THIRD SEMESTER

Subject Code	**MA1201**	**Total Contact Hour**	**30**
Semester	**3rd**	**Total Credit**	**3**
Subject Name	**Mathematics–III**		
SYLLABUS			
Module-I	Random variables (Discrete and Continuous. Cumulative Distribution Function (CDF). Variance and standard deviation. Moments. Functions of a random variable. Distributions: Binomial, Poisson, normal, Gaussian, uniform (definitions and examples only). Moment generating function.		6 Hrs
Module-II	Pairs of random variables. Joint probability density function. Joint probability mass function. Marginal distribution. Functions of two random variables, PDF and expected values of the sum of two random variables		6 Hrs
Module-III	Probability Models of n Random Variables. Vector notation. Independence of random variables and random vectors. Functions of random vectors. Expected value vector and correlation matrix.		6 Hrs
Module-IV	Stochastic Processes. Definitions and examples. Types of stochastic processes. Random variables from random processes. The Poisson process.		6 Hrs
Module-V	Markov Chains. Discrete-time Markov chain. Discrete-Time Markov chain dynamics. Limiting state probabilities for a finite Markov chain. State classification.		6 Hrs
Essential Reading	1. Roy D. Yates, Rutgers and David J. Goodman, Stochastic Processes, 2d Edition, John Wiley and Sons, INC. 2. Gregory F Lawler, Introduction to Stochastic Processes, Chapman & Hall/ CRC Press (Taylor Francis Group).		
Course Outcomes	The objective of this course is to familiarize the prospective engineers with techniques in Probability and Statistics. It aims to equip the students to deal with advanced level of Statistics that would be essential for Engineering disciplines. CO1. To apply different distributions in real life problems of industries CO2. To deal with problems that contains multivariable probability distribution. CO3.To enrich knowledge Probability Models of multi-Random Variables. CO4. To learn use of stochastic processes in daily life. CO5. Application of eigen values in solving matrices.		

Subject Code	**EC1201**	**Total Contact Hour**	**30**
Semester	**3rd**	**Total Credit**	**3**
Subject Name	**Analog Electronic Circuits**		
Course Objective	1. Acquire basic knowledge of BJT biasing and stabilization and develop the ability to analyze transistor re and hybrid models. 2. Study the characteristics and analyze different configurations of single-stage MOSFET amplifiers. 3. Able to design amplifier circuits using BJT and study the low and high-frequency response of BJT amplifiers. 4. Understanding of operational amplifier's specifications and parameters. Study of operational amplifier's various applications. Understand about various compound configurations. 5. Study of various oscillator circuits. Analysis of various power amplifiers and voltage regulators.		
SYLLABUS			
Module-I	BJT DC Analysis, Bias Stabilization, BJT modelling: The re model, Hybrid Model, BJT Low frequency small signal analysis, Effect of RS and RL.		7 Hrs
Module-II	MOSFET DC Analysis, Small signal modeling and operation, Single-stage MOSFET Amplifiers, Effect of RS and RL.		7 Hrs
Module-III	BJT Frequency Response: Low frequency analysis of single stage BJT amplifier, Bode Plot, Miller Effect Capacitance, High frequency response of BJT Amplifier, Square Wave testing of amplifiers.		6 Hrs
Module-IV	MOSFET compound configurations: Cascade, Cascode and Darlington connections, Current Source Circuits, Current Mirror Circuit, Differential amplifier Circuit.		5 Hrs
Module-V	Oscillator Circuits: Positive feedback circuit as Oscillator, Barkhausen's criteria, R-C phase shift, Colpitt, and Hartley Oscillators, Power Amplifiers: Class A, Class B, Push-pull amplifier.		5 Hrs
Essential Reading	1. Electronic Devices and Circuit Theory- R. Boyelsted and L. Nashelsky, Prentice Hall. 2. Microelectronic Circuits- Sedra/Smith, Oxford University Press. 3. Design of Analog CCMOS Integrated Circuit- B. Razavi, McGraw Hill.		
Supplementary Reading	1. Millman's Integrated Electronics –Jacob Millman and Christos Halkias, Chetan D Parikh, Mcgraw Hill. 2. Electronic Devices – Floyd, Pearson Education		

Course Outcomes	After completion of course student should be able to: 1. Acquire basic knowledge of BJT biasing and stabilization and develop the ability to analyze transistor re and hybrid models. 2. Understand the characteristics and analysis of different configurations of single stage MOSFET amplifiers. 3. Design amplifier circuits using BJT and study the low and high frequency response of BJT amplifiers. 4. Understand operational amplifier's specifications and parameters and its various applications. Student will learn about various compound configurations. 5. Analyze various power amplifiers and voltage regulators and they will have thorough knowledge of various oscillator circuits.

Subject Code	**EC1202**	**Total Contact Hour**	**30**
Semester	**3rd**	**Total Credit**	**3**
Subject Name	**Basic Communication Engineering**		
Pre-requisites	**Statistics, Signal and System**		
Course Objective	1. To understand time domain and frequency domain spectrum representation of signals 2. To analyze the transmitted power and bandwidth of AM and FM transmission 3. To understand and analyze the generation and detection of AM and FM Signals 4. To analyze the performance of AM and FM transmission in presence of channel noise 5. Comparison of output SNR for AM and FM receivers. 6. To understand the role of preemphasis and deemphasis filters for improvement in SNR		
Module-I	Fourier Series, Fourier Transform, Scaling, Time-shifting and Frequency shifting properties, Convolution, Parseval's Theorem, Correlation between waveforms, Auto and cross correlation,.		**6 Hrs**
Module-II	Amplitude Modulation, Generation of AM, Spectrum of AM Signal, Balanced Modulator, Envelope Demodulator, Square law Demodulator, DSB-SC, SSBSC, and VSBSC: Generation and Demodulation		**6 Hrs**
Module-III	Frequency Modulation Systems: Concept of Instantaneous Frequency, Generalized concept of Angle Modulation, Frequency modulation, Frequency Deviation, Spectrum of FM Signal with Sinusoidal Modulation, Bandwidth of FM Signal Narrowband and wideband FM, Carson's Rule, Generation of FM Signal, FM Demodulator, Pre-emphasis and De-emphasis Filters.		**6 Hrs**
Module-IV	Mathematical Representation of Noise, Frequency Domain Representation of Noise, Power Spectral Density, Spectral Components of Noise, Linear Filtering, Noise Bandwidth, Quadrature Components of noise. Noise in AM Systems: Super heterodyne Principle, Calculation of Signal Power and Noise Power in SSB-SC, DSB-SC and DSBC, Figure of Merit Calculation.		**6 Hrs**
Module-V	Noise in FM System: Mathematical Representation of the of the Limiter and Discriminator, Figure of Merit comparison between FM and AM, SNR improvement using pre-emphasis and Deemphasis.		**6 Hrs**

