 Hrs]**

MODULE-2

ANALYTICAL GEOMETRY: Area and perimeter of triangle, Areas and perimeter of Rectangle.Area and perimeter of Square, Area and perimeter of Parallelogram,Area and perimeter of Rhombus, Area and perimeter of Trapezium, Area and perimeter of Circle, Length of an arc, Area of sector(Direct Problems),Cartesian Co-Ordinates, Equation of axis, Distance formula, Section formula & midpoint,(Direct Problems),Definition of Centroid of Triangle(Direct Problems),
Slope: Definition, finding slope of straight line using (given two points, equation of a line and angle) , Condition for Perpendicularity and parallelism(Simple Problems). Equation of straight line: a) Y=mx+c, b) Point slope form c) Two point form d) Intercept form

Circle-Definition, Standard form (centre(h,k)and radius r), General Equation of a circle (Simple problems) to find center and radius ,Basic concept of parabola, To find focus, vertex, directrix and axis of the parabola, Basic Concept of Ellipse, length of major and minor axis. Basic Concept of Hyperbola, length of transverse and conjugate axis. **[10 Hrs]**

MODULE-3

3D Shapes, T.S.A, L.S.A and Volume of Cylinder , T.S.A, L.S.A and Volume of Cube, Cuboid, T.S.A, L.S.A and Volume of Cone, T.S.A, L.S.A and Volume of Sphere, T.S.A, L.S.A and Volume of Hemi-Sphere, T.S.A and Volume of Pipe **[05 Hrs]**

MODULE-4

Integral calculus and differential equations, Define Integrals of function and standard formulae of trigonometric functions, Problems using standard formulae. Integration by parts. Definite Integral and evaluation of definite integrals and simple problems.

Area under plane curves – simple problems. Define differential equations with example. Define order and degree of differential equations. Solve differential equations of the type a) $ad^2y/dx^2 + b\,dy/dx + cy = 0$ b) $ad^2y/dx^2 + b\,dy/dx + cy = e^{mx}$ **[07 Hrs]**

MODULE-5

Statistics, Mean, Median and Mode (Raw Data), Rage and Standard Deviation. Problems on above methods. **[05 Hrs]**

Text Books:

1. Technical mathematics - Rice and Knight, Mc-Graw Hill Book he.
2. Applied mathematics for Polytechnics-H.K. Dass

Reference Books:

1. Higher Engineering mathematics-B.S. Grewal
2. Higher Secondary Mathematics.

Course code: 18VM203 Total hours: 30	Electronics-II	L	T	P	C
		2	--	--	2
Course Objectives	The objective of this course is to make the students understand: 1. Understand the transistor operations and its applications. 2. To study and analyze the operation of Differential amplifier. 3. To familiarize with Op-Amp parameters. 4. To study the linear and non linear applications Op Amp . 5. Understand the operation of voltage regulators.				
Course Outcomes	Upon successful completion of this course, the trainee will be able to: 1. Familiarize Transistors, BJT and FET 2 Familiarize with OPAM, Filters and power supply				

MODULE-1

Transistors: Basic structure of a Transistor, Transistor operation, Transistor parameters-alpha, beta & characteristics- input, output, DC LOADLINE,Q Point, importance of Q point & biasing, Transistor biasing –emitter, collector feedback, voltage feedback, Configuration characteristics –CC, CB, CE, Transistor rating and specifications – current, voltage, power, Temperature etc.

Transistor applications, Basics of JFET & MOSFET, Transistor applications- as a switch (using LED, Relay), As a constant current source, as an inverter(NOT gate). Concept of amplification – transistor amplifiers, coupling Bypass capacitors. Cascaded amplifiers –need of cascading, power calculating Equation. **[15 Hrs]**

MODULE-2

Basics of JFET & MOSFET, Basics of JFET –symbol, structure, operation, applications, MOSFET-symbol, structure, operation, applications.

Power amplifier, Amplifier Terms –DC Load Line –AC Load Line, Classes operations, Types of coupling and Frequency ranges, Power rating of a Transistor, Frequency effects –Frequency Response Of an amplifier Decibel Power. **[12 Hrs]**

MODULE-3

Differential Amplifiers: Introduction about differential amplifier, DC and AC Analysis of Differential amplifiers, Input characteristics, common mode gain and CMRR

OPEARTIONAL AMPLIFIERS: OPERATIONAL AMPLIFIERS-Introduction & Pin, Configuration Of OP AMP 741, Block Diagram of 741 OP- AMP, OP-AMP Parameters –Slew Rate, Bias, Offset,Input & Output Impedance, Ideal OP-AMP and Open loop operation of OP-AMP, Datasheet of OP- AMP 741 **[03 Hrs]**

MODULE-4

LINEAR OPERATIONAL AMPLIFIER: Linear Circuits- inverting, non-inverting amplifiers, applications, voltage follower, instrumentation & summing amplifiers, current boosters & current sources.

NON LINEAR OPERATIONAL AMPLIFIER: NON LINEAR OP – AMP CIRCUITS – comparator, Zero crossing detector, inverting & differentiator, Wave form generators, a) square, triangular, saw tooth, b) Active diode circuits. **[08 Hrs]**

MODULE-5

Filters & Oscillators: Ideal Responses, Low Pass and High Pass Filters, Band pass, Band stop and All pass Filters, Sinusoidal Oscillators, RC and LC Oscillators, Timer IC 555 – Pin configuration , Monostable, Astable Operation and its application.

REGULATED POWER SUPPLIE: Power Supply characteristics, Series and Shunt Regulators, Linear and Switching Regulators, Variable Regulators - LM 317 **[04 Hrs]**

Text Books:

1. Electronic principles - Malvino
2. Linear Integrated Circuits - D.RoyChoudhury&Shail Jain
3. OP-AMPS and Linear Integrated Circuits - RamakantA.Gayakwad

Reference Book:

1. Electronic devices and circuit - Allan Mottershed.
2. Electronic devices and circuit theory - Boylested & Nashelsky.

Course code: 18VM204 Total Hours : 30	Electrical Engineering Science	L	T	P	C
		2	-	-	2
Course Objectives	The objective of this course is to make the students understand: 1. The importance of basic principles of electrical electronics for industrial application. 2. Electrical and Electronic measuring instruments and their usage 3. Working principles of Electrical motors				
Course Outcomes	Students after the completion of this course will be able to: 1. Learn basic concepts and working of electrical devices. 2. Apply the electronic and electrical measuring instruments for practical applications.				

MODULE-1

POWER SOURCES: Classification of power sources, Electrochemical primary and secondary batteries and introduction to fuel cells

NETWORK THEOREMS, Kirchhoff's laws, voltage sources and current sources, Source conversion, simple problems in source conversion. Superposition theorem, simple problems in super position theorem, Thevenin's theorem, Norton's theorem, simple problems, Reciprocity theorem, Maximum power transfer theorem, simple problems, Delta/star and star/delta transformation. **[04 Hrs]**

ELECTROSTATICS AND CAPACITANCE: Static electricity, absolute and relative permittivity of a medium, laws of Electrostatics, electric field, field strength, electric flux density energy stored in a capacitor, Charging and discharging of a capacitor, current voltage relationships in a capacitor.

MODULE-2

MAGNETISM: Basic definition of flux, m.m.f, reluctance, relation between B,H,I, Comparison between electric and magnetic circuits. **[04 Hrs]**

ELECTROMAGETISM AND INDUCTION: Relation between magnetism and electricity, production of induced e.m.f and current and Faraday's laws of electromagnetic induction, Direction of induced e.m.f and current-Lenz's law–self-inductance and mutual inductance, Magnetic hysteresis, residual magnetism, energy stored in magnetic field Rise and decay of current in inductive circuits.

SINGLE PHASE A.C. CIRCUITS: Generation of alternating voltage and current, Different forms of E.M.F equations, A.C. through R, L and C and power factor, AC through R,R-C and R-L series and parallel circuits, Active and reactive components of circuit & Active, reactive and apparent Power

MODULE-3

POLY PHASE A.C.CIRCUITS: Generation of Poly phase Voltages, Phase Sequence, Star or Wave (Y) connection - Values of Phase currents Voltages in star and delta connection.

TRANSFORMERS: Definition, Construction & Principle of operation, Types of Transformers, E.M.F Equation and Voltage Transformation Ratio, Tests on Transformers – OC & SC Test, Losses & Efficiency of a Transformer, Three Phase Transformer and connections, Auto Transformers& Instrument transformer –Principle & Working.

DC GENERATORS: Generator Principle, Construction & working, Parts of a Generator, EMF equation of Generator, Losses and Efficiencies in DC Generators, Characteristics of DC generators. **[06 Hrs]**

MODULE-4

DC MOTORS: Motor Principle, Comparison of motor and generator principle, Back EMF and Voltage Equation of a Motor, Torque, Armature Torque and shaft Torque, Rated Speed and speed regulation and sped control of D.C.Motors, Selection parameters of DC Motors.

MOTOR CHARACTERISTICS, T vs la, N vs la of A DC Shunt and series motor, T vs la, N vs la of A DC Compound motor.

INDUCTION MOTORS: Classification of AC Motors, Single Phase and Three Phase Induction Motors, General Principle & Construction, Starting of Induction Motor, Relationship between Slip, Torque, Power Stages in Induction Motor, Speed control of an Induction Motor. **[06 Hrs]**

MODULE-5

SPECIAL PUPOSE MOTORS: Universal motors and its specialty, Stepper Motors and PMDC Motor, Introduction to servo Motors.

ALTERNATORS: Basics Principle & Details of Construction, Stationary Armature & Rotor, Speed and Frequency Relation **[07 Hrs]**

Text Books:

1. Electrical Technology Vol 1 &2 by B.L. Theraja
2. Electrical Technology by Hughes

Reference Books:

Electrical, Electronic Measurements and Instruments by Sahney

Course Code: 18VM205 Total Hours :30	Mechanical Engineering	L	T	P	C
		2	-	-	2
Course Objectives	The objective of this course is to make the students understand: 1. Trainees will be able to understand the mechanical concepts used in various machines. 2. To understand various manufacturing methods used in a company. 3. To understand various cutting tools and work holding devices used in conventional machines.				
Course Outcomes	Students after the completion of this course will be able to: 1. Familiarize hand tools for benchwork 2. Familiarize with Conventional Machine 3. Familiarize with Manufacturing methods				

MODULE-1

ENGINEERING MATERIALS: The structure of materials; origin of engineering materials, forming engineering materials from the elements, properties. The solid state, Material classification-metals-ceramics-polymers, Properties and selection-types of polymers. **[05 Hrs]**

MODULE-2

HAND TOOLS FOR BENCH WORK: safety;Metal working hand tools and devices: Work bench - vices, types of vices, Files: Specification of files - parts of files - different types of files. Hammers: Parts of hammer - use of hammer - specification of hammer - types of hammers: ball peen hammer - cross peen hammer - straight peen hammer. Hacksaw: Different types of frames - parts of the blade - types of blades - setting of saw teeth - material of blade - selection of blade - fixing of the blades. Chisel: Different types of chisels - designation of the chisel. Screwdrivers, Spanners: Different types of spanners- Use method. **[05 Hrs]**

MODULE-3

CONVENTIONAL MACHINES: Types of drills-materials of drills, Drilling machine-parts- machine-block diagram, types of drilling machine, work, tool holding devices, tool holding devices, drilling machine operations, and. Speed time calculation. Milling Machine, types of milling machine-parts, machine-block diagram, milling cutters- milling process, up milling, down milling, materials of cutters, work holding devices, speed calculations. Lathe, functions of lathe-block diagram, types of lathe, lathe parts, work holding devices, lathe operations, taper turning, lathe cutting tools. Grinding Machine. Kinds of grinding, surface grinders-four types, surface grinding, machine-operations, wheels-Types of wheels, cylindrical grinding machine, work holding devices, wet and dry grinding. cutting tool materials. Cutting fluids and its importance. **[04 Hrs]**

MODULE-4

MANUFACTURING METHODS: Introduction to various methods of manufacturing like forming, joining methods (fabrication), Forming process- An over view on casting, forging, rolling, drawing,press work, etc, Joining methods-Temporary joints like screws, bolts, nuts, keys and cotters. Permanent joints like Rivets- Types and types of riveted joints, Arc and Gas welding. (Injection Moulding) **[05 Hrs]**

Text Books:

1. Elements of workshop technology volume 01- Hajra choudhury.
2. Elements of workshop technology volume 02- Hajra choudhury.

