| 24PCDC100 | Applied Mathematics | (3-0-0) 3 |

Contact Hours: 39

Course Learning Objectives (CLOs): The objective of this course is to make the student aware of, Formulation of mathematical models to simple physical systems, establishing numerical solutions based on extensive computational mathematics for the mathematical models developed and forming the basic algorithms for framing the basis for computer based solutions in modern systems.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		Mapping to POs(1 to 4)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	**Apply** the idea of random variables (discrete/continuous) and probability distributions in analyzing the probability models arising in random processes.	3	1	--
CO-2	**Apply** the concepts of optimization for constrained and un-constrained Engineering problems.	3	1	--
CO-3	**Utalise** the concepts of Numerical Differentiation & Integration related to Engineering problems.			
CO-4	**Understand** each technique and use appropriate numerical method to solve differential equations	3	1	--
CO-5	**Establish** the numerical solutions for simultaneous linear algebraic equations.	3	1	--

PO's	1	2	3
Mapping Level	2	-	3

Prerequisites: Basics of 1. Differentiation and Integration
                             2. Linear Algebra.

Course content:

1. **Probability Theory:** Definitions of random variables and probability distributions, probability mass and density functions, expectation, characteristic functions, probability generating and moment generating functions-illustrations. Binomial, Poisson, Exponential, Gaussian distributions example. **8 Hrs.**

2. **Optimization:** One dimensional unconstrained optimization, Constrained Optimization-Linear programming, and non-linear constrained optimization. **7 Hrs.**

3. **Numerical Differentiation & Integration:** Newton's forward and back ward difference formula. Newton–Cotes and Gauss Quadrature Integration formulae, Romberg's integration. **7 Hrs.**

4. **Numerical solutions for differential equations:** Numerical solution of Ordinary Differential Equations – Euler's modified Method and fourth order Runge-Kutta methods.
   Partial Differential Equations – Numerical solution for different structural problems, solution for explicit and implicit equations. Two dimensional wave and heat equations, examples. **9 Hrs.**

5. **Numerical Methods in Linear Algebra:** Gauss elimination, Gauss-Jordan, LU Decomposition, QR Method, Jacobi and Gauss-Seidel Method, Eigen values and Eigenvectors – Power method, householder transformation, physical interpretation of Eigen values and Eigenvectors. **8 Hrs.**

Reference Books:
1. S. S. Sastry, Introductory Methods of Numerical Analysis, PHI, 2005.
2. Steven C. Chapra, Raymond P.Canale, Numerical Methods for Engineers, Tata McGraw Hill, 4th Ed, 2002.
3. M K Jain, S.R.K Iyengar, R K. Jain, Numerical methods for Scientific and engineering Computation, New Age International, 2003.
4. Taha H A, "Operations research- An Introduction", Mc Milan PublishingCo,1982.
5. M.D. Raisinghania: Advanced Differential Equations, S. Chand & Co.

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Contact Hours: 39

Course Learning Objectives (CLOs):

- ➢ Ability to analyze the solution and examine its stability in operator theory.
- ➢ Ability to optimize and solve real life problems.
- ➢ Ability to solve image processing and signal processing problems.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		Mapping to POs(1 to 4)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	Use statistical technique and use appropriate method to analyze multivariate data.	3,6		
CO-2	Understand the probabilistic concepts required to test the hypothesis and take the decision using Analysis of variance.. Explain markov chains and describe stochastic process.			3,6
CO-3	Understand vector spaces and related topics arising in magnification and rotation of images.			3,6
CO-4	Apply the technique of singular value decomposition for data compression, least square approximation in solving inconsistent linear systems.		3,6	
CO-5	Compute orthogonal and orthonormal basis vectors required to analyze image and signal processing problems.		3,6	

POs	1	2	3	4	5	6
Mapping Level	-	-	1.8	-	-	1.8

Pre-requisites:

1. Statistical Averages
2. Basic probability theory.
3. Random variables (discrete and continuous).

Content:

1. Statistics

Statistical Inference: Introduction to multivariate statistical models: Curve fitting (Linear and Non-linear), Weighted least square approximation (Linear & Non Linear) Regression analysis: (Linear, Non Linear)& multiple regression. Correlation analysis: Correlation, Correlation for bivariate frequency distribution. The problem of over fitting model assessment. **7 Hrs.**

2. Probability

Sampling theory: Testing of hypothesis by z test, t-student test. Applications of the univariate and multivariate Central Limit Theorem.

