22PCDC100	Applied Mathematics	(4-0-0) 4

Contact Hours: 52

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	**Understand** each technique and use appropriate method to analyse multivariate data.	3	1	--
CO-3	**Apply** the concepts of optimization for constrained and un-constrained engineering problems.	3	1	--
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. 10 **Hrs.**
2.
3. **Statistics:** Statistical inference, Introduction to multivariate statistical models: regression and classification problems, principal components analysis. The problem of over fitting model assessment.
   Sampling: Random samples, sampling distributions of estimators, Methods of Moments and Maximum Likelihood. 11 **Hrs.**

4. **Optimization:** One dimensional unconstrained optimization –, Constrained Optimization-Linear programming, and non-linear constrained optimization. 10 **Hrs.**

5. **Numerical Differentiation & Integration:** Newton’s forward and back ward difference formula. Newton –Cotes and Gauss Quadrature Integration formulae, Romberg’s integration.
   Numerical solutions for differential equations: Numerical solution of Ordinary Differential Equations – Euler’s modified Method and fourth order Runge-Kutta methods. 11 **Hrs.**

6. **Numerical Methods in Linear Algebra:** Gauss elimination, Gauss-Jordon, LU Decomposition, QR Method, Jacobi and Gauss-Seidel Method, Eigen values and Eigenvectors – Power method, householder transformation, physical interpretation of Eigen values and Eigenvectors. 10 **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 Publishing Co,1982.
5. Applied statistics and probability for engineers by Douglas C. Montgomery and Geaorge C Runger, Wiley India, 4th edition.

22PDEC100	Applied Mathematics	(4-0-0) 4

Contact Hours: 52

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

1. Probability **2.** Differentiation and Integration **3.** 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 example. **10 Hrs.**

2) **Introduction to Linear Algebra:** Groups, Fields, Binary Field Arithmetic, Construction of Galois Field and its basic properties. Vectors, matrices, Vector spaces.

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. **12 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**.** **10 Hrs.**

4)Transform
Methods: Laplace transform methods for one dimensional wave equation – Displacement sina string–Longitudinal vibration of a elastic bar.
Fourier transform methods for one dimensional heat conduction problems. Fourier transform methods for Laplace equation and Poisson equation. **10 Hrs.**

5) **Linear and Nonlinear Programming:** Simplex Algorithm
Two Phase and Big M techniques-Duality theory-Dual Simplex method.
Nonlinear Programming Constrained extremal
Problems Lagrange's multiplier method, Kuhn-Tucker conditions and solutions. **10 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.

22PEPC100	Applied Mathematics	(4-0-0) 4

Contact Hours: 52

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	2.0	2.0	-	-	-	-

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, Gaussian distributions example.

10 Hrs.

2) Linear and Nonlinear Programming

Formulation of LPP problem. 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. **12 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. **10 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, Graeffe's root squaring method. **10 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, least square approximations**.** **10 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.

22PCSC100	Applied Mathematics (4-0-0) 4

Contact Hours: 52

Course Learning Objectives (CLOs):

Acquaint with principles of Probability theory, Random process, Linear Algebra, and apply the knowledge in the applications of Computer science and engineering applications.

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	Determine Type-I and Type-II errors and test for goodness of fit using different methods. 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	**Apply** Linear Algebra for decomposition and dimension-reduction of large data.		3,6	

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

Pre-requisites:

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

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, rank correlation, Correlation for bivariate frequency distribution. The problem of over fitting model assessment. **10 hrs.**

2. **Probability**

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

Markov chains: Probability vectors, stochastic matrices, fixed point vector, regular stochastic matrices. Higher transition probabilities, stationary distribution of regular Markov chains. **12 Hrs.**

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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.

10 hrs.

4. **Symmetric and Quadratic Forms**:

Diagonalization, Quadratic forms, Constrained Optimization, The Singular value decomposition. Applications to image processing and statistics, Principal Component Analysis . **10 hrs.**

5. **Orthogonality and least squares**:

Inner product, orthogonal sets, orthogonal projections, orthogonal bases. Gram-Schmidt orthogonalization process. QR factorizations of a matrices, least square problems. Applications to linear models (least square lines and least square fitting of other curves). **10 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 and Engg. 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.