Reference Books:

1. Production technology-O P Khanna.

Course code: 18VM206 Total hours: 30	Metrology	L	T	P	C
		2	--	--	2
Course objectives	The objective of this course is to make the students : 1. To understand the importance of inspection, measuring instruments in industries. 2. Awareness of limits, fits and its tolerance and its importance in manufacturing. 3. To understand the errors in measurements and calibration importance.				
Course Outcomes	Students after the completion of this course will be able to : 1. Explain the basics of standards of measurement, limits, fits & tolerances industrial applications. 2. Identify the uses of gauges and comparators 3. Understand the significance of measurement system, errors, transducers, intermediate modifying and terminating devices				

MODULE-1

INTRODUCTION TO METROLOGY: Definition and concept of metrology need of inspection, principles of measurements, process of measurements, methods of measurements, measuring system and accuracy of measurements, precision and accuracy. Linear measuring instruments, steel rule, calipers-inside and outside, vernier caliper, micrometer, error surface plate, angle plate, v-block, feeler gauge, radius gauge, wire gauge. Introduction precision measuring instruments- vernier caliper, vernier height gauge, micrometer. **[08 Hrs]**

MODULE-2

LIMITS FITS AND TOLERANCE: Introduction; limits, tolerance, system of writing tolerance, unilateral, bi-lateral system; relation between tolerance and cost. Maximum and minimum metal limits; conventional diagram for limits and fits, terminology for limits. Types of fits, allowance, system obtaining different types of fits; hole basis and shaft basis system. Types of assemblies; interchangeability; selective assembly. **[08 Hrs]**

MODULE-3

GAUGES: Introduction; gauges-its types, plain gauges, limit plug gauges, snap, adjustable type, Materials for gauges. work shop gauges, inspection gauges, Slip gauges; wringing of slip gauges, selection of slip gauge. **[04 Hrs]**

MODULE-4

ERRORS IN MEASURMENTS AND CALIBRATION: Introduction; Measurement error, types, controllable and systematic error. random error Calibration; its needs, calibration procedure, calibration of vernier caliper, Screw thread measurement; terminology, errors in thread, pitch errors, measurements of various elements of thread. **[05 Hrs]**

Module-5 Measurement of Power and Flow [05 Hrs]

Text Books:

1. Elements of workshop technology volume 01- Hajra choudhury.
2. Elements of workshop technology volume 02- Hajra choudhury.

Reference Books:

1. Metrology- M Mahajan.

Course Code: 18VM207 Total Hours : 75 Hrs	CADD	L	T	P	C
		-	-	10	5
Course Objectives	The objective of this course is to make students : 1. Understand Concept of CAD, Tool bars in CAD, coordinate system, snap,grid, and ortho mode 2. Understand Drawing commands – point, line, arc, circle, ellipse.				
Course Outcomes	Students after the completion of this course will be able to: 1. Familiarize with CAD system 2. Familiarize with orthographic Projections.				

LIST OF EXPERIMENTS

INTRODUCTION TO CAD: Importance of CAD, menu selection, begin new drawing, editing existing practice simple drawing, Co-ordinate system in CAD-absolute, relative and polar, Introduction to utility commands-Help, End, Quit, Save, Limits, Units-practice, Introduction to entity draw commands-Line, Point circles, Oops Undo, Copy, Move practice, Introduction to display commands-Zoom, Pan, Redraw-practice, Layers and its uses, Various file formats – export and import of files

ORTHOGRAPHIC PROJECTIONS CONTINUED: Exercises on drawing the 3 views of different types of objects in 1st angle projection

Text Books:

1. Auto CAD 2000: George Omura

LIST OF EXPERIMENTS

1. Try-square
2. Left Hand Knife Tool Grinding
3. Taper Plug Gauge
4. Stud
5. T-Nut
6. Channel Milling
7. Parallel Block Grinding
8. Tray
9. T – weld (Welding Exercise)

Text Books

DSU Work shop manual.

Course code: 18VM208 Total Hours: 75	Workshop Practice – II	L	T	P	C
		-	-	10	5

Course Objectives	The objective of this course is to make students : 1. Introduce to importance of different angles required for single point cutting tool. 2. Practicing for different angle grinding on pedestal grinding machine. 3. Introduce to lathe machine and different turning operations. 4. Practicing various turning operations such as straight, step, taper etc. 5. Practicing of die passing on lathe machine. 6. Introduce to milling machine and different milling operations. 7. Practicing the setting of work piece on machine. 8. Practicing of various milling operations such as face, step milling etc. 9. Introduce to surface grinding, cylindrical grinding machine and its operations. 10. To understand the importance of grinding and practicing different surface grinding. 11. Practicing sheet metal fabrication and to understand its importance. 12. Introduce to welding process and welding machine. 13. Practicing edge preparation and welding operation.
Course Outcomes	Students shall be able to 1. Familiarize with various workshop tools and practices.

Course code18VM209 Total Hours: 60	Electrical Lab	L	T	P	C
			-	8	4

Course Objectives	Students after the completion of this course will be able to: 1. Familiarize students with electrical Wiring 2. Familiarize students with transformers 3. Introduction to Motors and Generators

Course outcomes	Students after the completion of this course will be able to: 1. Understand Stair case wiring 2. Have acquired the proper procedure of plugging and unplugging Transformer 3. Understand various motors and Generators

LIST OF EXPERIMENTS

ELECTRICAL WIRING: Staircase wiring, Go down wiring, 2 Lamps by 1 switch, Parallel and Series wiring, One lamp by one switch, Extension box

TRANSFORMERS: Transformer familiarization, Transformer ratio, polarity test and measurement of internal resistance, Open circuit test and short circuit test on transformers, Load test on single phase transformer, Three phase transformer star and delta connection

GENERATORS: Familiarization of generators

MOTORS: Familiarization of timer/contactors, starting of 3-phase induction motor by auto-Transformer, Starting of 3-phase induction motor by DOL Starter. Automatic starting of three phase induction motor. Automatic starting of two 3-phase induction motor.

Reference Books:

1. ALTERNATING CURRENT MACHINES – A. Langsdorff
2. ELECTRICAL MACHINES – BHIMBRA
3. AC COMMUTATOR MOTORS – Taylor

Course code18VM210 Total Hours: 60	Electronic Lab – II	L	T	P	C
			-	8	4

Course Objectives	Students after the completion of this course will be able to: 1. Familiarize students with basic laboratory instruments used in circuits and electronics 2. Introduce laboratory techniques to implement and analyze electronic circuits 3. Familiarize students with various circuit and electronic devices and their applications
Course Outcomes	Students after the completion of this course will be able to: 1. Understand the application of Transistor 2. Understand OPAMP 3. Understand the usage of IC 555 for various applications

LIST OF EXPERIMENTS

Transistor Characteristics:
a. Ic vs IB
b. VBEvs !B
c. VBE vs lc

Transistor as switch,
Characteristics of FET.
JFET as switch
Familiarization of IC 741 & Verification of its Parameters.

Op Amp Applications – Voltage Follower, Summing Amplifier.
Design and Verification of Inverting Amplifier Circuit.
Design and Verification of Non Inverting Amplifier Circuit.
Op Amp as Comparator with Zero and Non Zero references.
Op Amp as Integrator and Differentiator.
Op Amp as Schmitt Trigger.
Op Amp as Filter Circuits and Study of Frequency Response LPF, HPF, BPF)
Op Amp as RC Phase Shift Oscillator.

Monostable Multivibrators using IC 555
Astable Multivibrators using IC 555

Familiarisation of Fixed Regulators – 7805, 7905
Familiarisation of Variable Regulators – LM 317.

Text Books:

1. Electronic Devices and Circuits by David A Bell 4 Edition PHI
2. Hand soldering and circuit board repair by H.(Ted)Smith, Thomas Delmar.

Reference Books:

1. Electronic instruments and systems – principles, maintenance and Troubleshooting. by R.G. Gupta.

SEM/YEAR : THIRD/SECOND
COURSE CODE : 18VM301
TITLE OF THE COURSE : DIGITAL ELECTRONICS

Course Objectives:

1. Understand number systems and codes and their application to digital circuits and
2. understand Boolean algebra, Karnaugh maps and its application to the design and
3. characterization of digital circuits.
4. Analyze a given combinational or sequential circuit using Boolean algebra as a tool
5. to simplify and design logic circuits.
6. Understand the logic design of programmable devices, including PLDs
7. Demonstrate various synchronous & Asynchronous counters and Universal Shift
8. Registers.

Course Outcomes:

1. Infer different Number systems, Codes, Logic Gates, Boolean laws and theorems.
2. Apply the knowledge of Boolean algebra to deduce optimal digital circuits.
3. Construct & Implement different types of combinational logic circuits using Logic gates
4. Develop and test different types of Sequential logic circuits using flip flops, counters
5. Design State Machines and sequence generators & sequence detectors
6. Modify traditional design techniques to yield innovative designs

MODULE-1

Introduction to Digital System
Difference between Analog and Digital Systems
Logic Levels and Pulse Waveforms
Importance of digital circuits
Decimal, Binary, Octal, Hexadecimal Numbers
9's & 10's Complements - 1's & 2's Complements
Conversion of Number Systems
BCD Code - Digital Codes – Weighted and Non-weighted Codes
Perform Arithmetic operations on all basic number system **[09 Hrs]**

MODULE-2

Inverter, AND, OR, NAND, NOR, EX-OR, EX-NOR gate
Universal Property of NAND & NOR
Boolean Operations, Logic Expression
Rules and Laws of Boolean Algebra
De Morgan's Theorem
Simplifications of Boolean Expressions-- Karnaugh Map of 2Varible,3 Variable & 4 Variable

QM/ Tabular Method for Boolean Simplification [09 Hrs]

MODULE-3

Combinational logic: Half and Full Adders, Applications
Explain the Concept, comparison and Applications of Serial adders & Parallel adders
Explain the Concept of Magnitude Comparators (1 bit, 2 Bit & 4 Bit comparator)
Explain the Concept of Decoder, Encoder & code conversion circuits
Multiplexers **(1:N MUX)** and De multiplexers/**Decoder(N:1), Boolean Simplification using MUX, Encoders**
Parity Generators and Checkers –Even & odd Parity
Operating Characteristics & Applications of Flip Flops
Sequential Circuits clock & explain the types of triggering
Latches & Flip Flops – Different Types of Flip Flops
Operation of R-S, D, J-K& T Flip flop, **Flip flop conversion**
Positive & Negative edge triggered Flip flop & Importance of synchronous and asynchronous signals

MODULE- 4

Types of Registers - SISO, SIPO, PISO, PIPO and application
Bidirectional Shift Registers, Introduction to IC Shift Registers
Shift Register Counters-Ring Counter & Johnson Counter with timing diagrams & application

Introduction to Counters & Modulus of a counter
Asynchronous Counters
4- Bit binary counter using IC 7493/IC 74293 Decade counters using IC 7490/IC 74290
MOD-N counters using flip flop
4-bit Synchronous counters - using flip flop.
Synchronous counters using IC 74161
Up/Down Counters – Synchronous & asynchronous
Counter Design
Applications of counters **[09 Hrs]**

MODULE-5

Introduction to PAL, PLA, PROM, **Implementation of Boolean expressions, VHDL description of combinational networks, Modeling flip-flops using VHDL, VHDL models for a multiplexer, Compilation and simulation of VHDL code, Modeling a sequential machine, Variables, Signals and constants, Arrays, VHDL operators, VHDL functions, VHDL procedures, Packages and libraries,**
VHDL model for a counter. [09 Hrs]

