**ADVANCED ENGINEERING MATHEMATICS**

**EMM 101**

**L-T-P=3-1-0**

**Course Outcomes (CO):**
Upon successful completion of this course, students should be able to:
**CO1:** To introduce different functions of complex variables, review of complex variables.
**CO2:** Analyze generalized Eigen vectors and factorization methods
**CO3:** Describe the basic concepts of functional dependent and independent variables
**CO4:** To Illustrate different Optimization Technique and Elements of calculus variation.
**Mapping of Course Outcomes (CO) and Program Outcomes (PO):**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | | 3 | 3 | | | 3 | | | |
| CO2 | 3 | 3 | 2 | | 3 | 1 | | | | | | |
| CO3 | | | | | | | | | 3 | | | |
| CO4 | 2 | 3 | 1 | | | 1 | | | | | | |

## Course Contents:

**Unit I: Complex Variables**
Review of complex variables, Conformal mapping & transformations, Function of complex variables, Pole and singularity, Integration with respect to complex argument, Residues and basic theorems on residues.

**Unit II: Numerical Analysis**
Introduction, Interpolation formulae, Difference equation, Roots of equations, Solution of simultaneous linear and non-linear equations, Solution techniques for ODE and PDE, Introduction to stability, Matrix eigen value and eigen vector problems.

**Unit III: Optimization Technique**
Calculus of several variables, Implicit function theorem, Nature of singular points, Necessary and sufficient conditions for optimization, Elements of calculus variation, Constrained Optimization, Lagrange multipliers, Gradient method, Dynamic programming.

**Unit IV: Linear Algebra**
Vector space, Linear dependence of vectors, basis, linear transformations, inner product space, rank and inverse of a matrix, solution of algebraic equations, consistency conditions, Eigen values and eigen vectors, Hermitian and Skew Hermitian matrices

**Text Books:**

1. John B. Conway, Functions of one complex variable, Springer International.

2. James Ward Brown & Ruel V. Churchill, Complex variable and application, Mc Graw Hill International edition .
3. Sen, M.K and Malik, D.F.-Fundamental of Abstract Algebra, Mc Graw Hill.
4. Khanna, V.K. and Ghamdri, S.K.- Course of Abstract Algebra, Vikash Pub.
5. Halmos, T.R. Naïve set theory,Van Nostrand.
6. Scarborough, J.B.- Numerical Mathematical Analysis, Oxford University Press

**References**

1. John H. Mathews, Numerical Methods for Mathematics , science and Engineering, PHI
2. D.C. Sanyal and K. Das, A text Book of Numeriacl analysis, U.N. Dhar & Sons Pvt. Ltd.
3. S.S.Rao,, Optimisation theory and application,
4. Wiely Eastern limited Hoffman & Kunze. R, Linear Algebra, PHI Control

## ADVANCED POWER SYSTEM ANALYSIS

**PSM 101**

**L-T-P=3-1-0**

**Course Outcomes (CO):**

Upon successful completion of this course, students should be able to:

**CO1:** To introduce different techniques of dealing with sparse matrix for large scale power systems.

**CO2:** To impart in-depth knowledge on different methods of power flow solutions.

**CO3:** To apply energy function method for analysis of transient stability in power system.

**CO4:** To Illustrate different numeric al integration methods and factors influencing transient stability.

**Mapping of Course Outcomes (CO) and Program Outcomes (PO):**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | | 3 | | 3 | 3 | | | | | 3 | |
| CO2 | 2 | | 1 | | 3 | 2 | | | 3 | | | |
| CO3 | 1 | | 1 | | | | | 3 | 2 | 3 | 2 | |
| CO4 | 3 | | 1 | | | 3 | 2 | | | | | 3 |

## Course Contents:

**Unit I : Network matrix:**

Physical interpretation of bus admittance and impedance matrices, introduction to admittance matrix formulation, formation of admittance matrix due to inclusion of regulating transformer, development of admittance matrix using singular transformation, modification of admittance matrix for branch addition/ deletion.

**Unit II: Complex power flow:**

Analytical formulation of complex power flow solution, Gauss-Seidal method of power flow, Newton Raphson method of power flow, algorithm for solving power flow problem using N-R method in rectangular form, algorithm for solving power flow problem using N-R method in polar form fast decoupled load flow method.

**Unit III: Power System Stability:**

Definitions, classification of stability-rotor angle and voltage stability, synchronous machine representation for stability study.