Essential Reading	Principles of Communication Systems by Taub & Schilling,2ndEdition.Tata Mc Graw Hill.
Supplementary Reading	1. Modern analog and digital communication system, by B. P. Lathi, 3rd Edition, Oxford University Press. 2. Communication Systems by Simon Haykin, 4th Edition, John Wiley and Sons Inc.
Course Outcomes	After successful completion of the course, the students are able to CO1. Understand basic analog transmission system. CO2. Analyze modulation format, calculation of transmitted power and bandwidth. CO3. Understand practical implementation and limitation of analog receiver CO4. Analyze the AM and FM receiver performance in presence of noise by calculating output SNR. CO 5. Calculate Figure of Merit for AM and FM transmission in presence of noise.

Subject Code	**EE1202**	**Total Contact Hour**	**30**
Semester	**3rd**	**Total Credit**	**3**
Subject Name	**Network Theory**		
Course Objective	1. To make the students capable of analyzing electrical network using theorems. 2. To study resonating circuit, transient response & Laplace transform methods of Reactive linear circuit. 3. To Infer and evaluate two port network parameters and their interrelationship & Graph Theory. 4. To Examine the properties of Network functions and check the stability. 5. To synthesize the Passive networks.		
SYLLABUS			
Module-I	ELEMENTARY CIRCUIT ANALYSIS AND NETWORK THEOREMS: Series and parallel combination of elements, Kirchhoff's laws, Node and Mesh Analysis, Star-Delta transformation, Source transformation, Application of Network Theorems in DC & AC Circuits (Thevenin's, Norton's, Superposition, Maximum Power Transfer).		6 Hrs
Module-II	RESONANCE: Series Resonance, Parallel Resonance, Selectivity. Q-factor TRANSIENT RESPONSE OF PASSIVE CIRCUITS: Transient response of series R-L, R-C & R-L-C circuit with DC and sinusoidal excitation. LAPLACE TRANSFORMATION AND ITS APPLICATION: Laplace transformation of a derivative and an Integral function, Initial and final value theorem, Convolution. WAVEFORM SYNTHESIS: The Unit step, Ramp and Impulse Function, Waveform Synthesis.		6 Hrs
Module-III	TWO PORT NETWORK ANALYSIS: Network Elements, {Z, Y, Hybrid & ABCD}-Parameters, Condition of Reciprocity and Symmetry, Inter relationship between Parameters of two port network, different types of Interconnections of two port networks, Image Impedances, Equivalent T- & π- section representation. INTRODUCTION TO GRAPH THEORY: Relation between twig and link. Properties of tree in graph, Formation of Incidence Matrix, Tie-Set matrix, Cut-Set matrix.		6 Hrs
Module-IV	PROPERTIES OF NETWORK FUNCTIONS: Driving and Transfer Impedance & admittance, Voltage and Current Transfer Ratio, Concept of Poles and Zeros in network functions, Restriction on location of poles & zeros, Routh-Hurwitz Criterion of Stability, Time domain behavior from pole-zero plot.		6 Hrs

Module-V	SYNTHESIS OF PASSIVE NETWORKS: Hurwitz Polynomials, properties of Hurwitz polynomials, procedure of testing for Hurwitz characteristics, Properties of positive real functions, procedure for testing of PR function, Network Synthesis, Reactive Networks, Pole-Zero interpretation in LC networks, LC network synthesis, Foster's canonic forms, Cauer Canonic forms, Identification of Foster & Cauer form of RL/RC networks, Foster & Cauer form synthesis of Lossy networks.	6 Hrs
Essential Reading	1. Network Analysis, by M.E. Van Valkenburg, 3rd Edition, PHI 2.Citcuit Theory, Analysis & Synthesis By A. Chakrabarti, Dhanpat Rai & Co.	
Supplementary Reading	1.Network Analysis and Synthesis, By Franklin F. Kuo, Wiley 2. Network Theory: Analysis And Synthesis 1st Edition By Smarajit Ghosh.	
Course Outcomes	CO1. Analyze the electrical networks using Theorems. CO2. Select the resonating circuit and solve the transient behavior of passive circuits. CO3. Verify the reciprocal and symmetrical circuits using circuit parameters and to apply the graph theory. CO4. Check the stability of a network and to understand the location of the network. CO5. Synthesize the network from its equation.	