Text Books:

1. Digital Design – Morris Mano, PHI, 3rd Edition, 2006.
2. Fundamentals of Logic Design – Charles H. Roth, Thomson Publications, 3rd Edition.1998.
3. The Designer's Guide to VHDL, Third Edition (Systems on Silicon) 3rd Edition

Reference Books:

1. Switching & Finite Automata theory – Zvi Kohavi, TMH, 2nd Edition
2. Modern Digital Electronics by RP Jain, TMH.
3. **E-course**: https://www.udemy.com/course/vhdl-and-fpga-development-for-beginners-and-intermediates/

SEM/YEAR : THIRD/SECOND
COURSE CODE : 18VM311
TITLE OF THE COURSE : CONTROL SYSTEMS

Course Objectives:

1. Understanding types of control systems and block diagram of an open loop and closed loop control systems
2. Modeling and transfer function evaluation of control system elements and components
3. Modeling and analysis of speed control and velocity control servo system

Course Outcomes:

1. Identify open and closed loop control system
2. Formulate mathematical model for physical systems
3. Simplify representation of complex systems using reduction techniques.
4. Analyze performance characteristics of system using Frequency response method

MODULE-1 **[08 Hrs]**

Introduction to Control System

Control System - System Definition, Control System Definition, Difference between System & Control System, Control System Classification, Examples, Advantages & Disadvantages, Basic Elements of Closed Loop Control System and Difference between Open Loop & Closed Loop Control System. Transfer Function of Control System & Feedback Types Mathematical modeling of a System. Translational Mechanical system and Basic elements, Translational motion in mechanical System, Mathematical modeling of a Translational System. Rotational Mechanical system and Basic elements, Rotational motion in mechanical System, Mathematical modeling of a Rotational System.

MODULE-2 **[08 Hrs]**

Components of Control System

Introduction to Control System Components - Block diagram of Closed loop control system - Basic components of closed loop control system - Devices used for Control system Components. Controllers in Control System - Function, Uses, Types & Advantages

MODULE-3 **[08 Hrs]**

Time response analysis- Transient Response, Steady State Response, Test signals, Response of First Order System, Response of Second Order System, Time Domain Specifications. Steady State Errors-Definition, Steady State Errors for Unity Feedback Systems Stability - Definition of Stability, Analysis of Stable, Unstable, Critically stable and Unconditionally stable. Relative stability, Stability relationship with poles. Frequency response analysis - Introduction, Frequency domain specifications, Methods of Frequency Response Analysis in Control system, Stability Analysis using Bode Plots

MODULE -4 **[06 Hrs]**

Basics of Process Control and Control methods - Introduction to Process Control, Terms and definitions of Process control and Control methods - Cascade control & Feed forward Control. Adaptive Control System - Introduction, Definition of Adaptive Control Machining, and Functions of Adaptive control system. Computerized Process Control - Role of Computer in measurement and Process control, Basic Components of Computer based measurement and Control System, Case Study, Types of Computerized Process Control & Advantages of Computers in Measurement and Control.

Text Books:

1. Control systems, A Nagoor Kani, (RBC Publishers-First Edition)
2. Computer Control of Manufacturing Systems, Yoram Korner, (TATA McGRAW-Hill- 2005 Edition)

Reference Books:

1. Process Control Instrumentation Technology, Curtis D. Jhonson, (PEARSON Education - Seventh Edition)
2. Control Systems Principles and Design, M. Gopal, (TATA McGRAW-Hill)

SEM/YEAR : THIRD/SECOND
COURSE CODE : 18VM303
TITLE OF THE COURSE : COMPUTER PROGRAMMING – C,C++

Course Objectives:

1. Acquire the knowledge about computer hardware and software.
2. Learn the problem solving techniques.
3. Gain knowledge in C and C++ programming.
4. Gain knowledge in implementing Data Structure using C

Course Outcomes:

1. Demonstrate the basic knowledge of computer hardware and software.
2. Ability to write algorithms for solving problems in C and C++.
3. Ability to draw flowcharts for solving problems in C and C++
4. Ability to select the data structures that efficiently model the information in a problem.
5. Ability to assess efficiency trade-offs among different data structure implementations or combinations.

MODULE-1 **[09 Hrs]**

Introduction to Computing – Computer Systems-Hardware and Software, Computer Languages, Algorithm, Flowchart, Representation of Algorithm and Flowchart with examples. Introduction to C– History of C, Features of C, Structure of C Program, Character Set, C Tokens-Keywords, Identifiers, Constants, Variables, Data types, Operators.

MODULE-2 **[09 Hrs]**

Selection statements (Decision Making), Repetition statements (loops), Unconditional statements, Functions, Arrays,Strings, Pointers, Structures

MODULE-3 **[09 Hrs]**

Object oriented Programming,Functions,Class and destructor, Operator overloading and Type Conversion

MODULE- 4 **[09 Hrs]**

Inheritance and polymorphism, **Console IO operations, Working with files**

MODULE-5 **[09 Hrs]**

Introduction to Data Structures, abstract data types, Linear list – singly linked list implementation, insertion, deletion and searching operations on linear list, Stacks-Operations, array and linked representations of stacks, stack applications, Queues-operations, array and linked representations.

Text Books:

1. Let Us C - Yashvant Kanetkar, BPB publications, 16th Edition, 2017
2. Object-Oriented Programming with C++ - Balaguruswamy, McGraw-Hill, 4th Edition, 2008.
3. Data structures, Algorithms, and Applications in C++, S.Sahni, University Press (India) Pvt.Ltd, 2nd edition, Universities Press Orient Longman Pvt. Ltd.

Reference Books:

1. The C Programming Language - Brian W. Kernighan / Dennis Ritchie, PHI publications, 2nd Edition, 2105
2. Object Oriented Programming using C++, Robert Lafore, Galgotia publication 2010
3. Data structures using C and C++, Langsam, Augenstein and Tanenbaum, PHI.

SEM/YEAR : 3rd SEM
COURSE CODE : 18VM312
TITLE OF THE COURSE : INDUSTRIAL ELECTRONICS

Course Objectives:

1. Design and troubleshoot circuits for demagnetizing inductors with switch.
2. Selections of Power switch for a given application.
3. To understand the working of Drive Circuits
4. To understand the working and specifications of UPS Analyze and evaluate performance parameters of AC and DC motors.

Course Outcomes:

1. The student will have an in-depth understanding of the theory of electrical energy conversion using power electronic systems
2. Understanding the applications within renewable energy, energy saving and industrial applications.
3. Discuss the device properties and its working principle.

MODULE-1 [10 Hrs]

Introduction to Industrial Electronics

Introduction Power Electronics Vs. Linear Electronics. Scope & Applications of industrial electronics. POWER DIODE - Construction, Operation, Characteristics. IGBT - Construction and working.

Introduction to Thyristor Family

SCR – Construction, Operation, Characteristics, Triggering and commutations methods.GTO - Construction and working, TRIAC - Construction and working. Introduction to new members of the family, SUS – Silicon Unilateral Switch and SBS – Silicon Bilateral Switch RCT – Reverse conducting Thyristor and LASCR – Light Activated Silicon Controlled Rectifier, SITh or SITS-Static Induction Thyristor and MCT – MOS Controlled Thyristor.

MODULE-2 [10 Hrs]

Control of DC Drives And AC Drives

Introduction to DC Drives: Need of Drives, DC Machine basic equations, Braking modes of DC drives, Speed control methods for DC Machines. Types of DC drives Single phase DC motor drives. Three phase DC motor driver Chopper drives, Closed loop control of DC drives, PLL control of DC drives, Microcomputer control of DC drives

Introduction to AC drives: Introduction to AC Motor drives, Advantages and dis-advantages of AC Drives, Torque - speed characteristic of induction motor, Speed control of induction motor - Stator voltage control, Variable frequency control, Rotor resistance control, Slip power recovery scheme.

MODULE-3 **[10 Hrs]**

Programmable Logic Controller

Evolution – advantages over relay logic, Introduction to PLC – Relays, Block diagram of PLC - PLC Programming Languages - Arithmetic Functions – (add, sub, mul, div,) – Comparison of functions- Basics of Input and output module (digital input and output module) - Logic functions- AND logic, OR logic, NAND logic, EX-OR logic -symbols used in ladder logic diagram.

Text Books:

1. James T Homphires & Lestie P Sheets, "Industrial electronics", P sheets publications.
2. M H Rashid "Power Electronics Circuits Devices & applications", Pearson publications.
3. Programmable Logic Controllers - "Frank D Petruzela" PHI publications.

Reference Books:

1. Industrial & Power Electronics By Harish C Rai, Umesh Publication, 5 th Edition 1994
2. Programmable Logic Controllers – Principles and applications - John W. Webb. Ronal A.Reis PHI publications 2017
3. Programmable Logic Controller –Pradeep Kumar & Srivashtava- BPB Publications

SEM/YEAR : THIRD/SECOND
COURSE CODE : 18VM313
TITLE OF THE COURSE : MECHANICS OF MACHINES

Course Objectives:

1. To make the student familiar with commonly used mechanism for industrial application.
2. Understand the fundamentals of the theory of kinematics of machines
3. Understand techniques for studying motion of machines and their components.

Course Outcomes:

1. Identify mechanisms in real life applications
2. Perform kinematic analysis of simple mechanisms.
3. Knowledge on different types of Drives, Gears

MODULE-1 **[10 Hrs]**

Introduction to Simple Machines

Definitions – Work, Energy, Load, Effort, Mechanical advantages, Work Input and Output, Efficiency, Velocity ratio. Simple Machines – Introduction to simple machines, Types of simple machines and example. Lifting machines – Introduction to lifting machines, Law of a lifting machines, Types of lifting machines. Simple Screw Jack – Definitions, Principle, Applications and calculations on velocity ration, Mechanical advantages and efficiency

MODULE-2 **[10 Hrs]**

Basics of Kinematics, Mechanism of Machines

Introduction to theory of machines, Difference between machine and machine Structure. Kinematic Link – Introduction to Kinematic link, Types of Kinematic links. Kinematic Pairs - Introduction to Kinematic Pairs, Types of Kinematic Pairs.
Kinematic Chain - Introduction to Kinematic chain, Types of Kinematic chains.
Intermittent Motion Mechanisms – Geneva wheel Mechanism, Ratchet and Pawl Mechanism. Mechanism used to convert rotary motion to linear motion.

MODULE-3 **[10 Hrs]**

Drives

Flat Belt – Materials for flat belt, Applications of flat belts, Speed ratio and RPM calculations of flat belt drives, Care and Maintenance of flat belts.
V-Belt drives – Types of V- Belt, Specification and Applications, Speed ratio and RPM calculations of V-belt drives, Care and Maintenance of V-belts.
Introduction to chain drives, Types, specification and applications of chains and sprockets.
Introduction to Gears, Types of Gears – Spur, Bevel, Helical, Rack & Pinion, Worm wheel.

Text Books:

1. Theory Of Mechanisms And Machines C. S. Sharma, Kamlesh Purohit PHI Learning Pvt. Ltd
2. Mechanics of Machines viswanatha RamamurtI CRC Press

Reference Books:

1. Theory of machines and mechanisms Joseph Edward Shigley Pearson
2. Theory of Machines R.S Khurmi and J.S Gupta S.Chand Publications

SEM/YEAR : THIRD/SECOND
COURSE CODE : 18VM310
TITLE OF THE COURSE : DIGITAL ELECTRONICS LAB

Course Objectives:

1. Know the fundamentals of Boolean algebra and theorems, Karnaugh maps including the minimization of logic functions to SOP or POS form and analyze logic to minimize gate count, signals, IC count or time delay.
2. Strengthen the principles of logic design and use of simple memory devices, flip-flops, and sequential circuits.
3. Infer the logic design of programmable devices, including PLDs.
4. Fortify the documentation standards for logic designs, standard sequential devices, including counters and registers.