Transient stability: Assumptions for transient stability, derivation of swing equation, swing equation for synchronous machine connected to infinite bus, swing equation for a two machine system, solution of swing equation by Euler and Runge Kutta method, equal area criterion, critical clearing angle, application of critical clearing angle to transient stability of synchronous machine. Methods of improving transient stability: reducing fault clearance time, automatic reclosing, single phase reclosing, electric braking, voltage regulators, fast governor action, high speed excitation system.

Voltage stability: Definition and classification of voltage stability, mechanism of voltage collapse, analytical concept of voltage stability for a two bus system, expression for critical receiving end voltage and critical power angle at voltage stability limit for a two bus power system, PV and QV curves, L index for the assessment of voltage stability.

**Text Book:**

1. A. Chakrabarti,M.L. Soni, P.V. Gupta, U. S. Bhatnagar "A text book on Power System Engineering", Dhanpat Rai and Co.

**Reference Book:**

1. Power system Analysis by John J. Grainger & William D. Stevenson, JR: Tata McGraw-Hill Edition.
2. P.Kundur, "Power System Stability and Control", McGraw Hill, 1994

## HIGH VOLTAGE TRANSMISSION SYSTEM

**PSM 102**

**L-T-P=4-0-0**

**Course Outcomes (CO):**

Upon successful completion of this course, students should be able to:

**CO1:** Distinguish HVDC Transmission and EHVAC transmission system.

**CO2:** Analyze HVDC transmission with Current Source Converters and Voltage Source Converters

**CO3:** To analyze system dynamic performance and reactive power requirements.

**CO4:** To know about corona and radio & TV interference and design filters for reduction of harmonics **.**

**Mapping of Course Outcomes (CO) and Program Outcomes (PO):**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | | 3 | | 3 | 1 | | | | | 3 | |
| CO2 | 2 | | 1 | | | 3 | | | 3 | | 3 | |
| CO3 | 2 | | 1 | | 3 | | | 2 | 3 | 3 | 1 | |
| CO4 | 3 | | 3 | | | 3 | 1 | 1 | | | | 1 |

## Course Contents:

**Unit I**
High voltage transmission line trends and preliminary aspects of standard transmission voltages. Comparison between HVAC and HVDC transmission, planning for HVDC transmission, links, properties of HVDC thyristor valves, components of HVDC transmission system.

**Unit II**
HVDC converters: 6 pulse converter circuits and working principle, converter bridge characteristics, working principle and characteristics of a twelve pulse converter with two & three valve conduction mode, three valve conduction mode and three and four valve conduction mode

**Unit III**
Calculation of line resistance and inductances: resistance of conductors, temperature rise of conductor and current carrying capacity. Properties of bundled conductors and geometric mean radius of bundle, inductance of two conductors lines and multi-conductor lines coefficient matrix.

**Unit IV**
Line capacitance calculation: capacitance of two conductor line, and capacitance of multi conductor lines, potential coefficient for bundled conductor lines, sequence inductance and capacitances.

**Unit V**
Corona: Corona in EHV lines- corona loss formulates- Audio noise due to corona, its generation, characteristics and limits measurement of audio noise.

**Unit VI**
Introduction of Electric Field calculation, Uniqueness theorem, Field calculation by finite difference method with equal and unequal nodal distance in 2-D and 3D system.

**Text Book:**

1. Rakosh Das Begamudre, ‘Extra high voltage ac transmission engineering’ New Age International Publisher

**Reference Book:**

1. Padiyar K. R. ‘HVDC transmission systems’ Wiley.
2. Begamudre, R..D., EHVAC Transmission Engineering, New Age International (P) Limited, Publishers (2006).

**POWER SYSTEM PLANNING AND RELIABILITY**

**PSM 103(A)**

**L-T-P=4-0-0**

**Course Outcomes (CO):**

Upon successful completion of this course, students should be able to:
**CO1:** Students will develop the ability to learn about load forecasting.
**CO2:** To study the fundamentals of Generation system, transmission system and Distribution system reliability analysis
**CO3:** Learners will understand the significance ancillary services and pricing of transmission network
**CO4:** Students will understand the concepts of Contingency analysis and Probabilistic Load flow Analysis

**Mapping of Course Outcomes (CO) and Program Outcomes (PO):**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | | 3 | 3 | | | | | 2 | |
| CO2 | 2 | 2 | 2 | | | 3 | | | 3 | | 3 | |
| CO3 | 1 | 1 | 1 | | 2 | 3 | | 3 | 3 | 3 | 2 | 3 |
| CO4 | 3 | 1 | | 3 | | 3 | 3 | 3 | | | | 3 |