Subject Code	**EE1203**	**Total Contact Hour**	**35**
Semester	**3rd**	**Total Credit**	**2**
Subject Name	**Optimization and Soft Computing**		
Pre-requisites	**Knowledge of MATLAB**		
SYLLABUS			
Module-I	Introduction to Optimization: Objective function and constraints, Solution approaches, Multiobjective optimization. Evolution of Soft Computing: What is Soft Computing? Difference between Hard and Soft computing, Requirement of Soft computing, Major Areas of Soft Computing, various types of soft computing techniques, Applications of Soft Computing.		8 Hrs
Module-II	Introduction to Fuzzy Logic: Fuzzy Sets : Basic Definition and Terminology, Set-theoretic Operations, Fuzzy versus Crisp set, Fuzzy Relation, Linguistic variables, Fuzzification and Defuzzification Method, Membership Function Formulation and Parameterization, Fuzzy Rules and Fuzzy Reasoning, Fuzzy If-Then Rules, Fuzzy Reasoning, Fuzzy Inference Systems, Mamdani Fuzzy Models, Some applications of Fuzzy logic.		8 Hrs
Module-III	Artificial Neural Network: Concept of Biological neurons and its working, Important Terminology in ANN, Supervised and Unsupervised Learning, Simulation of biological neurons to problem solving, Different ANNs architectures, Training techniques for ANNs, Applications of ANNs to solve some real-life problems.		8 Hrs
Module-IV	Introduction to genetic algorithm and their terminology, Working Principles, operators in genetic algorithm- coding - selection - cross over – mutation, Stopping condition for genetic algorithm flow, Introduction to Fitness function.		7 Hrs
Module-V	Introduction to Non-traditional Metaheuristic Optimization Techniques, Concept of Swarm Intelligence Algorithm, Particle Swarm Optimization, Ant colony optimization (ACO).		4 Hrs
Essential Reading	1. D.K. Chaturvedi, Soft Computing Techniques and its Applications in Electrical Engineering, Springer 2. A.E. Eiben, J.E. Smith, Introduction to Evolutionary Computing, Springer. 3. S.N.Sivanandam, S.N.Deepa , Principles of Soft Computing, Wiley India Pvt Ltd.		
Supplementary Reading	1. S S Rao, Engineering Optimization: Theory and Practice, Wiley. 2. Jang, Sun and Mizutani, Neuro-Fuzzy and Soft Computing: archive.nptel.ac.in/courses/106/105/106105173/		

Course Outcomes	CO1. Formulate optimization problem and evaluate the application of soft computing for solution. CO2. Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems. CO3. Apply Artificial Neural Network to solve optimization problems. CO4.Apply genetic algorithm to solve optimization problems. CO5.Apply swarm intelligence algorithms to solve optimization problems.

Subject Code	**HS1201**	**Total Contact Hour**	**30**
Semester	**3rd**	**Total Credit**	**2**
Subject Name	**Engineering Economics**		
SYLLABUS			
Module-I	**Basic Principles of Economics:** Definition, Nature, Scope and significance of economics for Engineers. Demand & Supply and their Determinants, Elasticity-Government policies and application. Basic Macroeconomics concept: National income accounting (GDP/GNP/NI/Disposable Income etc.) and identities for both closed and open economies.		6 Hrs
Module-II	**Utility Analysis:** Cardinal and ordinal measurability of utility, Assumptions of cardinal utility analysis, law of diminishing marginal utility, Consumer's equilibrium: Principle of equi-marginal utility; Indifference curve-Concepts, properties, Budget line, Equilibrium of the consumer, Revealed preference hypothesis, Individual choice under Risk and Uncertainty: St. Petersburg paradox and Bernoulli's hypothesis, Neumann-Morgenstern method of constructing utility index, Friedman-Savage hypothesis		6 Hrs
Module-III	**Production, Cost and Market Structure:** Production function: short run production function and law of variable proportion; Long run production function: Isoquants, isocost line, returns to scale, Optimum factor combinations, Cost Analysis: Concepts, Classification- Short run and Long run cost curves, Analytical and accounting cost concepts; Market structure: Market classifications, Perfect competition: Characteristics, price and output determination in Short run and long run, Monopoly market: Price and output determination, price discrimination Modern theories of firms: Baumol's theory of sales revenue maximisation, Bain's limit pricing model.		6 Hrs
Module-IV	**Money and Banking:** Money-Function of Money, Demand for Money Theory. Quantity theory of money; Banking: Commercial Banks and their Functions, Central bank's Functions. Role of the Banks in Economic Development, Monetary and Fiscal Policy Tools and their impact on the economy.		6 Hrs
Module-V	**Capital Budgeting and Investment Analysis:** Time value of money: use of cash flow diagram, Annual economic worth, present worth, future worth, Internal Rate of Return (IRR), Net Present Value (NPV), Payback period method, Analysis of public projects: Cost-Benefit analysis, Cost effectiveness.		6 Hrs

Essential Reading	1. Koutsoyiannis, A. (1979). Modern Microeconomics. The Macmillan Press Ltd., London 2. Pindyck, R. S., D. N. Rubinfeld and P. L. Meheta (2009). Microeconomics, Pearson India, New Delhi. 3. Panneerselvam, R. (2007). Engineering Economics, Prentice-Hall of India, New Delhi. 4. Mankiw Gregory N. (2002). Principles of Economics, Thomson Asia.
Course Outcomes	CO1- Utilise economics principles in consumption process CO2- Describe the utility measurement and measure the utility associated with risk CO3- Efficient use of resources in production and take decision regarding optimum output CO4- Describe market mechanism and analyse product market to take proper decisions CO5- Implement economic principles in company related decision making

SESSIONALS

Subject Code	**EC1281**	**Total Contact Hour**	**16**
Semester	**3rd**	**Total Credit**	**1.5**
Subject Name	**Analog Electronic Circuits Laboratory**		
Course Objective	1. To make the students familiar with the operation of BJTs. 2. To make the students familiar with the operation MOSFETs. 3. To make students familiar with the operations of Oscillators 4. To make students familiar with the operations of Power amplifiers. 5. To make students familiar with the operation of OP-AMP		
List of Experiments			
1	Study of biasing circuits of BJT.		
2	Study of biasing circuits of MOSFET.		
3	Measurement of pinch off voltage and plot transfer characteristics and drain characteristics of MOSFET.		
4	Plotting of gain frequency response of RC coupled amplifier.		
5	Study of Class A, B power amplifier		
6	Study of integrator and differentiator circuits using OPAMP		
7	Study and calculation of phase-shift of RC phase shift oscillator.		
8	Calculation of rise time, tilt, and low cut off frequency by square wave testing of amplifier		
Course Outcomes	After completion of the sessional course students should be able to:- 1. Analyze the BJTs and MOSFETs biasing circuits. 2. Study and plot the characteristics of BJTs and MOSFETs. 3. Design oscillators for applications. 4. Design and study power amplifier. 5. Know the applications OP-AMP.		