Course Outcomes:

1. Minimize logic functions to SOP or POS form and Implement practically using basic gates.
2. Design simple combination logic and experiment using logic gates.
3. Conduct practical experiments to implement design of complex combinational logics.
4. Verify functioning of sequential elements like flip flops,
5. Design counters and implement practically.
6. Design and implement sequence generator
7. Training on usage of Digital trainer boards

LIST OF EXPERIMENTS

Note: Use discrete components to test and verify the logic gates.

1. Study of simple logic gates (IC 7400, 7402, 7404, 7432, 7486)
2. Simplification, realization of Boolean expressions using logic gates/Universal gates
3. Realization of Half/Full adder and Half/Full Subtractors using logic gates and **parallel**
4. **adder/Subtractors using 7483 chip**
5. BCD to Excess-3 code conversion and vice versa.
6. Realization of Binary to Gray code conversion and vice versa.
7. **Design of decoders, encoders and priority encoders and function table verification**
8. Verification of the functioning of Multiplexer and De-multiplexers and **Boolean function Implementation**
9. Realization of One/Two bit comparator and study of 7485 magnitude comparator
10. Truth table verification of **Flip-Flops along with Asynchronous inputs: (i) JK Master slave (ii) T type and (iii) D type.**
11. **Realization of 4 bit counters as a sequential circuit and MOD – N counter design.**
12. Shift left; Shift right, SIPO, SISO, PISO, PIPO operations using 74S195.
13. Wiring and testing Ring counter/Johnson counter.

SEM/YEAR : THIRD/SECOND
COURSE CODE : 18VM306
TITLE OF THE COURSE : COMPUTER PROGRAMMING C AND C++ LAB

Course Objectives:

1. Develop modular, efficient and readable C and C++ programs by hands-on experience.
2. Interpret good profound knowledge in C and C++programming language and enable them to build programs using operators, control structures, arrays, strings, functions, pointers and structures to solve the real world problems. .

Course Outcomes:

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems related to Computer Science and Engineering.
2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems related to Computer Science and Engineering and reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. Design/development of solutions: Design solutions for complex engineering problems related to Computer Science and Engineering and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

List of Experiments

1. Write a C program to check whether a number is even or odd using ternary operator.
2. Write a C program to perform the addition of two numbers without using + operator.
3. Write a C program to generate all the prime numbers between 1 and n, where n is a value supplied by the user
4. Write a C program to find the roots of a quadratic equation.
5. Write a C program to count and display positive, negative, odd and even numbers in an array.
6. Write a C program to print the transpose of a given matrix using function.
7. Create a Book structure containing book_id, title, author name and price. Write a C program to pass a structure as a function argument and print the book details.
8. Write a C++ Program to display Names, Roll No., and grades of 3 students who have appeared in the examination. Declare the class of name, Roll No. and grade. Create an array of class objects. Read and display the contents of the array.
9. Write a C++ program to read the data of N employee and compute Net salary of each employee (DA=52% of Basic and Income Tax (IT) =30% of the gross salary).

10. Write a C++ program to use scope resolution operator. Display the various values of the same variables declared at different scope levels.

11. Write a C++ program to create multilevel inheritance.

12. Write a C++ program to use pointer for both base and derived classes and call the member function. Use Virtual keyword.

13. Write a C program that uses stack operations to convert a given infix expression into its postfix equivalent. Implement the stack using an array.

14. Write C programs to implement a double ended queue ADT using

    i. array and
    ii. doubly linked list respectively

15. Write a C program that uses functions to perform the following:

    i. Create a singly linked list of integers.
    ii. Delete a given integer from the above linked list.
    iii. Display the contents of the above list after deletion.

a) Write a C program that uses functions to perform the following:

    i. Create a doubly linked list of integers.
    ii. Delete a given integer from the above doubly linked list.
    iii. Display the contents of the above list after deletion.

SEM/YEAR : III SEM
COURSE CODE : 18VM314
TITLE OF THE COURSE : Industrial Electronics Lab

Course Objectives:

1. To teach fundamental principles of thyristor family.
2. To develop an overall approach for students from construction of control rectifier, inverter, choppers, study its specification, the functionality, design and practical applications
3. To become familiar with power devices and their application in various fields
4. Learners are expected to understand various controllers, converters, inverters and choppers.

Course Outcomes:

1. Demonstrate an understanding of fundamentals of thyristor family.
2. Analyze the various applications and circuits based on thyristor.
3. Build and test circuits using power devices such as SCR, IGBT and UJT.
4. Analyze and design controlled rectifier, DC to DC converters, DC to AC inverters, how to analyze these inverters and some basic application examples.

LIST OF EXPERIMENTS

Note: Last 5 experiments will be executed by PLC Software using Ladder diagram.

1. Familiarization of digital oscilloscope.
2. General Design and winding of an inductor.
3. General Magnetization and demagnetization of L load using diode and resistor.
4. Reverse recovery characteristics of power diode.
5. VI characteristics of IGBT, SCR and TRIAC.
6. Resistance triggering of SCR and RC triggering of SCR.
7. UJT as a relaxation oscillator and Chopper fed DC motor driver.
8. Case study of Half bridge converter and Full bridge converter.
9. Case study of buck converter and boost converter.
10. Design a PLC Program for the following condition Switch– ON Light – Glows.
11. Design a program DOL Starter for motor. Design a program for forward – Reverse – stop with mutual interlock.
12. Design a program for motor start & stop by using Set & Reset Function
13. Design a program for switching on & off of light using Flip-flop.
14. Design a program for Basic Gates (AND, OR, NOT, NAND, NOR, Ex-or and Ex-Nor Gate).
15. Draw a program file for following expression (L+M+N) + (Q.R) R = S

SEM/YEAR : III SEM / II
COURSE CODE : 18VM308
TITLE OF THE COURSE : PCB DESIGN AND FABRICATION LAB

Course Objectives:

1. Understand the need for PCB Design and steps involved in PCB Design and Fabrication process
2. Familiarize Schematic and layout design flow using Electronic Design Automation (EDA) Tools

Course Outcomes:

1. Understand the steps involved in schematic, layout, fabrication and assembly process of PCB design.
2. Design (schematic and layout) PCB for analog circuits, digital circuits and mixed circuits
3. Design (schematic and layout) and fabricate PCB for simple circuits.

LIST OF EXPERIMENTS

1. Basics of eagle software.
2. Properties of copper clad laminates
3. Layout general rules & parameters
4. Pcb layout design
5. Design a pcb layout for the 5v power supply circuit
6. Design a pcb layout for the given multi-vibrator circuit.
7. Design the pcb layout for automatic street light circuit
8. Design a pcb layout for the given tone generator circuit
9. Design a pcb layout for the given ir sensor circuit
10. Design a pcb layout for the given remote control receiver circuit
11. Design a plc program for the following condition switch– on light – glows.
12. Layout planning
13. Photo printing
14. Plating
15. Etching
16. Multilayer pcb

SEM/YEAR : FOURTH / SECOND
COURSE CODE : 18VM401
TITLE OF THE COURSE : MICROCONTROLLERS & APPLICATIONS

Course Objectives:

1. Familiarization of Micro controller
2. Describe architecture & Instruction set of 8051
3. Understand the programming and Applications of 8051

Course Outcomes:

1. Students can analyze Micro controller
2. Write assembly language coding with the help of instruction set
3. Write programming for various application.

MODULE-1

Introduction to Microprocessors & Microcomputers, Evolution of Microprocessors, Introduction to Microcontrollers, Microcontroller Survey, Comparison of Microprocessors & Micro

Basic memory storage element, 4x8 Bit Register, R/W Memory Model, ROM Memory Model Memory Map and Addresses, Memory Classification, Memory Decoding, RISC & CISC CPU Architectures, Harvard & Von-Neumann CPU architecture, Stacks.

MODULE-2

Functional Pin Description & Architecture of 8051, I/O ports, Memory organization, 8051 addressing modes Instructions set, Assembler directives,8051 assembly language programming and Time delay calculations, Software simulators of 8051, Introduction to Keil Compiler

MODULE-3

8051 Timer/counter, Serial communication Interrupts of 8051

MODULE-4

Square wave generator, Rectangular wave generator, Staircase ramp generator, Temperature controlling system using 8051 , DC Motor Control, Stepper Motor Control, Interfacing 8051 to LCD

MODULE-5

Arduino Microcontroller

Fundamentals of Embedded system, Getting Started with Arduino Exploring the Board of IDE (with its installation procedure). Interfacing with Arduino: Control LEDS from GPIO Pins, Input-Switch Buttons, DC Motor, Stepper motor, Relay, Sensor Interface: LDR, Analog POT, LM35 and Serial Communication

Text Books:

The 8051 micro controller architecture, programming & applications - Kenneth.J.Ayala

Reference Books:

The 8051 micro controller & embedded systems - M.A.Mazidi

SEM/YEAR : FOURTH
COURSE CODE : 18VM411
TITLE OF THE COURSE : PYTHON PROGRAMMING

Course Objectives:

1. Understand the need of python programming
2. Understand data collection using python
3. Understand Functions in python
4. Ability to do programming in python

Course Outcomes:

1. Understand the advantage of python in various fields.
2. Can to analysis on various data collection using python
3. Can create his own Functions in python
4. Can to do programming in python for his own application

MODULE-1

Introduction to Python Programming Language:

- Strengths
- Naming Conventions,
- String Values,
- String Operations,
- String Slices,
- String Operators,
- Numeric Data Types,
- Conversions,
- Built in Functions

MODULE-2

Data Collections and Language Component:

- Introduction,
- Control Flow and Syntax,
- Indenting,
- The if Statement,
- Relational Operators,
- Logical,
- Operators,
- True or False,
- Bit Wise Operators,
- The while Loop,
- The for Loop, Lists,
- Tuples,
- Sets,
- Dictionaries,

MODULE-3

Object and Classes:

- Classes in Python
- Principles of Object Orientation
- Creating Classes
- Instance Methods
- File Organization
- Special Methods
- Class Variables
- Inheritance
- Polymorphism
- Type Identification
- Custom Exception Classes

MODULE-4

Functions

- Introduction
- Defining Your Own Functions
- Parameters
- Function Documentation
- Keyword and Optional Parameters
- Passing Collections to a Function
- Variable Number of Arguments
- Passing Functions to a Function
- Mapping Functions in a Dictionary

MODULE-5

I/O and Error Handling In Python:

- Introduction
- Data Streams
- Creating Your Own Data Streams
- Access Modes
- Writing Data to a File
- Reading Data From a File
- Additional File Methods
- Using Pipes as Data Streams
- Handling IO Exceptions
- Working with Directories
- Metadata
- Errors
- Run Time Errors
- The Exception Model
- Exception Hierarchy
- Handling Multiple Exceptions

Text Books:

1. Kuhlman, Dave. *A python book: Beginning python, advanced python, and python exercises*. Lutz: Dave Kuhlman, 2009.

Reference Books:

1. Python Crash Course: A Hands-On, Project-Based Introduction to Programming (2nd Edition)

SEM/YEAR : FOURTH
COURSE CODE : 18VM404
TITLE OF THE COURSE : MEMS

Course Objectives:

1. Understand the MEMS fundamentals
2. Understand the MEMS fabrication technology
3. Understand Packaging
4. Understanding Micro sensors and actuators

Course Outcomes:

1. Analyze MEMS fabrication technology.
2. Analyze the various Packaging technology
3. Application of MEMS in various fields.