## Course Contents:

**Unit I**
Load Forecasting: Load Forecasting Categories-Long term, Medium term, short term, very short term Applications of Load Forecasting, Factors Affecting Load Patterns Medium and long term load forecasting methods- end use models, econometric models, statistical model based learning.
Short Term Load Forecasting (STLF): Applications of Load Forecasting, methods- similar day approach, regression methods, time series, ANN, Expert systems, Fuzzy logic based method, support vector machines ANN architecture for STLF, Seasonal ANN, Adaptive Weight, Multiple-Day Forecast, STLF Using MATLAB'S ANN Toolbox, Training and Test Data, Stopping Criteria for Training Process, sensitivity analysis
**Unit II**
Power System Reliability: Basic Notions of Power System Reliability- sub systems, reliability indices, outage classification, value of reliability tools, Concepts and methodologies, power system structure, Reliability based planning in power systems, Effect of failures on power system, Planning criteria, Risk analysis in power system planning, multi-state systems.
**Unit III**
Basic Tools and Techniques- random processes methods & Markov models, Computation of power system reliability measures by using Markov reward models, Evaluation of reliability indices, Universal Generating Function (UGF) Method, Monte Carlo simulation
**Unit IV**
Reliability of Generation Systems- capacity outage calculations, reliability indices using the loss of load probability method, unit commitment and operating constraints, optimal reserve management, single and multi-stage expansion.
**Unit V**
Reliability Assessment for Elements of Transmission and Transformation Systems- reliability indices of substations based on the overload capability of the transformers, evaluation and

analysis of substation configurations, Reliability analysis of protection systems for high voltage transmission lines.

**Text Book:**

1. Markey operations in electric power systems Forecasting, Scheduling, and Risk Management, Shahidehpour M, Yamin H, Li z, John Wlley & sons

**Reference Book:**

1. Reliability evaluation of power systems, Billinton R, Allan R (1996) Plenum Press New York.
2. B.R. Gupta, "Generation of Electrical Energy",S.Chand Publications 1983.

**POWER SYSTEM APPARATUS**

**PSM 103(B)**

**L-T-P=4-0-0**

**Course Outcomes (CO):**
Upon successful completion of this course, students should be able to:
**CO1:** Students will develop the ability to learn about VCB and SF6 Circuit breaker, Ratings, Selection.
**CO2:** To know the reactive power control in electrical power transmission lines and the importance of FACTS devices.
**CO3:** Learners will understand to Analyze the operation, performance and applications of SVC.
**CO4:** Students will develop the ability to learn about TCR and TSR, FC-TCR (Fixed Capacitor, Thyristor Controlled Reactor), Hybrid VAR Generators. Static VAR Compensator (SVC & STATCOM).

**Mapping of Course Outcomes (CO) and Program Outcomes (PO):**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | | | 3 | 3 | | | | | 2 | |
| CO2 | 2 | 3 | | | 3 | 2 | | | 3 | | 3 | 3 |
| CO3 | 3 | 2 | | | 3 | 2 | | 3 | 2 | 3 | 2 | 3 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO4 | 3 | 2 | | 3 | 1 | 3 | 1 | 3 | | | | 1 |

## Course Contents:

**Unit I**
Circuit Breaker: Introduction, Operating Principle, Detail study on VCB and SF6 Circuit breaker, Ratings, Selection. Surge Arrester & Surge Absorber. Insulation Co-ordination, BIL.

**Unit II**
FACTS: Concepts and general system consideration: Opportunities for FACTS. Basic types of FACTS controllers. Brief description and definition of FACTS controllers. Shunt connected controllers. Series Connected controllers. Combined Shunt and Series connected controllers.

**Unit III**
Static Shunt Compensators: Objectives of Shunt Compensations. Midpoints voltage regulation for line segmentation. Improvements of transient stability, Methods of controllable VAR generation. Variable impedance type static VAR generation, TCR and TSR, FC-TCR (Fixed Capacitor, Thyristor Controlled Reactor), Hybrid VAR Generators. Static VAR Compensator (SVC & STATCOM). Transfer Function and Dynamic Performance. Power Oscillation, Damping. Transient Stability.

**Unit IV**
Static Series Compensators: GCSC, TSSC, TCSC and SSSC: Basic Operating Control Schemes for GCSC, TSSC and TCSC.