Subject Code	**EC1282**	**Total Contact Hour**	**20**
Semester	**3rd**	**Total Credit**	**1.5**
Subject Name	**Basic Communication Engineering Laboratory**		
Pre-requisites	**Signal and systems, Fourier Analysis**		
Course Objective	1. To familiar with signal and spectrum generation using DSO 2. To analyze the results for AM Generation and Detection Circuit 3. To analyze the results for FM Generation and Detection Circuit 4. To understand AM and FM using MATLAB programming 5. To understand the suppressed carrier modulation and demodulation using MATLAB programming		
List of Experiments			
1	Write MATLAB code to find convolution, autocorrelation, cross-correlation and power spectral density of different functions and Modulation.		
2	Write MATLAB program for generation and detection of i)DSB-SC ii)SSB-SC		
3	Study of balanced modulator and detector of AM signal (using H/W Kit-C020).		
4	To study amplitude modulated waveforms for different modulation depths and measure the value of modulation index (using H/W Kit- C09A).		
5	Study the demodulation process and measure detection efficiency (using H/W Kit- C009).		
6	Generate and detect frequency modulation (FM) signals using MATLAB.		
7	Detect FM signal using Foster-Seely discriminator (using H/W Kit- C15C).		
8	Study of PLL using MATLAB code and detection of FM signal (using H/W Kit- C15B).		
9	Write MATLAB code to generate and detect PM.		
10	Study of Voltage Controlled Oscillator (using H/W Kit- C25A)		
Essential Reading	Principles of Communication Systems by Taub & Schilling,2nd Edition.Tata Mc Graw Hill.		
Supplementary Reading	1. Modern analog and digital communication system, by B. P. Lathi, 3rd Edition, Oxford University Press. 2. Communication Systems by Simon Haykin, 4th Edition,John Wiley and Sons Inc.		
Course Outcomes	After completion of course, student should be able to CO1 Understand spectrum of signals. CO2 Understand generation and detection of AM signal. CO3Understand generation and detection of FM signal. CO4 Understand spectrum of AM and FM signals. CO5Understand principle of operations of Voltage Controlled Oscillator used in modulation.		

Subject Code	**EE1282**	**Total Contact Hour**	**20**
Semester	**3rd**	**Total Credit**	**1.5**
Subject Name	**Network Theory Laboratory**		
Course Objective	1. To make the students capable of analyzing electrical network using theorems. 2. To study resonating circuit, transient response of Reactive linear circuit. 3. To Infer and evaluate two port network parameters. 4. To Examine the properties of Network functions. 5. To analyze the Passive networks		
List of Experiments			
1	To verify the maximum power transfer theorem for different internal resistance.		
2	Study of Norton's, Thevenin's and superposition Theorem.		
3	Study of transient response of series and parallel RL & RC circuit		
4	Study of transient response of series and parallel RLC circuit.		
5	Determination of Impedance (Z), Admittance (Y) & Hybrid parameters of two port network		
6	Determination of driving point and transfer functions of a two port ladder network and verify with theoretical values.		
7	Measurement of Z- parameter of T- and π- networks.		
8	To verify all the theorems (Norton's, Thevenin's, superposition and maximum power transfer theorem) using circuit maker.		
9	Determination of Impedance (Z) & Admittance(Y) parameters of two port network using circuit maker.		
10	Determination of driving point and transfer functions of a two port ladder network using circuit maker.		
Course Outcomes	CO1. Analyze the electrical networks using Theorems. CO2. Select the resonating circuit and solve the transient behavior of passive circuits. CO3. Verify the reciprocal and symmetrical circuits using circuit parameters CO4. Check the stability of a network. CO5. Synthesize the network.		

Subject Code	**EE1283**	**Total Contact Hour**	**14**
Semester	**3rd**	**Total Credit**	**1.5**
Subject Name	**Optimization and Soft Computing Laboratory**		
List of Experiments			
1	Solution of single objective optimization problem using MATLAB Optimization Toolbox (lin-prog, quadprog, fmincon).		
2	Solution of single objective optimization using OCTAVE sqp and GAMS solvers.		
3	Implementation of fuzzy tool box to solve optimization problem.		
4	Design of Fuzzy rule base and Fuzzy Inference System to solve an optimization problem.		
5	Implementation of Genetic Algorithms to solve an optimization problem.		
6	Implementation of Artificial Neural Networks to solve optimization problems.		
7	Implementation of Particle Swarm Optimization to solve optimization problems.		
Course Outcomes	Upon completion of the course, the students will be able to: CO1. Demonstrate the use of MATLAB, OCTAVE and GAMS solvers. CO2. Demonstrate the use of fuzzy logic to solve optimization problems. CO3. Demonstrate the use of genetic algorithm to solve optimization problems. CO4. Demonstrate the use of artificial neural networks to solve optimization problems. CO5. Demonstrate the use of swarm optimization algorithms to solve optimization problems		

FOURTH SEMESTER

Subject Code	**EC1204**	**Total Contact Hour**	**30**
Semester	**4th**	**Total Credit**	**3**
Subject Name	**Digital System Design**		
Course Objective	1. To understand concepts of digital electronics and to formulate, design and solve different digital circuits. 2. To design, implement and simulate various combinational and sequential circuits. 3. To understand various logic families and memory modules. 4. To provide the students with a solid foundation in engineering fundamentals required to solve problems and also to pursue higher studies. 5. To understand the fundamentals of VLSI design flow.		
SYLLABUS			
Module-I	Logic Simplification: Review of Boolean Algebra, SOP & POS forms, Canonical forms, Karnaugh maps up to 5 variables, Binary codes, Code Conversion, Binary addition and subtraction using 1's and 2's complements.		**4 Hrs**
Module-II	Combinational Logic Design: MSI devices like Half and Full Adders, Subtractors, Serial and Parallel Adders, BCD Adder, Binary multiplier, magnitude comparator, Multiplexers, Encoder, Decoder,		**5 Hrs**
Module-III	Sequential Logic Design: Building blocks like S-R, D, T, JK and Master-Slave JK FF, Edge triggered FF, Ripple and Synchronous counters, Shift registers, Analysis of clocked sequential circuits, Finite state machines, Design of synchronous FSM,		**6 Hrs**
Module-IV	Sequential Logic Design: Building blocks like S-R, D, T, JK and Master-Slave JK FF, Edge triggered FF, Ripple and Synchronous counters, Shift registers, Analysis of clocked sequential circuits, Finite state machines, Design of synchronousFSM,		**6 Hrs**
Module-V	VLSI Design flow: Design entry: Schematic, FSM & HDL, Digital Design using Verilog: Introduction, Verilog Naming Conventions, Operators in Verilog, Verilog Data types, Behavioural Modelling, Structural Modelling, Combinational and Sequential Logic in Verilog,blocking and Non-Blocking Statement, Procedural Statements.		**4 Hrs**
Essential Reading	1. R.P. Jain, "Modern digital Electronics", Tata McGraw Hill, 4th edition, 2009. 2. Digital Design, 4th edition by M. Morris Mano, M. D. Ciletti, Pearson Education. 3. Samir Planitkar, "Verilog HDL", Prentice Hall, 2nd edition,2003.		