Markov chains: Probability vectors, stochastic matrices, fixed point vector, regular stochastic matrices. Higher transition probabilities, stationary distribution of regular Markov chains. **8 Hrs.**

3. Vector Spaces

Vector spaces; subspaces,Linearly independent and dependent Vectors, Basis and dimension, coordinate vectors-Illustrative examples. Linear transformations, Representation of transformations by matrices.

8 Hrs.

4. SymmetricMatrices

Introduction to Eigen values and eigen vectors, Diagonalization, The Singular value decomposition. Applications to image processing and statistics, Principal Component Analysis . **8 Hrs.**

5. Orthogonality and least squares

Inner product, orthogonal sets, orthogonal projections, orthogonal bases. Gram-Schmidt orthogonalization process. QR factorizations of a matrices, least squareproblems.Applications to linear models (least square lines and least square fitting of other curves). **8 Hrs.**

REFERENCE BOOKS
1. Linear Algebra and its Applications **David C. Lay, Steven R. Lay and J. J. McDonald** Pearson Education Ltd 5 th Edition 2015.
2. Numerical methods for Scientific andEngg. Computation ,**M K Jain, S.R.K Iyengar, R K. Jain** New Age 2014   International 6th Ed.,
3. Probability, Statistics and Random Process, **T. Veerarajan** Tata Mc-Graw Hill Co 3 rd Edition 2016.

24PDEC100	Applied Mathematics	(3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs): This course will enable students to: Acquaint with principles of Probability theory, Random process, Linear Algebra, Wavelet transforms Laplace transform and Linear programming problems and apply the knowledge in the applications of Electronics and Communication Engineering Sciences.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		Mapping to POs(1 to 4)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	Learn the idea of random variables (discrete/continuous) and probability distributions in analyzing the probability models arising in random processes.		1,2	
CO-2	Learn the concept of Wavelets and its Applications to Denoising**.**		1,2	
CO-3	Apply Linear Algebra, QR and singular value decomposition techniques for data compression, least square approximation in solving inconsistent linear systems.		1,2	
CO-4	Apply transform method to solve one-dimensional wave equation, one-dimensional heat equation, Laplace equation, Poisson equation.		1,2	
CO-5	Solve system of linear and non-linear equation arising in engineering fields.		1,2	

PO's	1	2	3	4	5	6
Mapping Level	2.0	2.0	-	-	-	-

Prerequisites: Basics of Probability, Differentiation and Integration **and** Vectors.

Contents:

1.Probability Theory

Review of basic probability theory. Definitions of random variables and probability distributions, probability mass and density functions, expectation, moments, central moments, characteristic functions, probability generating and moment generating functions-illustrations. Binomial, Poisson, Exponential, Gaussian and Rayleigh distributions and examples. **8 Hrs.**

2. Introduction to Wavelets

Introduction, The origin of wavelets, wavelets and other reality transforms. Wavelets in future. Continuous Wavelets: First level of introduction of wavelet transforms. Continuous time frequency representation of signals. Discrete Wavelet Transform signal decomposition (Analysis) frequency response, signal reconstruction. Applications of Wavelets in science and Engineering,

Denoising: Introduction, Denoising using wavelet shrinkage – statistical modelling and estimation, Noise estimation, Denoising Images with MATLAB. **8 Hrs.**