MODULE-1

Overview and Introduction

New trends in Engineering and Science: Micro and Nanoscale systems Introduction to Design of MEMS and NEMS, Overview of Nano and Microelectromechanical Systems, Applications of Micro and Nanoelectromechanical systems, Microelectromechanical systems, devices and structures Definitions, Materials for MEMS: Silicon, silicon compounds, polymers, metals

MODULE-2

Mems Fabrication Technologies

Microsystem fabrication processes: Photolithography, Ion Implantation, Diffusion, Oxidation. Thin film depositions: LPCVD, Sputtering, Evaporation, Electroplating; Etching techniques: Dry and wet etching, electrochemical etching; Micromachining: Bulk Micromachining, Surface Micromachining, High Aspect-Ratio (LIGA and LIGA-like) Technology;

MODULE-3

Packaging

Microsystems packaging, Essential packaging technologies, Selection of packaging materials

MODULE-4

Micro Sensors

MEMS Sensors: Design of Acoustic wave sensors, resonant sensor, Vibratory gyroscope, Capacitive and Piezo Resistive Pressure sensors- engineering mechanics behind these Microsensors. Case study: Piezo-resistive pressure sensor

MODULE-5

Micro Actuators

Design of Actuators: Actuation using thermal forces, Actuation using shape memory Alloys, Actuation using piezoelectric crystals, Actuation using Electrostatic forces (Parallel plate, Torsion bar, Comb drive actuators), Micromechanical Motors and pumps. Case study: Comb drive actuators

References:

1. Marc Madou, "Fundamentals of Microfabrication", CRC press 1997.
2. Stephen D. Senturia," Micro system Design", Kluwer Academic Publishers,2001
3. Tai Ran Hsu ,"MEMS and Microsystems Design and Manufacture" ,Tata Mcraw Hill, 2002.
4. Chang Liu, "Foundations of MEMS", Pearson education India limited, 2006,
5. Sergey Edward Lyshevski, "MEMS and NEMS: Systems, Devices, and Structures" CRC Press, 2002

SEM/YEAR : FOURTH
COURSE CODE : 18VM412
TITLE OF THE COURSE : PLC

Course Objectives:

1. Understand the PLC fundamental
2. Understand the PLC hardware component
3. Understand programming concept in PLC

Course Outcomes:

1. Analyze hardware component in the PLC
2. To do programming in PLC

MODULE-1

PLC BASICS
Introduction to PLC
Overall look inside PLC
BASIC PLC PROGRAMMING
General PLC programming procedure and I/O devices
On/Off inputs and On/Off outputs
Relation between digital gates & coil/contact logic
Creating ladder diagrams for process control

MODULE-2

BASIC FUNCTIONS
Registers basics
Timer functions
Counter functions
INTERMEDIATE FUNCTIONS
Arithmetic functions
Number comparison functions
Number conversion functions

MODULE-3

DATA HANDLING FUNCTION
PLC SKIP & MASTER CONTROL RELAY functions
JMP instruction
Data Movement instruction
Other Functions
Digital bit functions & their applications
Sequencer functions
Robot control with PLC

MODULE-4

ADVANCED PLC FUNCTIONS
Analog input & output functions
Networking PLC –Profibus
Troubleshooting PLC

MODULE-5

Introduction to HMI,SCADA
Introduction to HMI
Introduction to SCADA

Reference Books:

1. Programmable Logic Controllers: Principles and Applications
2. Introduction to Programmable Logic Controllers

SEM/YEAR : FOURTH
COURSE CODE : 18VM413
TITLE OF THE COURSE : MEASURING SYSTEMS

Course Objectives:

1. To get an overview of various industrial instrumentation and its utility
2. To understand various sensors/transducers
3. To understand different electrical/electronics measuring instruments

Course Outcomes:

1. Understand various industrial instrumentation and its utility
2. Analyze various sensors/transducers
3. Analyze different electrical/electronics measuring instruments

MODULE-1

Definition of measuring system.
Measurement system and its constituent elements.
Sensors and transducers.
Performance Terminology.
Static and Dynamic characteristics
Electronic instrumentation
V-F Converter
F-V Converter

MODULE-2

Introduction to Temperature Measurement
Non electrical type temperature sensor: Bimetallic Strip.
Electrical type temperature sensors: Thermistor, RTD, Principles, Types,
Selection of RTD's and signal conditioning circuits.
Thermocouples, Principle, Types, Selection, Standard table of
Thermocouples and signal conditioning circuits
Measurement of temperature using Diodes
IC temperature Transducer using LM35 and AD590

MODULE-3

Introduction to pressure measurement.
Pressure Standards.
Conventional Pressure sensors.
Electrical and Electronic pressure transducers.
Introduction to Calibration and Calibration of Pressure Gauge

MODULE-4

Introduction to displacement measurement.
Potentiometer Sensor, Types, Construction, Operation and Errors.
LVDT, Principle, Operation and Application
Inductive Proximity Switch
Digital Encoder: Contact, Magnetic and Optical Encoder
Rotational Displacement/Angular position: Using optical Encoder and Signal Conditioning circuits.

MODULE-5

Introduction to force, weight and flow measurement. Strain gauge and its function, Load Cell, principle and operation of load cell. Flow measurement using Orifice plate.Introduction, mechanical tachometers, electrical tachometers, types like contact less, frequency type. Basic Ultrasonic Transmission Link, piezoelectric, ultrasonic transmitter and receiver, principle and example.

Reference Books:

1. Principle of measurement systems 2000 JP Bentlley Addision Wesley
2. Instrumentation and Control system Bhasker, Anuradha Agencies

SEM/YEAR : FOURTH / SECOND
COURSE CODE : 18VM410
TITLE OF THE COURSE : MICROCONTROLLERS & APPLICATIONS LAB

Course Objectives:

1. Understand programming in controller and interfacing

Course Outcomes:

1. Do programming in controller and interfacing

S. No	List of experiment
	Microcontroller 8051
1	Familiarization of Keil Compiler
2	Write a program to place the number 8Dh in RAM locations from 30h to 34h
3	Write a program to copy the contents of DPTR to registers R0 (DPL) & R1 (DPH)
4	Write a program to add two 8 bit numbers and store the result in RAM location 35h
5	Write a program to subtract the contents of RAM location 13h from the Ram location 2Bh put the result in RAM location 2Ch
6	Write a program to add two 16 bit numbers without carry and store the result in 30h(LSB) and 31h(MSB)
7	Write a program to exchange the contents of B register and RAM address 30h
8	Write a program to swap the bytes in timer 0.put TL0in TH0 and TH0 inTL0
9	Write a program to Double the number in register R2, and put the result in register in R3 (high byte) and R4 (low byte)
10	Write a program to add the unsigned numbers found in internal RAM locations 25h, 26h and 27h together and put the result in RAM locations31h (MSB) and 30h(LSB)
11	Write a program to multiply unsigned numbers in register R3 by the number in register in R4and put the result in external RAM locations 10h (MSB) and 11h (LSB).
12	Write a program to divide the data in RAM location 3Eh by the number 12h,put the quotient in R4 and the reminder in R5
13	Write a program to place any number in the internal RAM location 3Ch and increment it until the number equal 2Ah
14	Write a program to move a block of data from memory X to Y.
15	Write a program to find the factorial of the number stored in the internal RAM locations 30h.
16	Interfacing programs with 8051
17	LED & Switch Interfacing and display the status in LED
18	Seven segment display interface
19	Alpha numeric LCD interface
20	DC Motor Interfacing
21	Stepper Motor Interfacing
22	Waveform generation:- a) Square Wave b) Rectangular Wave
23	4x4 Matrix Keypad Interfacing
24	Interfacing of ADC

SEM/YEAR : FOURTH / SECOND
COURSE CODE : 18VM414
TITLE OF THE COURSE : PYTHON PROGRAMMING LAB

Course Objectives:

1. Understand using list in python
2. Understand the instructions in python
3. Creating function using python
4. Understand inbuilt function in python

Course Outcomes:

1. Write a coding using list in python
2. Write instructions in python
3. Creating his own function using python
4. Use the inbuilt function in python to his application

List of Experiments:

1. Write python program to print Hello World
2. Write python program to Hello World using string variable
3. Write python program to store data in list and then try to print them.
4. Write python program to do basic trim and slice on string.
5. Write python program to print list of numbers using range and for loop
6. Write python program to store strings in list and then print them.
7. Write python program to find maximum number in the list
8. Write python program in which a function is defined and calling that function prints Hello World
9. Write python program using a function to print the square root of a number.
10. Write python program to find the exponentiation of a number.

SEM/YEAR : FOURTH / SECOND
COURSE CODE : 18VM415
TITLE OF THE COURSE : PLC LAB

Course Objectives:

1. Understand automation and its importance
2. Understand working of PLC
3. Understand I/O modules of PLC

Course Outcomes:

1. Known the importance of automation in the field of interest
2. Implement the various task using PLC
3. Develop programming knowledge in PLC

List of Experiments:

Sl. No	List of Experiment
1	Basic Programming
2	Design a PLC Program for the following condition Switch ON Light – Glows Switch – OFF Light - Puts Off Design a program DOL Starter for motor. Design a program for forward – Reverse – stop with mutual interlock.
3	Design a program for forward – Reverse – stop with direct reversal.
4	Design a program for start – stop – jog. Design an Alarm system.
5	Design a program for motor start & stop by using Set & Reset Function
6	Design a program for switching on & off of light using Flip-flop
7	Design a program that there are three machines, each with its own start and stop functions, only one may run at a time Design a program that the circuit consist of two start and stop button, when any one button is pressed ,the motor runs , even it is released and the stop button is used to stop the motor
8	Design a program a) AND, OR and NOT gate. b) NAND and NOR gate. c) Ex-or and Ex-Nor Gate
9	Design a conveyer control system in which conveyer 'C' is to run when Any one of the 4 inputs is ON & it should stop when any one of the 4 other inputs are ON. Write a program that a fan 'P' will run the equation is getting satisfied. (I1) (I2+I3) (I5.I6) = P
10	Draw a program file for following expression (L+M+N) + (Q.R) R = S

SEM/YEAR : FOURTH / SECOND
COURSE CODE : 18VM416
TITLE OF THE COURSE : MEASUREMENT AND INSTRUMENTATION LAB

Course Objectives:

1. Understand the Procedure of System Measurement
2. Understanding the Use of sensors
3. Understand the concept of temperature control

Course Outcomes:

1. Analyze of various measuring instruments.
2. Use the sensor and measure various parameters
3. Use the various control for various application of interest.

LIST OF EXPERIMENTS:

Sl. No	List of Experiment
1.	Converters V to F Converter using ICL 8038 F to V Converter using LM2907
2.	Thermocouples & RTD Study of types of Thermocouple and characteristics of Thermocouple. Study of RTD and characteristics of RTD.
3.	Sensors Temperature sensing using Diodes. Using LM35 and AD590 as temperature sensor
4.	Temperature Controllers Study of ON OFF control using temperature controller using Thermocouple and RTD.
5.	Pressure gauges Finding error in the given pressure gauge with respect to Digital Gauge. Finding error in the given pressure gauge with respect to Dead Weight Tester.
6.	Measurement of displacement Measurement of Displacement using LVDT.
7.	Design of Counter Designing a counter circuit using Proximity Sensor.
8.	Measurement of load by using Load cell, a. Expansion Method b. Compression method.
9.	Measurement of Speed a. Contact type (Tachometer) b. Non- Contact Type (Proximity Sensor & Stroboscope)
10.	Familiarization of Proximity switch- Familiarization of Inductive Proximity, Capacitive Proximity, IR and Reed Switch. Calibration Experiments

SEMESTER	**V**					
YEAR	**3rd**					
COURSE CODE	**18VM513**					
TITLE OF THE COURSE	**Embedded System and IOT**					
SCHEME OF INSTRUCTION	**Lecture Hours**	**Tutorial Hours**	**Practical Hours**	**Seminar/ Projects Hours**	**Total Hours**	**Credits**
	3	**-**	**-**	**-**	**45**	**3**

Perquisite Courses (if any)			
S. No	**Sem./Year**	**Course Code**	**Title of the Course**
1.	3rd/2nd	18VM301	Digital Electronics
2.	3rd/2nd	18VM303	Computer Programming - C, C++
3.	4th/2nd	18VM401	Micro-controller & Applications

Course Objectives:

1. Describe the architecture instruction set of PIC16F87X.
2. Describe an Embedded System
3. Describe IoT and providing knowledge in Programming

Course Outcomes:

CO No.	**Outcomes**	**Bloom's Taxonomy Level**
CO1	Able to identify architecture and advanced features of embedded processors and micro-controllers	L1
CO2	Able to Understand architecture, instruction set and programming of advanced embedded processors and controllers.	L2
CO3	Able to solve specific real world applications by working with specific microprocessor / micro-controllers	L3
CO4	Able to Understand basic components and building blocks of Internet of Things	L2
CO5	Able to explain about IoT based communication protocols	L1

Course Content:

MODULE-1 **[09 Hrs]**

Introduction: Categories, Overview of embedded system architecture, Applications, Recent trends. Hardware architecture, software architecture. Special Features: Power on reset feature, Watch dog timer, SLEEP mode, Interrupt handling capability.