Course Outcomes	After completion of course student should be able to: 1. Understand different number systems and logic gates 2. Design and analysis of different combinational logic circuit. 3. Design and analysis of different sequential logic circuit. 4. Understand the characteristics of different logic families and memory. 5. Implement digital circuits in different models in Verilog HDL.

Subject Code	**EC1205**	**Total Contact Hour**	**30**
Semester	**4th**	**Total Credit**	**3**
Subject Name	**Advanced Communication Engineering**		
Pre-requisites	Analog Communication Systems, Stochastic Process, Random Variables		
Course Objective	1. To explain basic concepts analog to digital conversion using sampling, quantization and encoding. 2. To introduce the concept of line codes and basic digital baseband data transmission. 3. To discuss the effect of different modulation schemes on the digital communication systems 4. To elaborate the importance of pulse shaping and limitation of ideal Nyquist channel. 5. To introduce the data acquisition system.		
SYLLABUS			
Module-I	Sampling Theorem, Low Pass Signal, Band Pass Signal, Signal Reconstruction, Practical Difficulties, The Treachery of Aliasing, The Anti-aliasing Filter, Application of Sampling Theorem, PAM, PWM and PPM Signal Generation and Detection.		**8 Hrs**
Module-II	Pulse Code Modulation: Quantization of Signals, Uniform and Non-Uniform Quantization, Encoder, Transmission Bandwidth and output SNR, Output SNR of PCM in presence of quantization noise. Differential PCM, Delta Modulation(DM), Adaptive Delta Modulation, Noise in DM, Output SNR of DM, Comparison of SNR between PCM and DM		**6 Hrs**
Module-III	Line Coding, Various line codes, Characteristics of Line Codes		**6 Hrs**
Module-IV	Pulse Shaping: Nyquist Criterion for zero ISI, Scrambling, Regenerative Repeater, Preamplifier, Equalizer, Eye diagram, Timing Extraction, Timing Jitter, Base-band Signal Receiver, Matched Filter as Optimum Receiver, , Probability of Error of the Matched Filter, Matched Filter as Integrate and Dump Circuit		**5 Hrs**
Module-V	Passband Digital Data Transmission, Geometrical Representation of Signals, Relation between Signal and Vector domain using concept of analyzer and synthesizer ,Matched Filter receiver and Correlator, BPSK, BFSK, QPSK, Minimum Shifting Keying (MSK), Use of Signal Space to calculate probability of Error for BPSK, BFSK and QPSK, Comparison of PSD of different digital modulated signals, Constellation Mapper in MIMO OFDM communication		**5 Hrs**

Essential Reading	1. Principles of Communication Systems by Taub& Schilling,2nd Edition. Tata Mc Graw Hill. 2. Modern analog and digital communication system, by B. P. Lathi, 3rd Edition, Oxford University Press.
Supplementary Reading	1. Communication Systems by Simon Haykin, 4th Edition, John Wiley and Sons Inc.
Course Outcomes	After successful completion of the course, the students are able to understand CO1. Basic steps to generate digital signals and the basic building blocks of a digital communication system. CO2. Effect of noise in baseband pulse transmission and performance evaluation using SNR. CO3. Signal Space Diagram using different digital modulation and demodulation techniques. CO4. Understand the reconstruction of data sequence in presence of noise and ISI. CO5. Analysis of BER and BER performance of Digital Receiver.

Subject Code	**EC1206**	**Total Contact Hour**	**30**
Semester	**4th**	**Total Credit**	**3**
Subject Name	**Electromagnetics**		
Course Objective	1.To acquire the knowledge of basic mathematical concepts of vector fields and their applications. 2.To impart the knowledge of electrostatic fields and their behavior. 3.To familiar with Maxwell's Equations and their importance in Electromagnetic field theory. 4.To identify, formulate and solve the electromagnetic fields and waves propagation problems in different mediums. 5.To introduce the concepts of EM wave propagation through transmission lines with their problems and solutions.		
SYLLABUS			
Module-I	Vector calculus – orthogonal Coordinate System, Transformations of coordinate systems; Gradient, Divergence, Curl – their physical interpretations; Laplacian operator, Divergence Theorem, Stokes Theorem. Coulomb's law, electric field intensity, Field due to a continuous volume distribution, Electric Flux, flux density and its properties.		**6 Hrs**
Module-II	Gauss' law, Application of Gauss's law, Potential and Potential gradient, work done in moving a charge in an electric field, Potential difference, Electric dipole, Energy density in Electrostatic field, Conductors, Continuity Equation and relaxation time, Boundary conditions, Poisson's & Laplace's equations. Uniqueness theorem, Method of Images.		**6 Hrs**
Module-III	Biot-Savart's law, Ampere's circuit law and applications, Maxwell's equation for static fields, Scalar and Vector Magnetic Potential. Forces due to magnetic fields, Magnetic torque and moment, Magnetic dipole. Magnetic Boundary conditions.		**5 Hrs**
Module-IV	Faraday's law, Concept of Displacement Current. Maxwell's equations in final form, Time-harmonic EM fields, Helmholtz wave equation, Plane Wave Propagation in lossless, lossy dielectric medium and conducting medium, Plane wave in good conductor, Surface resistance, depth of penetration, Poynting's Theorem.		**6 Hrs**
Module-V	High Frequency Transmission line: The Lumped-Element Circuit model for a Transmission line. Wave propagation. The lossless line. Field Analysis of Co-axial Transmission Lines. R,L,C, G parameters of Co-axial & Two wire.		**7 Hrs**