**Unit V**
Static Voltage and Phase Angle Regulators: TCVR and TCPAR.
Unified power flow controllers

**Text Book:**

1. Understanding FACTS by Narain G. Hingorani & Laszlo Gyugyi: IEEE Press

**Reference Book:**

1. Power System Switchgear & Protection by Sunil S. Rao
2. B.R. Gupta, “Generation of Electrical Energy”,S.Chand Publications 1983

**POWER QUALITY**

**PSM 103(C)**

**L-T-P=4-0-0**

**Course Outcomes (CO):**
Upon successful completion of this course, students should be able to:
**CO1:** Discuss the various types of power quality problem.
**CO2:** Analyze the sources, types and mitigation of over voltage issues and model of over voltage problem with computer software tools.
**CO3:** Evaluate the effects of harmonics on power system equipments and analyze the methods of controlling of harmonics.
**CO4:** Explain the principle of operation of various types of power quality monitoring devices.

**Mapping of Course Outcomes (CO) and Program Outcomes (PO):**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | | 3 | 3 | | | | | 3 | |
| CO2 | 2 | 2 | 2 | | | 3 | | | 3 | 3 | 1 | 3 |
| CO3 | 3 | 3 | 3 | | 2 | 2 | | 3 | 1 | 3 | 1 | 3 |
| CO4 | 3 | 3 | | | | 3 | | 3 | | | | 3 |

## Course Contents:

**Unit I**
Electric power quality phenomena: Impacts of power quality problems on end users, Power quality standards, power quality monitoring.

**Unit II**
Power quality disturbances:- transients, short duration voltage variations ,long duration voltage variations, voltage imbalance, wave-form distortions, voltage fluctuations, power frequency variations, power acceptability curves.

**Unit III**
Power quality problems: poor load power factor, loads containing harmonics, notching in load voltage, dc offset in loads, unbalanced loads, disturbances in supply voltage.

**Unit IV**
Transients: Origin and classification- capacitor switching transient-lighting-load switching-impact on users-protection- mitigation

**Unit V**
Harmonics: harmonic distortion standards, power system quantities under non sinusoidal conditions-harmonic indices-source of harmonics-system response characteristics-effects of harmonic distortion on power system apparatus –principles for controlling harmonics, reducing harmonic currents in loads, filtering, modifying the system frequency response- Devices for controlling harmonic distortion, inline reactors or chokes, zigzag transformers, passive filters, active filters.

**Unit VI**
Power quality conditioners: Shunt and series compensators, Dstatcom-dynamic voltage restorer, unified power quality conditioners

**Text Book:**

1. Arindam and Ledwich Gerard, ‘Power quality enhancement using custom power devices’ Springer
2. Arrillaga J., Watson N. R. and Chen S., ‘Power System Quality Assessment’ Wiley.

**Reference Book:**

1. Angelo Baggini ‘Handbook of Power Quality’ – Wiley

**OPTIMIZATION TECHNIQUES**

**PSM 104 (A)**

**L-T-P=4-0-0**

**Course Outcomes (CO):**

Upon successful completion of this course, students should be able to:

**CO1:** Able to formulate mathematical models of real world problems

**CO2:** Understand the major limitations and capabilities of deterministic operations

**CO3:** Handle, Solve and analyze problems using linear programming and other mathematical programming algorithms

**CO4:** Solve various multivariable optimization problem

**Mapping of Course Outcomes (CO) and Program Outcomes (PO):**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | | | | | | | | | 3 | |
| CO2 | 3 | 2 | | | | | | | | | 3 | 1 |
| CO3 | 3 | 3 | | | | | | | | | 2 | 3 |
| CO4 | 2 | 3 | | | | | | | | | | 1 |

## Course Contents:

**Unit I**

Fundamentals of optimization techniques: Definition-Classification of optimization problems-Unconstrained and Constrained optimization-Optimality conditions-Classical Optimization techniques (Lamda Iteration method, Linear programming, Quadratic programming).

**Unit II**

Lamda iteration method: Brief introduction to lamda iteration method, formulate the Lagrange function, Lamda iteration method to solve Optimal dispatch problem.

**Unit III**

Quadratic programming: Introduction to quadratic programming, Working principle, sequential programming, Linear constrained optimization problem, Karush-Kuhn-Tucker conditions and its application to solve various problems, Interior point method, lagrangian duality

**Unit IV**

Linear programming: Examples of linear programming problem, The Simplex Method I, Fundamental theorem of linear programming, Weak and strong duality theorems, Integer programming, Network flow, develop a linear programming model from problem description.