MODULE-2 **[09 Hrs]**

Introduction to Peripheral Interface Controller and its features. Pin diagram, Architecture, Memory organization. I/O Ports, Timers, Programming of PIC.

MODULE-3 **[09 Hrs]**

Introduction to Node MCU and its features, Pin configuration of NODE MCU, Introduction to Arduino and its features, Variables, Data Types Constants, Programming Structure, Programming Structure, Programming Structure, Serial Data Monitoring.

MODULE-4

Definition, Basic terminologies used in IoT, Components of IoT, Architecture of IoT, Four Stages of IoT Architecture, Industrial IoT – Process, Advantages and Applications

MODULE-5

Networking Layers and Protocols, Networking Layers and Protocols, MQTT, Comparison of MQTT with other protocols and PUB/SUB approach, Control the Interface through Mobile App Using Node MCU.

Text Books:

1. Embedded / Real-Time Systems: Concepts, Design and Programming K.V.K. Prasad Dream tech Press.
2. PIC Microcontroller and Embedded System: Using assembly and C for PIC 18 - Mazidim Muhammad Ali – Pearson.

References:

1. PIC Microcontroller and Embedded System: Using assembly and C for PIC 18 - Mazidi Muhammad Ali – Pearson.
2. The Fourth Industrial Revolution" by Klaus Schwab.

SEMESTER	**V**					
YEAR	**III**					
COURSE CODE	**18VM514**					
TITLE OF THE COURSE	**Product Design and Development**					
SCHEME OF INSTRUCTION	**Lecture Hours**	**Tutorial Hours**	**Practical Hours**	**Seminar/ Projects Hours**	**Total Hours**	**Credits**
	2		-	-	30	2

Perquisite Courses (if any)			
S. No	**Sem./Year**	**Course Code**	**Title of the Course**
1	Nil		

Course Objectives:

1. Introducing a learner or students to concepts of Engineering design
2. Introducing a learner or students to concepts of Product design and development according to the market need.

Course Outcomes:

CO No.	**Outcomes**	**Bloom's Taxonomy Level**
CO1	Understanding the basic theories in production planning in product development	L2
CO2	Imparting the knowledge of design thinking & innovation	L3
CO3	Applying design thinking knowledge to develop a prototype of an desired product	L3
CO4	Understanding Product Life Cycle in production planning	L3
CO5	Analysis of Product Design	L4

Course Content:

MODULE-1 **[06 Hrs]**

Design Process, Key Elements for Design, Bottom up and Top down Design, Characteristics of Structural model – Hierarchy, Modularity, Regularity and Locality

MODULE-2 **[06 Hrs]**

Introduction to design thinking, Design Thinking Process, Emphasize, Define the Problem, Ideate, Develop Prototype, Test the Product, Case Studies.

MODULE-3 **[06 Hrs]**

What is a Product? Defining Product by Nature of Demand, New Product Strategy, Production Classification, Product Life Cycle and various stages of PLC, Managing Product Life Cycle.

MODULE-4 **[06 Hrs]**

Introduction to Product design practice, Product strategies, Time to market, Analysis of the Product, The Three S's - Standardization, Simplicity and Specialization.

MODULE-5 **[06 Hrs]**

Plan and Define Program, Product Design and Development Verification, Process Design and Development Verification, Product and Process Validation.

Text Books:

1. Product design and process Engineering - Benjamin W. Nebel Alnab - Draper – McGraw Hill edn.

References:

1. Mechatronics: Electronics in Product and Process - Bradley Dawson, N C Burd A Loader

SEMESTER	**V**					
YEAR	**III**					
COURSE CODE	**18VM515**					
TITLE OF THE COURSE	**CNC Technology**					
SCHEME OF INSTRUCTION	**Lecture Hours**	**Tutorial Hours**	**Practical Hours**	**Seminar/ Projects Hours**	**Total Hours**	**Credits**
	3	-	-	-	30	2

Perquisite Courses (if any)			
S. No	**Sem/Year**	**Course Code**	**Title of the Course**
1	III/ II	18VM311	Control System

Course Objectives:

- To gain knowledge in NC and CNC
- Gain knowledge in different types of cutting tool materials, holders, ATC

Course Outcomes:

CO No.	**Outcomes**	**Bloom's Taxonomy Level**
CO1	Understanding the introduction and classification of CNC	L2
CO2	Imparting the knowledge on various tools used in CNC	L3
CO3	Imparting the knowledge on manual operation	L3
CO4	Understanding Functions for Milling and Turning	L2
CO5	Analysis of Machine Maintenance and problems associated	L4

Course Content:

MODULE-1 **[06 Hrs]**

CNC: Introduction - Application - Advantages - Disadvantages - Development - Economy, Classification of CNC based on Feed Back control system. Open loop control system - Closed loop control system, Classification of CNC based on Motion control system - Point to Point - Straight cut - Contouring, Types of Spindle drive: AC Servo Motor - Special features of servomotor, Hydraulic drives, Types of Axis Drive – stepper motor – servo motor - Features of stepper motor, Friction reducing elements, Reciprocating ball bushes - Metallic and non-metallic guide ways - Spindle Bear- ing - Ball lead screw, Feedback devices,Machine Control Unit, Automatic Tool Changer, Automatic Pallet Changer, Automatic swarf removal mechanism, Tool and Work holding devices

MODULE-2 **[06 Hrs]**

CNC Turning Centre - Application of Face Tool, Turn Tool, Groove Tool, Bore Tool, Thread Tool, CNC Machining Centre - Application of End Mill cutter, Ball Nose Cutter, Slab Mill Cutter, Hollow Mill Cutter, Thread Mill Cutter, Face Mill Cutter, Dovetail Cutter, Special profile milling cutters

MODULE-3 **[06 Hrs]**

Manual Operating Mode, Jogging an Axis, Continuous Jog, Incremental Jog,Hand Pulse Generator (HPG) Jog, Arbitrary Angle Jog, Jog Offset, Resetting over travels, Mechanical Handle Feed, Removing an Axis, Manual Machine Homing.

MODULE-4 **[06 Hrs]**

Axis Nomenclature, Coordinate System, Tool Length Compensation, Cutter Radius Compensation, Preparatory and Miscellaneous Functions for Milling and Turning, Program Format, exercise on Part Programming in Milling and Turning.

MODULE-5 **[06 Hrs]**

Coolant - Function, Types and Application, Understanding and Responding to Alarms in CNC, Types of Machine Maintenance, Maintenance Tools and Accessories required for CNC Machine Main- tenance, Problems related to Mechanical Systems in CNC, Causes for the failure of Electronic System in CNC, Deviations from Normal Performance in CNC Machine, Backlash, Checklist for CNC Main- tenance, Best Maintenance Practices, Troubleshooting - Causes and Remedie.

Text Books:

1. Student Workbook for Programming of CNC Machines - KEN EVANS - Industrial Press Inc
2. CNC Programming Techniques: An Insider's Guide to Effective Methods and Applications -Peter Smid - Industrial Press Inc.

Reference Books:

1. CNC Programming Techniques: An Insider's Guide to Effective Methods and Applications - Peter Smid - Industrial Press Inc
2. CNC Machines - M.Adithan - B S Pabla - New Age International Publishers

SEMESTER	**V**					
YEAR	**III**					
COURSE CODE	**18VM516**					
TITLE OF THE COURSE	**Robotics**					
SCHEME OF INSTRUCTION	**Lecture Hours**	**Tutorial Hours**	**Practical Hours**	**Seminar/Projects Hours**	**Total Hours**	**Credits**
	2	-	-	-	30	2

Perquisite Courses (if any)			
#	**Sem/Year**	**Course Code**	**Title of the Course**
1	I	18VM104	Electronics-1
2	II	18VM205	Mechanical Engineering

Course Objectives:

- Familiarization to industrial robot and its application.
- Familiarization to the robot programming language.
- Familiarization to Robot Maintenance Safety

Course Outcomes:

CO No.	**Outcomes**	**Bloom's Taxonomy Level**
CO1	Gaining knowledge on introduction to robotics.	L1
CO2	Understand the mechanics of robotics.	L2
CO3	Learn about Robotic Programming Language	L3
CO4	Understand the applications of Robotics	L3
CO5	Design and analyze the robotics.	L4

Course Content:

MODULE-1 **[06 Hrs]**

Introduction to Robotics and Basic Structure, Laws of Robotics, Definition of Robot, Robot Component Recognition – Robot Arm, Robot Controller, End Effector, Robot Arm components, Robot Controller Components, Accessories and Input devices, Types of Robot, Selection of Robot- Payload, Speed, Reach, Parts of Industrial Robots, Links, Joints and Joints Notation Scheme, Degrees of Freedom, Required DOF in a Manipulator, Arm Configuration and Wrist Configuration, Work Cell, Work Envelope, and Work Volume, Robot End Effectors – Definition, Classification of End Effectors, Types of Grippers, Consideration in gripper selection and designing.

MODULE-2 **[06 Hrs]**

Introduction, link description, Joint link connection description, Kinematic modelling of manipulator, Direct and Inverse manipulator Kinematics, Manipulator dynamics, Trajectory planning – Basics, Robot Communication methods for I/O Interfacing, Robot Communication methods for I/O Interfacing.

MODULE-3 **[06 Hrs]**

Types of Programming methods, Types of Programming methods, Robot Programming Languages.

MODULE-4 **[06 Hrs]**

Industrial applications: Material Handling, Machining, Welding, Painting, Non-industrial applications

MODULE-5 **[06 Hrs]**

Introduction Risks specific to robots, General Robot maintenance ,Different start modes in Robot, Mastering of Robot

Text Books:

1. Introduction to Robotics: Mechanics and Control - John. J. Craig - Pearson Education India
2. Robotics: Beginner to Expert - Peter Mckinnon - Create Space Independent Publishing Platform

References:

1. Robotics and Control - RK Mittal, I.J.Nagra - McGraw Hill Education - Peter Smid - Industrial Press Inc.
2. Industrial Robotics (Special Indian Edition) - Groover - Tata McGraw-Hill Education

SEMESTER	**V**					
YEAR	**III**					
COURSE CODE	**18VM522**					
TITLE OF THE COURSE	**Advanced PLC**					
SCHEME OF INSTRUCTION	**Lecture Hours**	**Tutorial Hours**	**Practical Hours**	**Seminar/Projects Hours**	**Total Hours**	**Credits**
	3	-	-	-	45	3

Perquisite Courses (if any)			
S. No	**Sem/Year**	**Course Code**	**Title of the Course**
1	IV	18VM412	Programmable logic Controllers

Course Objectives:

1. Familiarization with PLC Hardware & Troubleshoot the PLC connections
2. Understanding the various communication protocols in PLC
3. Understanding the concept of distributed control system.