Essential Reading	**1.** Elements of Electromagnetic by Mathew N. O. Sadiku, Oxford University Press. **2.** Knowledge of VectotMicrowave Engineering by D. M. Pozar, John Willy & Sons.
Supplementary Reading	**1.** Electromagnetic Fields Theory Fundamental, B.S. Guru & Huseyn R. Hiziroglu, Thomson Asia Pvt. Ltd. Singapore **2.** Electromagnetic Waves and Radiating Systems, E.C. Jordan & K.G. Balmain, PHI publication **3.** Microwave Devices and Circuits, Samuel Y, Liao, Pearson Education
Course Outcomes	CO1. Knowledge of Vector calculus and to be familiar with orthogonal co-ordinate system. CO2. Understanding of basic laws related with electrostatic and electro-dynamics. CO3. Solving Maxwell's equation for Electromagnetic wave propagation. CO4.Understanding the nature of Electromagnetic wave propagation in various medium. CO5.Familiar with transmission lines and their properties used at microwave frequency.

Subject Code	**EC1207**	**Total Contact Hour**	**30**
Semester	**4th**	**Total Credit**	**3**
Subject Name	**Electronics Instrumentation**		
Pre-requisites	**Basic electronics, Basic electrical engineering**		
Course Objective	1. To explain basic concepts of measurement and bridge configurations. 2. To understand the applications of instruments used for measurement of basic parameters. 3. To discuss the circuits of CRO and its applications. 4. To elaborate the importance of signal generators and analyzers in Measurement. 5. To introduce the data acquisition system.		
SYLLABUS			
Module-I	Basics of Measurements: Accuracy, Precision, Resolution, Reliability, Repeatability, Validity, Errors and their analysis, Classification of Standards of measurement. Bridge Measurement: DC bridges- Wheatstone, Kelvin, AC bridges – Hay, Maxwell, Schering, and Wien. Electronic Instruments for Measuring Basic Parameters: Amplified DC meter, AC Voltmeter, True- RMS responding Voltmeter, Electronic multi-meter, Digital voltmeter.		6 Hrs
Module-II	Oscilloscopes: Cathode Ray Tube, Vertical and Horizontal Deflection Systems, Delay lines, Probes and Transducers, Oscilloscope measurement Techniques. Special Oscilloscopes – Sampling oscilloscope, Digital storage oscilloscope.		6 Hrs
Module-III	Signal Generators: Sine wave generator, Frequency – Synthesized Signal Generator, Sweep frequency Generator. Function Generators. Signal Analysis: Wave Analyzer, Spectrum Analyzer (Basic type and FFT).		6 Hrs
Module-IV	Signal Generators: Sine wave generator, Frequency – Synthesized Signal Generator, Sweep frequency Generator. Function Generators. Signal Analysis: Wave Analyzer, Spectrum Analyzer (Basic type and FFT).		6 Hrs
Module-V	Digital Data Acquisition System: Interfacing transducers to Electronics Control and Measuring System. Instrumentation Amplifier, Isolation Amplifier. Computer-Controlled Test Systems: Interfacing using IEEE-488 GPIB Bus. Controller: Open Loop, Feed Forward and Feed Back, ON-OFF,P,I,D, PID control (A.K. Sawhney, and P. Sawhney , 9th edition ch 35).		6 Hrs

Essential Reading	1. Modern Electronics Instrumentation & Measurement Techniques, by Albert D. Helstrick and William D. Cooper, Pearson Education. Selected portion from Ch.1, 5-13. 2. Electrical and Electronic Measurements and Measuring Instruments – A.K. Sawhney, and P. Sawhney (19th edition, 2011), Dhanpat Rai Publication (Selected portion from Ch. 2,3, 14,16,20,21,22,23,25 and 35).
Supplementary Reading	1. Elements of Electronics Instrumentation and Measurement-3rd Edition by JoshphJ.Carr. Pearson Education. Selected portion from Ch.1,2,4,7,8,9,13,14,18,23 and 25. 2. Doebelin, E.O., Measurement systems, McGraw Hill, Fourth edition, Singapore, 1990.
Course Outcomes	CO1.Gain basic knowledge about measurement and measuring Instruments. CO2.Understand CRO circuits in details with special types and applications. CO3. Familiar with signal generators and analyzers. CO4.Learn about frequency counters and transducers. CO5. Introduced with digital data acquisition system, IEEE-488 GPIB Bus Interface and basic controllers.

Subject Code	**CS1205**	**Total Contact Hour**	**30**
Semester	**4th**	**Total Credit**	**2**
Subject Name	**Programming in Python**		
Course Objective	1: Introduction to Python Language and its features. 2: To understand the concept of Python Program using sequence data and Control statements. 3: To be able to understand and create User Defined Function. 4: To understand the concept of OOPs and its implementation. 5: To understand the concept of strings and file handling		
SYLLABUS			
Module-I	Beginning Python Basics Introduction to Python Features of Python, Application of Python Data Types, Keywords, Identifiers, Literals, Constants. Python Indentation. Operators and expressions. Naming Conventions with examples, Managing Input and Output, Concept of Indentation. Conditional statement, Looping statements, break and continue, pass & return statements, Nesting of loops.		6 Hrs
Module-II	Modules: Built-in Modules, Import statement, Packages, Date and Time Modules. Array and its operations, Handling Strings and Characters, List: slicing, bound, cloning, nested list, list and methods, Adding Element: append, extend, count, index and insert). Mutability: Sort, reverse, remove, clear and pop. Map, Filter		8 Hrs
Module-III	Tuple and methods, Sets and methods, Dictionary: Basic operation, iterator and methods. Function: Introduction to Functions, passing arguments, Anonymous functions (Lambda Function), Recursive Functions.		6 Hrs
Module-IV	Object Oriented Programming: Classes and Objects, Class methods. Encapsulation, Data Abstraction, Constructor, Destructor and Inheritance. Exception Handling: Handling Exceptions: try-except, try-finally		6 Hrs
Module-V	Strings and Regular Expressions: Methods of String Objects, Escape Sequence, Iterating Strings, String Module, String Formatting, Regular Expressions: Re-Module File Handling: Introduction to File Handling, File Operations, Directories.		4 Hrs
Essential Reading	1. Python Programming Python Programming for Beginners by Adam Stewart. 2. Python Cookbook By David Beazley and Brian K. Jones.		