**Unit V**

Genetic Algorithm: Introduction to genetic Algorithm, working principle, Principles of Genetic Algorithm- Evolutionary Strategy and Evolutionary Programming-Genetic Operators-Selection, Crossover and Mutation fitness function. GA operators; Similarities and differences between GA and traditional methods; Unconstrained and constrained optimization using Genetic Algorithm.

**Unit VI**

Particle Swarm Optimization: Fundamental principle-Velocity Updating-Advanced operators-Parameter selection- Hybrid approaches (Hybrid of GA and PSO, Hybrid of EP and PSO) -Binary, discrete and combinatorial

**Unit VII**

Differential Evolution: Fundamental principle, developing DE based solution techniques for OPF problems with single and multiple objectives and comparing the performance and computational effectiveness of DE with other evolutionary and conventional techniques

**Unit VIII**

Application of population based optimization techniques in power systems: Algorithms and flow chart of various optimization techniques for solving economic load dispatch and hydro-thermal scheduling problem

**Text Book:**

1. S.S.Rao, Engineering Optimization, 3rd Edition, New Age International (P) Ltd
2. Genetic Algorithm – D.E.Goldberg
3. Principle of soft computing by S.N.Sivanandam & S.N. Deepa
4. Soft computing Technique and its application in electrical Engineering by Chaturvedi

**Reference Book:**

1. Optimization on Power system Operation by Jizhong Zhu Wiley-IEEE Press.
2. An Introduction to Optimization, 3rd Edition by K.P. Chong, Stanislaw H. Zak.

## SOFT COMPUTING TECHNIQUES

**PSM 104 (B)**

**L-T-P=4-0-0**

**Course Outcomes (CO):**

Upon successful completion of this course, students should be able to:

**CO1:** Students Will be able to know the basic ANN architectures, algorithms and their limitations.

**CO2:** Will be capable of developing ANN based models and control schemes for non-linear system.

**CO3:** Will be competent to use hybrid control schemes and P.S.O and support vector Regressive.

**CO4:** Will be knowledgeable to use Fuzzy logic for modeling and control of non-linear systems.

**Mapping of Course Outcomes (CO) and Program Outcomes (PO):**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 2 | 3 | 2 | 1 | | | | | 3 | |
| CO2 | 2 | 3 | | | | 1 | | | | | 1 | 3 |
| CO3 | 3 | 1 | | | 3 | 2 | | | | | | 3 |
| CO4 | | 3 | | | | | | 3 | 1 | | | 3 |

## Course Contents:

**Unit I**

Introduction to Soft Computing, components of soft computing, traditional computing and drawbacks, advantages of soft computing techniques

**Unit II**

Introduction to fuzzy logic: definition, general idea and importance in practical life. Fuzzy set theory: concept of fuzzy set, membership functions, comparison of fuzzy set and classical set. Operations on fuzzy sets, properties of standard operations, T norm and S norm, Extension principle and application.

Height of fuzzy set, core of fuzzy set, support of fuzzy set, normal fuzzy set, normalization of fuzzy set, level set, α cut and strong α cut of fuzzy set, concentration and dilation of fuzzy sets, fuzzy singleton, crossover points. Fuzzy relation: fundamentals of fuzzy relations, operations on fuzzy relations, composition of fuzzy relations, fuzzy reasoning, fuzzy relation inferences, compositional rule of inference, fuzzification.

Fuzzy methods in control theory: Introduction to fuzzy logic controller, types of fuzzy logic controllers, basic structure of fuzzy knowledge based controllers, defuzzification methods, applications of fuzzy logic control.

**Unit III**

Introduction to artificial neural networks, artificial neuron model, types of activation functions. Learning in neural networks, feed forward and feedback neural networks, back propagation training algorithm, Hopfield network, Boltzman machine. Self-organizing map, learning vector quantization algorithm.

**Unit IV**

Basic concept of genetic algorithm, comparison of GA and traditional techniques, objective function and fitness function, crossover, mutation, GA search, applications of GA.

**Text Book:**

1. Klir, G.J. & Yuan, B.- Fuzzy sets and Fuzzy logic, theory and applications, Prentice Hall of India Private Limited.
2. M. Ganesh - Introduction to fuzzy sets and fuzzy logic, PHI.

**Reference Book:**

1. N. P. Padhy – Artificial intelligence and intelligent systems, Oxford
2. Timothy J. Ross – Fuzzy logic with engineering applications, Wiley.

## DIGITAL SIGNAL PROCESSING

**PSM 104 (C)**

**L-T-P=4-0-0**

**Course Outcomes (CO):**

Upon successful completion of this course, students should be able to:

**CO1:** Students will be able to expose the fundamentals of digital signal processing in frequency domain& its application.