Course Outcomes:

CO No.	**Outcomes**	**Bloom's Taxonomy Level**
CO1	Familiarizing with PLC Wiring and Analog & Digital I/O	L2
CO2	Interfacing PLC to external devices using different Communication Protocols	L3
CO3	Understanding Trouble shooting of PLC Connection	L3
CO4	Understanding the Role of Distributed Control System in an industrial Process	L3
CO5	Apply the knowledge of Troubleshooting, Programming to design Distributed Control System	L4

Course Content:

MODULE-1 **[09 Hrs]**

Representing Analog signals with Binary Numbers, Bits and Bytes, A/D Converter, Resolution of Analog Signals, Analog Signal Range, Analog Input, Wiring of Analog Inputs, Voltage Analog Input Wiring, Current Analog Input Wiring, 3 2- Wire, 3- Wire and 4- Wire Analog Input, Analog Input Scaling, Analog Output, Wiring of Analog Outputs, Voltage Analog Output Wiring, Current Analog Output Wiring, Analog Output Scaling and Un-scaling.

MODULE-2 **[09 Hrs]**

ADVANCED PLC PROGRAMMING LANGUAGES – BASICS:
Types of PLC Programming, Functional Block Diagram (FBD)
PLC COMMUNICATION PROTOCOLS: PLC Communication Protocol and Types, Modbus RTU, Ethernet/IP and Ethernet TCP/IP, Mod- bus TCP/IP, Profibus and Profinet

MODULE-3 **[09 Hrs]**

PLC TROUBLE SHOOTING: Module Failure in the input and output I/O system, Electrical Noise Interference, Corrupted Memory, Power Problems, Communication Issues
HUMAN MACHINE INTERFACE – HMI
Introduction to MMI/HMI, Types of Operator Interface, Data handling with HMI, HMI Wiring Procedure, Configuration and Interfacing to PLC and HMI, Communication Protocols, Advantages and Applications of HMI

MODULE-4 **[09 Hrs]**

DISTRIBUTED CONTROL SYSTEM: Introduction, Architecture of DCS, Elements of DCS, Features of DCS, Comparison of PLC and DCS, Advantages and Applications of DCS

MODULE-5 **[09 Hrs]**

Advantages and Applications of DCS: Introduction, Role of SCADA in Automation, Difference between SCADA and HMI, Components of SCADA System – Field Instruments, Field Controllers (RTUs/PLCs), HMI, Network Connectivity, Data Base, SCADA Architecture, Types of SCADA System, Features of SCADA, Application Example of SCADA, SCADA Communication Protocol-IEC, Distributed Network Protocol (DNP3), OPC Communication.

Text Books:

1. Programmable Logic Controllers: Principles and Applications - John. Webb, Ronald.A. Reis - Prentice Hall India Learning Private Limited
2. Programmable Logic Controllers - Frank D Petruzella - McGraw - Hill Education

References:

1. Programmable Logic Controllers: Industrial Control - Khaled kamel - Mc Graw - Hill Education.

SEMESTER	**V**					
YEAR	**III**					
COURSE CODE	**18VM523**					
TITLE OF THE COURSE	**Process Control**					
SCHEME OF INSTRUCTION	**Lecture Hours**	**Tutorial Hours**	**Practical Hours**	**Seminar/Projects Hours**	**Total Hours**	**Credits**
	3	-	-	-	45	3

Perquisite Courses (if any)			
S.No	**Sem/Year**	**Course Code**	**Title of the Course**
1	III/ II	18VM311	Control System

Course Objectives:

- To Prepare the students/learner to understand how a Process is controlled in industries.
- To enable the students to understand the concept of instrumentation, various sensors and transducers used to control the process.
- Impart the knowledge of various controller.

Course Outcomes:

CO No.	**Outcomes**	**Bloom's Taxonomy Level**
CO1	Interpret PLC architecture and configure DCS to handle local and distributed automation tasks	L3
CO2	Design and Conduct experiments, as well as analyze and interpret data	L3
CO3	Analyze Various types of Controllers to configure proper process control.	L4
CO4	Recommend necessary final control element for a given application.	L3
CO5	Design or configure various subsystems for industrial automation	L3

Course Outcomes:

MODULE-1 **[09 Hrs]**

Definition – Process – Functional block diagram of an Automatic process control system – Set point – Measured variable – Comparator – Error – Controller – Final control element. Controlled variable – Manipulated variable – disturbances –Advantages of Automatic control system – Simple Liquid level control system – Flow control system – Temperature control system with transportation Lag – Self Regulation – Capacitance and Capacity. Piping and Instrumentation flow Diagram (BIS standard) for the above system

MODULE-2 **[09 Hrs]**

Controller – Block diagram, Types, General properties – Reverse and Direct action, Controller modes – Discontinuous – On – Off Control with differential gap, without differential gap – Neutral zone– Continuous – Proportional controller – Proportional band (PB) – Effect of PB on a controller output – Offset –Integral control – PI – PD – PID – Definition, salient features, applications and limitations of the above controllers – Selection of control action – Electronic controllers – Error detector Two position controller – P,I,D,PI,PD, PID controllers –reverse action – pneumatic controllers – Flapper– Nozzle mechanism, Pneumatic relay.

MODULE-3 **[09 Hrs]**

Concept of tuning – Criteria for controller tuning – Quarter decay ratio, IAE, ISE, ITAE – Methods of tuning – Open loop response method – Process reaction curve –Closed loop response method – Ultimate cycle method, Damped oscillation method.

MODULE-4 **[09 Hrs]**

Signal converters – P to I Converter, I to P Converter – Actuators – Electrical, Pneumatic, Hydraulic and Electro pneumatic – Valve Positioners – Control valve –Characteristics Quick opening, Linear, Equal percentage – Control valve sizing – Cv rating – Selection of a control valve – Effects of Cavitation and Flashing on control valve performance

MODULE-5 **[09 Hrs]**

Cascade control system, Ratio control systems, feed forward control system, Comparison of feedback control system and feed forward control system. (One specific application for each of the above systems) – Introduction DCS and SCADA Block Diagram of Fuzzy logic controller – block diagram – typical application-washing machine.

Text Books:

1. Donald P Eckman, Process control,Wiely Eastern limited,1991
2. Peter Hariot, Process control,TataMcgraw Hill.

References:

1. George Stephanopoulos, Chemical process control.
2. B. SankaraGomathi, Process control (Principles and applications), J J Publications, 1981

SEMESTER	**V**					
YEAR	**III**					
COURSE CODE	**18VM517**					
TITLE OF THE COURSE	**Embedded System Lab**					
SCHEME OF INSTRUCTION	**Lecture Hours**	**Tutorial Hours**	**Practical Hours**	**Seminar/Projects Hours**	**Total Hours**	**Credits**
	-	-	3	-	45	3

Course Objectives:

1. Familiarization to Embedded Systems
2. Familiarization to Programming and Interfacing

Course Outcomes:

1. Understand the Embedded Controller
2. Understand basic concepts of Programming

LIST OF EXPERIMENTS

1. Write a program to place a number FFh in memory location 20h to 25 h
2. Write a program to add two 8-bit numbers without carry
3. Write a program to subtract two 8- bit numbers and store the result in memory location 25h
4. Write a program to shift an 8 {bit number to the left by two bits
5. Write a program to move a block of 05 numbers present in memory location 20h to 30h
6. Write a program to mask the lower four bits of an 8 {bit data present in memory location 25h'
7. Write a program to check the D3 rd bit of an 8 bit data is 1 or not if it is 1 store FF in memory location 25h else store 00h
8. Write a program to SWAP an 8-bit data and store the result in 25h
9. Write a program to complement an 8-bit data and store the result in 21h
10. Interfacing Programs On Pic Micro Controller Led Blinking

SEMESTER	**V**					
YEAR	**III**					
COURSE CODE	**18VM518**					
TITLE OF THE COURSE	**CNC Technology Lab**					
SCHEME OF INSTRUCTION	**Lecture Hours**	**Tutorial Hours**	**Practical Hours**	**Seminar/Projects Hours**	**Total Hours**	**Credits**
	-	**-**	**3**	**-**	**45**	**3**

Course Objectives:

1. Familiarization to CNC Machine
2. Familiarization with Maintenance of CNC machine

Course Outcomes:

1. Understand of CNC Machine
2. Understand the Maintenance of CNC Machine

LIST OF EXPERIMENTS

1. Introduction to CNC Machine
2. Machine specification
3. Machine Control Panel
4. Settings of Offset
5. Editing of program
6. Single Block, Dry run
7. Measuring work co-ordinate offset, DNC
8. Introduction to Master CAM
9. 2D Drafting
10. 2D Contour
11. Pocket
12. Drill
13. Facing
14. 3D Counter Surface Machining

SEMESTER	**V**					
YEAR	**III**					
COURSE CODE	**18VM519**					
TITLE OF THE COURSE	**Advanced PLC Lab**					
SCHEME OF INSTRUCTION	**Lecture Hours**	**Tutorial Hours**	**Practical Hours**	**Seminar/Projects Hours**	**Total Hours**	**Credits**
	-	-	3	-	45	3

Course Objectives:

1. To understand the ladder logic programming using PLC.
2. To develop an overall approach for students, learn basics of Hardware and Software of PLC family.
3. Learners are expected to understand Timer, Counters, Conveyors and PID Controllers
4. To apply knowledge of PLC in real world applications.

Course Outcomes:

1. Understand and develop the programming language in PLC
2. Demonstrate the understanding of fundamentals of Timers and Counters.
3. Analyze the various real time applications using PLC
4. Different Advanced Case Studies using PLC

LIST OF EXPERIMENTS

Note : All the experiments will be demonstrated using Rexroth Bosh Labs(Hydraulics, Pneumatics, PLC)

1. Study Hardware and Software Used in PLC
2. Study understand perform experiments on Timers
3. Implementation of ON and OFF delay Timers
4. Study understand perform experiments on Counters.
5. Implementation of UP and Down Counters.
6. Demonstration of UP-Down Counter.
7. Implementation of PLC Arithmetic Instructions
8. Logic Implementation for Bottle Filling Application
9. Logic Implementation of Traffic Control applications
10. Design PLC Program for Direct and Indirect Double acting Cylinder
11. Case study of Conveyor System Using PLC
12. Case Study of PID controller Using PLC

SEMESTER	**V**					
YEAR	**III**					
COURSE CODE	**18VM520**					
TITLE OF THE COURSE	**Robotics Lab**					
SCHEME OF INSTRUCTION	**Lecture Hours**	**Tutorial Hours**	**Practical Hours**	**Seminar/Projects Hours**	**Total Hours**	**Credits**
	-	-	3	-	45	3

Course Objectives:

1. Familiarization of Robotics handling
2. Familiarization with writing and running robotics programming

Course Outcomes:

1. Understand Robotics handling
2. Understand writing and running robotics programming

LIST OF EXPERIMENTS

1. Robot component recognition
2. Manipulating the robot
3. Recording the position
4. Writing and running robot programs
5. Creating a Program using
6. Control Instruction
7. Create a Pick and Place Program using control Instruction
8. Robot Simulation
9. Coordinate System
10. Macros, Mastering, Backup and restore

SEMESTER	**VI**					
YEAR	**III**					
COURSE CODE	**18VM608**					
TITLE OF THE COURSE	**Industrial Management**					
SCHEME OF INSTRUCTION	**Lecture Hours**	**Tutorial Hours**	**Practical Hours**	**Seminar/Projects Hours**	**Total Hours**	**Credits**
	3	**-**	**-**	**-**	**45**	**3**

Perquisite Courses
No Prerequisite courses.

COURSE OBJECTIVES:

1. Familiarization of levels of management.
2. Familiarization of productivity.
3. Familiarization of with the definition of TQM/TPM

Course Outcomes:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Understand the definitions and levels of management	L3
CO2	Understand the meaning of productivity.	L3
CO3	Understand the programming and Applications of Arduino	L4
CO4	Understand the industrial factories act.	L3
CO5	Understand the recruitment Procedure.	L2

Course Content:

MODULE-1 **[09 Hrs]**

Basics of management and Functions, Levels of management, role and responsibility, Quality control, inspection, 7 QC tools, SQC and SPC, Quality standards, ISO 9000 Clauses and Steps to Implement ISO 9000.