Supplementary Reading	1. Introduction to Python Programming by Gowrishankar S. Veena A. 2. Python Programming: Using Problem Solving Approach, Oxford University Press by Reema Thareja. 3. Python Programming University Press by Ch Satyanarayan, M Radhika, B N Jagadesh.
Course Outcomes	CO1: Understand the Python Language and its features. CO2: Apply sequence data and control statements to solve problem CO3: Able to create user defined functions to solve problems. CO4: Analyze the concept of OOPs and its implementation. CO5: Create the python program using strings and files.

Subject Code	**HS1202**	**Total Contact Hour**	**30**
Semester	**4th**	**Total Credit**	**2**
Subject Name	**Organizational Behaviour**		
Course Objective	1: To understand the relevance of organizational behavior concepts and theories in real-life organizational settings & to develop skills in critical thinking, decision –making, problem-solving in applying organizational behavior concepts to practical situations. 2: To provide an understanding of individual behavior in the workplace, including personality, motivation, perception, learning, and attitudes. 3: To understand the impact of team composition, diversity, and communication on team performance & to understand the role of motivation and leadership in managing organization. 4: To explore how organizational culture affects behavior, communication and decision making by enhancing creativity and innovation and give an episteme how to cope with change and stress. 5: To Develop intercultural competence, including awareness, knowledge, and skills for effective communication, negotiation, and collaboration across culture		
SYLLABUS			
Module-I	**Fundamentals of OB & Understanding the Basic Framework of OB:** Evolution of OB through Quality Management movement, Definitions, Scope & Importance of OB, Challenges (Diversity, Globalization & Ethical Perspective) and opportunities for OB, models of OB, applying OB to solving problems.		6 Hrs
Module-II	**Understanding the Determinants of Individual Behavior:** **Personality:** Determinants of personality, Theories of Personality (Type &Psychoanalytic theory), MBTI, Big five personality traits and other major traits influence workplace behavior. **Perception:** Meaning, Perceptual Process, Application of Perception at Workplace. **Motivation:** Motivation Framework, Content theory (Maslow's need hierarchy & Hertzberg's two factors theory), Process theory (Adam's Equity & Vroom's Expectancy theory), Job Design and motivation, Importance of motivation at Workplace. **Learning:** Theories of learning (Classical Conditioning, Operant Conditioning, & Cognitive Theory), Principles of Learning. Bhavioral modification through learning.		6 Hrs

Module-III	**Understanding Group and Team Behavior at Workplace:** **Group & Team:** Defining and classifying groups, the five-stage model of group development Group properties: Roles, norms, status, size and cohesiveness, Group decision making. **Leadership:** Meaning, Definition & types of leadership, Traditional theories of leadership: Trait theories, Behavioral theories, Contingency theories, Contemporary approaches to leadership, importance of leader in organizations.	6 Hrs
Module-IV	**Understanding Group and Team Behavior at Workplace:** **Organizational Culture:** Meaning, Definition, Cultural dimensions, effect of Organizational culture. **Organizational Change & Development:** Nature, Levels & types of Change, Change Agents: Resistance to Change, Force field theory of Change, Managing the Change.	6 Hrs
Module-V	**Conflict & International Organizational Behavior:** **Managing Conflict and Negotiations:** Meaning, views, & levels of Conflict, Process of conflict, Conflict resolution techniques. **Transactional Analysis:** Meaning, Importance of TA, Life position, Ego states and their encounters. **IOB:** Internationalization of Business, Cultural differences and similarities, Understanding Interpersonal behavior across culture through Hofstede's Cultural Dimensions.	6 Hrs
Essential Reading	1. "Organizational Behavior: Text, Cases, & Games" by K. Aswathappa. Publisher: Himalaya Publishing House 2. "Essentials of Organizational Behavior" by Stephen P. Robbins and Timothy A. Judge. Publisher: Pearson Education.	
Supplementary Reading	1. "Organizational Behavior: Improving Performance and Commitment in the Workplace" by Jason A. Colquitt, Jeffery A. LePine, and Michael J. Wesson. Publisher: McGraw-Hill Education. 2. "Organizational Behavior: Human Behavior at Work" by John W. Newstrom and Keith Davis. Publisher: McGraw-Hill Education. 3. "Organizational Behavior: An Evidence-Based Approach" by Fred Luthans. Publisher: McGraw-Hill Education. 4. "Organizational Behavior: Emerging Knowledge, Global Reality" by Steven L. McShane and Mary Ann Von Glinow. Publisher: McGraw-Hill Education. 5. "Organizational Behavior and Management" by Ivancevich, Konopaske, and Matteson. Publisher: McGraw-Hill Education. 6. "Organizational Behavior: Theory, Research, and Practice" by John R. Schermerhorn Jr., James G. Hunt, and Richard N. Osborn. Publisher: Wiley	

Course Outcomes	CO1. Explain the importance of organizational behavior in improving individual and organizational effectiveness with Ethical practices. CO2. Evaluate the effectiveness of different leadership styles and their application in different situations. CO3.Develop critical thinking, Creativity& Innovation, problem-solving, and communication skills necessary for success in organizational settings. CO4. Develop strategies for managing organizational change effectively and maintaining sustainability. CO5. Apply organizational behavior concepts and theories to practical organizational situations.