**CO2:** Will be capable of comparing Architectures & features of Programmable DS processors & develop logical functions of DS Processors.

**CO3:** Will be competent to comprehend the DFTs and FFTs, design and analyze the digital filters, comprehend the Finite word length effects in Fixed point DSP Systems.

**CO4:** Will be able to apply z-transform and inverse Z transform and analyze discrete time systems.

**Mapping of Course Outcomes (CO) and Program Outcomes (PO):**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | | 3 | 3 | | 3 | | 1 | 3 | |
| CO2 | 1 | | | | | | | | | | 2 | 3 |
| CO3 | 3 | | | | | | | | | 2 | 1 | 1 |
| CO4 | 3 | 2 | | | 3 | 2 | | 2 | | 3 | | 3 |

## Course Contents:

**Unit I**

Description of Signals and Systems: Types of signals and their characteristics, types of systems and their behavior.

Discrete-time description of signals: Discrete-time sequences, their frequency domain behaviour, comparison with analog signals, convolution of two sequences, sampling a continuous function to generate a sequence, reconstruction of continuous-time signals from discrete-time **sequence.**

**Unit II**

Discrete-time description of systems: Unit-sample response of a system, Time-invariant systems, Superposition principle for linear systems, Stability criterion for discrete-time systems, Causality criterion for discrete-time systems.

Discrete-time Fourier transform: Definition of Fourier transform ( FT), important properties of FT, properties of FT for real- valued sequences, use of FT in signal processing, FT of special sequences, the inverse FT, FT of the product two discrete-time sequences

**Unit III**

Discrete Fourier Transform: The definition of the Discrete Fourier Transform (DFT), efficient computation of DFT, properties of the DFT.

Digital filter: Definition and anatomy of a digital filter, frequency domain description of signals and systems, replacing analog filters with digital filters, filter categories: IIR and FIR, recursive and non-recursive.

Optimal and adaptive filters: Wiener filtering technique, adaptive filters and their applications.

**Unit IV**

Spectrum estimation and analysis: Principles, Periodogram method, Blackman – Turkey method, fast correlation method. Autoregressive spectrum estimation.

Wavelet Transforms: Fourier Transform and its limitations, Short Time Fourier Transform, introduction of Continuous Wavelet

Transform, Discretization of the Continuous Wavelet Transform (DWT).

**Text Book:**

1. Ramesh Babu- Digital Signal Processing

**Reference Book:**

1. John Proakis – Digital Signal Processing

2. John. G. Proakis, Dimitris G. Manolakis, “Digital signal processing”, Pearson Edu, 2002

## OBJECT ORIENTED PROGRAMMING

**PSM 104 (D)**

**L-T-P=4-0-0**

**Course Outcomes (CO):**
Upon successful completion of this course, students should be able to:
**CO1:** Students Will be able to Develop a simple program in C++ using functions.
**CO2:** Design classes and objects with constructors and destructors.
**CO3:** Create programs using the concept of compile time polymorphism and function overloading.
**CO4:** Apply hierarchical programs using inheritance and virtual functions
**Mapping of Course Outcomes (CO) and Program Outcomes (PO):**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | 3 | 3 | | | 3 | | 3 | 3 | |
| CO2 | 3 | 2 | 2 | 2 | 2 | 2 | | | 2 | | | 3 |
| CO3 | 3 | 3 | | 3 | 3 | | | | 3 | 3 | | 3 |
| CO4 | 3 | | | 3 | 3 | 3 | | 3 | 3 | 3 | | 3 |

## Course Contents:

**Unit I**
Objective oriented programming paradigm: Introduction – reusability – security – object oriented programming fundamentals – abstraction -encapsulation - derivation – object oriented languages and packages
**Unit II**
Classes and objects: Introduction to C++ - procedural oriented approach to C++ - data types – control structures – problem solving - standard input and output streams – C++ enhancements – function prototypes - defaults reference variables – constant – classes – constructors – destructors – constraint objects – member objects and the functions.
**Unit III**
Advanced features: Dynamic memory allocation pointers – new and delete operators – classes with pointers – copy constructor – static member –friend classes –friend functions –operator overloading.
**Unit IV**
Function overloading – connection classes – derived classes – class conservation – protected members – virtual functions – dynamic binding – abstract classes – multiple inheritance – templates error handling.
Case studies: Overview of typical object oriented systems – case studies – application to electrical engineering.