3.**Linear Algebra:** Computation of Eigen values and Eigen vectors of real symmetric matrices-Given's method. Orthogonal vectors and orthogonal bases. Gram-Schmidt orthogonalization process. QR decomposition, singular value decomposition, least square approximations**. 7 Hrs.**

4.Transform Methods: Laplace transform methods for one dimensional w ave equation – Applications to E & C Engineering. Fourier transform methods for one dimensional heat conduction and applications to E & C Engineering. Fourier transform methods for Laplace equation and Poisson equation, problems. **8 Hrs.**

5.Linear and Nonlinear Programming: Simplex Algorithm and Simplex method. Nonlinear Programming Constrained extremal Problems : Lagrange's multiplier method, Kuhn-Tucker conditions and solutions.
8 Hrs.

Reference Books:

1) Richard Bronson, *"*Schaum's Outlines of Theory and Problems of Matrix Operations*"*, McGraw-Hill, 1988.
2) Venkataraman M K," Higher Engineering Mathematics", National Pub.Co,1992.
3) Sneddon.I.N.,"Elements of partial differential equations",Dover Publications, 2006.
4) Taha H A, "Operations research- An Introduction", Mc Milan Publishing Co, 1982.
5) K.P. Soman, K.I. Ramachandran, Dr.G.Resmi; Insight into Wavelets (From theory to Practice), PHI Publications,3rd edition. 2010.

24PEVC100	Applied Mathematics	(3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs):

Learn the idea of random variable and probability distribution. To prepare the students to formulate and solve linear programming problem. Study Numerical methods to solve algebraic, transcendental equations. Learn to solve system of linear equations. Introducing students to the fundamental concepts of Graph theory and linear algebra.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		Mapping to POs(1 to 4)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	Learn the idea of random Variables (discrete/continuous) and probability distributions in analyzing the probability models arising in power system engineering.			1,2
CO-2	Apply the concept of optimization to Solve system of linear and non linear programming problems.			1,2
CO-3	Learn the Concept of graph theory in engineering problems.			1,2
CO-4	Employ numerical techniques in order to achieve more accurate values in the computation of roots of algebraic and non-linear equations			1,2
CO-5	Apply standard iterative methods to compute Eigen values			1,2

PO's	1	2	3	4	5	6
Mapping Level	1.0	1.0	-	-	-	-

Prerequisites: Differentiation, Matrices, vectors, Basic probability theory

Contents:

1) Probability Theory

Definitions of random variables and probability distributions, probability mass and density functions, expectation, moments, central moments, characteristic functions, probability generating and moment generating functions-illustrations.Binomial, Poisson, Exponential.   **5 Hrs.**

2) Linear and Nonlinear Programming

   Simplex Algorithm-Two Phase andBig M
techniques– Duality theory-Dual Simplex method. Nonlinear Programming
Constrained extremal problems-Lagranges multiplier method- Kuhn-Tucker
conditionsand solutions.   10 **Hrs.**

3) Graph Theory

   Basic terminologies, types of graphs, sub graphs, graphs isomorphism,
   connected graphs-walks, paths, circuits, connected and disconnected
   graphs, operations on graphs, Eulerian paths and circuits, Hamiltonian
   paths and circuits, shortest path algorithms, applications of graphs.
                                                                 8 **Hrs.**

4) Numerical Methods

  Solution of algebraic and transcendental equations- iterative methods
  based on second degree equation – Muller method (no derivation),
  Chebyshev method. Fixed point iteration method (first order), acceleration
of convergence, Δ - Aitken's method. Bairstow's method.   **8** Hrs.