SESSIONALS

Subject Code	**EC1284**	**Total Contact Hour**	**20**
Semester	**4th**	**Total Credit**	**1.5**
Subject Name	**Digital System Design Laboratory**		
Course Objective	1. Understanding different MSI ICs and their specifications used in laboratory and practical field. 2. To formulate, design and implement various combinational and sequential circuits. 3. To formulate, design and implement various sequential circuits. 4. To design and implement memory. 5. To familiar with the Hardware Description Language.		
List of Experiments			
1	Digital logic gates: Design, Implement & test a given design example with Universal Gates only.		
2	Gate level minimization: Two level & multi-level implementation of Boolean function.		
3	Combinational circuits: design, construct & test: adder& subtractor, code converter, gray code to binary and 7 segment displays.		
4	Design with multiplexers & de multiplexers.		
5	Flip flop: Construct, test& investigate operation of SR, D, J-K flip flop.		
6	Shift register: Investigate the operation of all types of shift register with parallel load Design.		
7	Counters: design, construct& test various ripple & synchronous counters-decimal counter, Binary counter with parallel load.		
8	Design of Combinational circuit using Verilog HDL		
9	Design of Sequential circuit using Verilog HDL		
10	Design of memory using Verilog HDL		
Course Outcomes	1. Identify different ICs used in laboratory and practical field 2. Design and analyze combinational circuits 3. Design and analyze sequential circuits 4. Have an brief idea of working principle of memory 5. Implement the digital circuits in HDL and FPGA Hardware.		

Subject Code	**EC1285**	**Total Contact Hour**	**14**
Semester	**4th**	**Total Credit**	**1.5**
Subject Name	**Advanced Communication Engineering Laboratory**		
Pre-requisites	Basic Communication Concept, Statistics and Random Process		
Course Objective	1. To study Sampling, Quantization and Encoding Process 2. Comparative Analysis of PCM, DM , ADM based ADC 3. Modulation and Demodulation Analysis of ASK/PSK/FSK 4. Generation of PAM/PPM/PWM. 5. Generation of DM/ADM.		
List of Experiments			
1	Study the Pulse code Modulation and Demodulation using Experimental Boards		
2	Study of Delta Modulation and Adaptive Delta Modulation using Experimental Boards		
3	Study the ASK/PSK/FSK and Demodulation using Experimental Boards		
4	Study of PAM/PPM/PWM using Experimental Boards		
5	MATLAB Coding for ASK/PSK/FSK Generation and Detection		
6	MATLAB Coding for PCM, DM, ADM Generation		
7	Performance Analysis of Transmitter and Receiver in presence of Noise using MATLAB.		
Essential Reading	1. Principles of Communication Systems by Taub & amp; Schilling, 2nd Edition. Tata Mc Graw Hill. 2. Modern analog and digital communication system, by B. P. Lathi,3rd Edition, Oxford University Press..		
Supplementary Reading	1. Communication Systems by Simon Haykin, 4th Edition, John Wiley and Sons Inc.		
Course Outcomes	After completion of course, student should be able to CO1 Understand spectrum of digital modulated signals. CO2 Understand generation and detection of digital modulated signals. CO3 Understand the constellation diagram of different digital modulated signals. CO4 Understand the use of MATLAB for generation and detection of digital modulated signals. CO5 Understand the effect of noise on digital modulated signals.		

Subject Code	**EC1286**	**Total Contact Hour**	**20**
Semester	**4th**	**Total Credit**	**1.5**
Subject Name	**Electronics Instrumentation Laboratory**		
Pre-requisites	**Basic electronics, Electronics Instrumentation & Measurement**		
Course Objective	1. To familiar with DC and AC bridges. 2. To study LVDT and Strain gage. 3. To understand concept of PID control. 4. To study characteristics of optical transducers. 5. To understand principle of operation of IC temperature transducer.		
List of Experiments			
1	Determination of unknown resistance using Wheatstone bridge.		
2	Determination of unknown capacitance and dissipation factor using Schering bridge.		
3	Study input characteristics of LVDT and determination of linearity and sensitivity.		
4	Study the phase difference between secondaries of LVDT.		
5	Study of Strain gauge cantilever assembly.		
6	Determination of sensitivity of the Strain gauge.		
7	Understand different blocks of PID controller and observe their open loop characteristics.		
8	Study the characteristics of Photoconductive cell.		
9	Study the characteristics of Photovoltaic cell.		
10	Study of IC Temperature sensor.		
Essential Reading	1. Modern Electronics Instrumentation & Measurement Techniques, by Albert D. Helstrick and William D. Cooper, Pearson Education. Selected portion from Ch.1, 5-13. 2. Electrical and Electronic Measurements and Measuring Instruments – A.K. Sawhney, and P. Sawhney (19th edition, 2011), Dhanpat Rai Publication (Selected portion from Ch. 2,3, 14,16,20,21,22,23,25 and 35).		
Supplementary Reading	1.Elements of Electronics Instrumentation and Measurement-3rd Edition by Joshph J. Carr. Pearson Education. Selected portion from Ch.1,2,4,7,8,9,13,14,18,23 and 25. 2. Doebelin, E.O., Measurement systems, McGraw Hill, Fourth edition, Singapore, 1990.		
Course Outcomes	CO1 Understand working of AC and DC bridges. CO2 Understand operational characteristic of LVDT. CO3 Know about uses of Strain gauge. CO4 Understand the working of PID controller CO5 Understand principle of operations of IC temperature transducer and photo transducers.		

Subject Code	**CS1289**	**Total Contact Hour**	**20**
Semester	**4th**	**Total Credit**	**1.5**
Subject Name	**Programming in Python Laboratory**		
Course Objectives	1: Introduction to Python Language and its features. 2: To understand the concept of Python Program using sequence data and Control statements. 3: To be able to understand and create User Defined Function. 4: To understand the concept of OOPs and its implementation. 5: To understand the concept of strings and file handling		
List of Experiments			
1	Program on basics of python Programming Language.		
2	Program on basic Data Structures in Python.		
3	Program on Conversion from on data type to another.		
4	Program on Functions in Python.		
5	Program using Object Oriented Programming in Python.		
6	Program using Inheritance in Python.		
7	Program using String in Python.		
8	Program using Regular expression in Python.		
9	Program using File Handling in Python.		
10	Program using basics of Pandas and Matplotlib module in Python.		
Course Outcomes	CO1: Understand the Python Language and its features. CO2: Apply sequence data and control statements to solve problem. CO3: Able to create user defined functions to solve problems. CO4: Analyze the concept of OOPs and its implementation. CO5: Create the python program using strings and files.		