MODULE-2 **[09 Hrs]**

Types of Pollution and Environmental issues, Environment Management System - ISO 14001, Losses due to Industrial Accidents, Direct Indirect Losses, Preventive Measures, Safety Committee Safety Management System(OSHAS 18001)

MODULE-3 **[09 Hrs]**

Brief about TPS 14 Principles of Toyota, Definition of Lean, Lean thinking, 8 Waste of Lean Manufacturing and Common lean tools, JIT (JUST IN TIME) in lean and Lean Deployment

MODULE-4 **[09 Hrs]**

Definitions Descriptions of TPM, Benefits of Implementing TPM, TPM Model and 8 Pillars of TPM, Introduction to Overall Equipment Effectiveness(OEE), TQM Overview and Principles of TQM, Cost of Quality and 6 Cs of Quality, 5 Core Tools, TQM Implementation

MODULE-5 **[09 Hrs]**

Recruitment Procedure, Training Training Needs, Leadership,Team Building Creativity, Employee's welfare facilities, Industrial relations-Industrial disputes, Trade union act-rights and Liabilities, In- dian factories act, Payment of wages act, workmen's compensation act, workmen's compensation act

Text Books:

1. Industrial Engineering and Management - O P Khanna.

Reference Books:

1. Hi-Tech Industrial Management – B C Prabhakar

SEMESTER	**VI**					
YEAR	**III**					
COURSE CODE	**18VM609**					
TITLE OF THE COURSE	**Industrial Equipment Maintenance**					
SCHEME OF INSTRUCTION	**Lecture Hours**	**Tutorial Hours**	**Practical Hours**	**Seminar/Projects Hours**	**Total Hours**	**Credits**
	3	-	-	-	45	3

Perquisite Courses (if any)			
S.No	**Sem/Year**	**Course Code**	**Title of the Course**
1	II/I	18VM204	Electrical Engineering Science
2	III/II	18VM312	Industrial Electronics
3	V/III	XXXXX	CNC Technology

Course Objectives:

1. To understand and become familiar with Industrial Equipment.
2. To become familiar with Condition based Maintenance of Instruments.
3. To be able understand on electrical equipment maintenance.

Course Outcomes:

CO No.	**Outcomes**	**Bloom's Taxonomy Level**
CO1	Understand the concept of reliability aspects of Electronics equipment	L2
CO2	Understand importance of calibration of Electronics equipment	L3
CO3	Understand the maintenance of Power Transmission Devices	L2
CO4	Understand the maintenance Material Handling equipment.	L4
CO5	Understand the electronics equipment test maintenance.	L2

Course Content:

MODULE-1 **[09 Hrs]**

Introduction, Objectives of Maintenance, Maintenance Policies, Types of maintenance – Scheduled, Proactive, Preventive, Breakdown. Organizational setup and Maintenance Departments, Maintenance Planning, Planning Scheduling, Repair Cycle, Repair Complexity, Equipment History card, Master Schedule Card, Work-Order, Work-Report, Controlling – Maintenance Reliability Spare Parts Planning – Codification of Spares, Preservation of Past Data, Practice to use standard spares, Effective Purchase Procedures ,Classification of spare Parts – ABC Analysis Utilization of Human Resources in Maintenance; Maintenance – Work Specification–Work Measurement; Maintenance organization, training of maintenance personnel, planning of spares inventory, assessment of spare parts requirement Example of engine lathe and milling machine overhaul, inspection and checking.

MODULE-2 **[09 Hrs]**

Introduction of Maintenance of Power Transmission Devices, Maintenance of bearings, clutches, brakes and couplings Installation and alignments, Maintenance of power transmission elements like belt drives, chain drives and gear Drives, Trouble in hydraulic systems and their causes, technical environment required for assembly of hydraulic transmission Pumps its Repair, Maintenance of portable electric tools, Maintenance of portable pneumatic tools, Maintenance of air compressors.

MODULE-3 **[09 Hrs]**

Installation, Erection, Commissioning Maintenance Of CNC Machines, Installation, Erection, Com- missioning Of CNC Machines, Maintenance Of CNC Machines.

MODULE-4 **[09 Hrs]**

MAINTENANCE OF MATERIAL HANDLING EQUIPMENTS:
Maintenance of rope – wire rope and fiber rope, Maintenance of hoist equipment, Wrench and EOT Crane, Maintenance of belt conveyors, Maintenance of hydraulic and pneumatic conveyors.
CONDITION BASED MAINTENANCE:
Condition Monitoring – Methods Of Load Monitoring, Temperature Monitoring, Lubrication Monitoring, Leak Detection, Corrosion Monitoring OFF – Load Monitoring – Crack Detection, Vibration Monitoring Lubrication Monitoring – Debris Deposited, Debris In Suspension, Condition Of Used Oil, Ferro Graph. Thermal Monitoring, Location Of Temperature Measurement, Temperature Monitoring Devices, Sensors, Optical Pyrometer, Radiation Pyrometer. Vibration And Noise Monitoring
Causes, Measurement, Noise Signals, Signature Analysis.

MODULE-5 **[09 Hrs]**

REPAIR OF A.C. AND D.C. MACHINES:
Repair of A.C. Machines – starting of induction motor, sparking at slip rings, abnormal heating of the bearings, oil leakage and oil splashing from bearings Dismantling and assembling of induction motor, adjustment, testing and repair of A.C. machines Main faults of D.C. motors, brush sparking, commutator overheating, Armature overheating of pole coils, motor fails to start, Dismantling and assembly of D.C. motors, adjustment, testing of assembled motor after repair of transformers, dismantling of transformers, repair of windings, testing of transformers
ELECTRONICS TEST EQUIPMENT MAINTENANCE:
Trouble shooting and servicing of Electronics test equipment Calibration of Electronics Test Equipment Fault detection techniques, watchdog techniques Parity and error coding checks, common hard- ware faults Microprocessor systems, Emulation and simulation Reliability Aspects Of Electronic Equipment

Text Books:

1. Testing of Machine Tools Dr. George Schlesinger, Pergamon Press
2. Industrial Maintenance by HP Chand Co

Reference Books:

1. Management of Industrial Maintenance, A Kelly M J Harris
2. Maintenance Engineering, L C Morrow

SEMESTER	**VI**					
YEAR	**III**					
COURSE CODE	**18VM610**					
TITLE OF THE COURSE	**Additive Manufacturing**					
SCHEME OF INSTRUCTION	**Lecture Hours**	**Tutorial Hours**	**Practical Hours**	**Seminar/Projects Hours**	**Total Hours**	**Credits**
	3	-	-	-	45	3

Perquisite Courses (if any)			
S. No	**Sem/Year**	**Course Code**	**Title of the Course**
1	I/I	18VM105	Basics of Computer I
2	III/II	18VM313	Mechanics of Machines
3	V/III	XXXX	CNC Technology

Course Objectives:

1. To understand the fundamentals for additive manufacturing and how it is different and discuss about various types of liquid based, solid based and powder-based AM technologies
2. To understand the various types of Pre-processing, processing, post-processing errors in AM. Also to know the various types of data formats and software's used in AM.
3. To know the various applications of AM in design analysis, aerospace, automotive, biomedical and other fields

Course Outcomes:

CO No.	**Outcomes**	**Bloom's Taxonomy Level**
CO1	Understand the fundamentals of Additive manufacturing	L2
CO2	Understand the system and analysis of the same	L4
CO3	Understand the power based AM system	L2
CO4	Understand the AM format and analyzing the software needs	L4
CO5	Applying the AM knowledge for various application	L5

MODULE-1 **[09 Hrs]**

Prototyping fundamentals: Need for time compression in product development, Need for Additive Manufacturing, Historical development, Fundamentals of Additive Manufacturing, AM Process Chain, Advantages and Limitations of AM, Commonly used Terms, Classification of AM process, Fundamental Automated Processes: Distinction between AM and CNC, other related technologies.

MODULE-2 **[09 Hrs]**

Liquid-based AM Systems: Stereo lithography Apparatus (SLA): Models and specifications, Process, working principle, photopolymers, photo polymerization, Layering technology, laser and laser scanning, Applications, Advantages and Disadvantages, Case studies. Solid ground curing

(SGC): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Polyjet: Process, Principle, working principle, Applications, Advantages and Disadvantages, Case studies. Microfabrication. Solid-based AM Systems: Laminated Object Manufacturing (LOM): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Fused Deposition Modeling (FDM): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Multi-Jet Modelling (MJM): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies.

MODULE-3 **[09 Hrs]**

Powder Based AM Systems: Selective laser sintering (SLS): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Three-dimensional Printing (3DP): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Laser Engineered Net Shaping (LENS): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Electron Beam Melting (EBM): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Rapid Tooling: Introduction to Rapid Tooling (RT), Conventional Tooling Vs RT, Need for RT. Rapid Tooling Classification: Indirect Rapid Tooling Methods: Arc Spray Metal Deposition, Investment Casting, Sand Casting, 3D Keltool process. Direct Rapid Tooling: Direct AIM, LOM Tools, DTM Rapid Tool Process, EOS Direct Tool Process and Direct Metal Tooling using 3DP.

MODULE-4 **[09 Hrs]**

AM Data Formats: Reengineering for Digital Representation, STL Format, STL File Problems, Consequence of Building Valid and Invalid Tessellated Models, STL file Repairs: Generic Solution, Other Translators, Newly Proposed Formats. Mesh Refining by Sub division Techniques. AM Software's: Need for AM software, Features of various AM software's like Magics, Mimics, Solid View, View Expert, 3 D View, Velocity 2, Rhino, STL View 3 Data Expert and 3 D doctor, SurgiGuide, 3-matic, Simplant, MeshLab.

MODULE-5 **[09 Hrs]**

AM Applications: Application – Material Relationship, Application in Design, Application in Engineering, Analysis and Planning, Aerospace Industry, Automotive Industry, Jewelry Industry, Coin Industry, GIS application, Arts and Architecture. RP Medical and Bioengineering Applications: Planning and simulation of complex surgery, Customised Implants & Prosthesis, Design and Production of Medical Devices, Forensic Science and Anthropology, Visulization of Biomolecules. Web Based Rapid Prototyping.

Text Books:

1. Rapid prototyping: Principles and Applications - Chua C.K., Leong K.F. and LIM C.S,
2. World Scientific publications , Third Edition, 2010.
3. Rapid Manufacturing – D.T. Pham and S.S. Dimov, Springer , 2001

Reference Books:

1. Wholers Report 2000 – Terry Wohlers, Wohlers Associates, 2000
2. Rapid Prototyping & Engineering Applications – Frank W.Liou, CRC Press, Taylor & Francis Group, 2011.

SEMESTER	**VI**					
YEAR	**3rd**					
COURSE CODE	**18VM611**					
TITLE OF THE COURSE	**Automotive Electronics Lab**					
SCHEME OF INSTRUCTION	**Lecture Hours**	**Tutorial Hours**	**Practical Hours**	**Seminar/Projects Hours**	**Total Hours**	**Credits**
	-	-	4	-	60	4

Course Objectives:

1. Familiarization of Code Warrior IDE
2. Familiarization with Interfacing Concepts, driver Concepts and CAN

Course Outcomes:

1. Understand Code Warrior IDE
2. Understand Interfacing Concepts, driver Concepts and Controller Area Network

LIST OF EXPERIMENTS

1. Introduction to HCS12 Demonstration board and Code Warrior IDE
2. I/O Configuration and Port Integration Module of HCS12 Microcontroller
3. Interface a LED with the Board and Write a driver to control it
4. Interface a SWITCH with the Board and Write a driver to control it
5. Write a driver to control a the device using ADC (Analog to Digital Conversion)
6. Write a driver to establish a SCI communication between a host PC and the HCS 12 demo board
7. Write a driver to configure the Timer of HCS12 controller
8. Write a driver to configure the PWM of HCS12 and control the actuator
9. Write a driver to establish a SPI communication between a host PC and the HCS 12 demo board
10. Write a driver to establish a CAN (Controller Area Network) communication between a host PC and the HCS 12 demo board