5) Linear Algebra

   Computation of Eigen values and Eigen vectors of real symmetric matrices-
Given's method.Orthogonal vectors and orthogonal bases. Gram-Schmidt
orthogonalization   process.   QR   decomposition,   singular   value
decomposition**.**   **8 Hrs.**

Reference Books:
   1) **M K Jain, S R K Iyengar and R K Jain**, "Numerical Methods for
      Scientific and Engineering Computations", New Age International, 2004.
   2) **Dr. B.S. Grewal**, "Higher Engineering Mathematics", 41stEdition,
      Khanna Publishers, 2011.
   3) **NarsinghDeo,** "Graph Theory with Applications to Engineering and
      Computer Science", PHI, 2012.
   4) **Kenneth Hoffman and Ray Kunze**, "Linear Algebra", 2nd Edition, PHI,
      2011.
   5) **Richard Bronson**, "Schaum's Outlines of Theory and Problems of
      Matrix Operations", McGraw-Hill, 1988.

Contact Hours: 39

Course Learning Objectives (CLOs):

Learn the idea of random variable and probability distribution. To prepare the students to formulate and solve linear programming problem. Study Numerical methods to solve algebraic, transcendental equations. Learn to solve system of linear equations. Introducing students to the fundamental concepts of Graph theory and linear algebra.

Course Outcomes (COs):

Description of the Course Outcome:		Mapping to POs(1 to 4)		
At the end of the course the student will be able to:		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	Learn the idea of random Variables (discrete/continuous) and probability distributions in analyzing the probability models arising in power system engineering.			1,2
CO-2	Apply the concept of optimization to Solve system of linear and non linear programming problems.			1,2
CO-3	Learn the Concept of graph theory in engineering problems.			1,2
CO-4	Employ numerical techniques in order to achieve more accurate values in the computation of roots of algebraic and non-linear equations			1,2
CO-5	Apply standard iterative methods to compute Eigen values			1,2

PO's	1	2	3	4	5	6
Mapping Level	1.0	1.0	-	-	-	-

Prerequisites: Differentiation, Matrices, vectors, Basic probability theory

Contents:

1) Probability Theory

Definitions of random variables and probability distributions, probability mass and density functions, expectation, moments, central moments, characteristic functions, probability generating and moment generating functions-illustrations. Binomial, Poisson, Exponential.   **5 Hrs.**

2) Linear and Nonlinear Programming

 Simplex Algorithm-Two Phase and Big M
techniques– Duality theory-Dual Simplex method. Nonlinear Programming
Constrained extremal problems-Lagranges multiplier method- Kuhn-Tucker
Conditions and solutions.   10 **Hrs.**

3) Graph Theory

 Basic terminologies, types of graphs, sub graphs, graphs isomorphism,
connected graphs-walks, paths, circuits, connected and disconnected
graphs, operations on graphs, Eulerian paths and circuits, Hamiltonian
paths and circuits, shortest path algorithms, applications of graphs.
                                                            8 **Hrs.**

4) Numerical Methods

 Solution of algebraic and transcendental equations- iterative methods
 based on second degree equation – Muller method (no derivation),
 Chebyshev method. Fixed point iteration method (first order), acceleration
of convergence, Δ - Aitken's method. Bairstow's method.   8 Hrs.

5) Linear Algebra

 Computation of Eigen values and Eigen vectors of real symmetric matrices-
Given's method. Orthogonal vectors and orthogonal bases. Gram-Schmidt
orthogonalization   process.   QR   decomposition,   singular   value
decomposition**.**   **8 Hrs.**

Reference Books:
1) **M K Jain, S R K Iyengar and R K Jain**, "Numerical Methods for
   Scientific and Engineering Computations", New Age International, 2004.
2) **Dr. B.S. Grewal**, "Higher Engineering Mathematics", 41stEdition,
   Khanna Publishers, 2011.
3) **Narsingh Deo,** "Graph Theory with Applications to Engineering and
   Computer Science", PHI, 2012.
4) **Kenneth Hoffman and Ray Kunze**, "Linear Algebra", 2nd Edition, PHI,
   2011.
5) **Richard Bronson***, "*Schaum's Outlines of Theory and Problems of
   Matrix Operations*",* McGraw-Hill, 1988.