SDM COLLEGE OF ENGINEERING & TECHNOLOGY, DHARWAD

Department of Mathematics

20PMCSC100	Mathematical Foundations of Computer Science	(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	**Apply** the idea of random variables (discrete/continuous) and probability distributions in analyzing the probability models arising in random processes.		3,6	
CO-2	**Use** different techniques for estimating the parameters of a given distribution.		3,6	
CO-3	**Understand** each technique and use appropriate method to analyze multivariate data.		3,6	
CO-4	**Apply** Linear Algebra for decomposition and dimension-reduction of large data.	3,6		
CO-5	**Apply** the mathematical concepts in fields of computer science and engineering		3,6	

POs	**1**	**2**	**3**	**4**	**5**	**6**
Mapping Level	-	-	2.2	-	-	2.2

Pre-requisites:

1. Basic probability theory.
2. Random variables.
3. To obtain Statistical Averages.

Content:

1. **Probability:**
Probability mass, density, and cumulative distribution functions, Parametric families of distributions, Expected value, variance, conditional expectation, Applications of the univariate and multivariate Central Limit Theorem, Probabilistic inequalities, Markov chains. **12 Hrs.**

2. **Sampling:**
Random samples, sampling distributions of estimators, Methods of Moments and Maximum Likelihood. **10 Hrs.**

3. **Statistics:**
Statistical inference, Introduction to multivariate statistical models: regression and classification problems, principal components analysis. The problem of overfitting model assessment**.** **10 Hrs.**

4. **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.**

5. **Computer science and engineering applications:**
Applications to varying fields of CSE like bioinformatics, soft computing, machine learning, data mining, computer vision, Network protocols, analysis of Web traffic, computer security, operating systems, distributed systems. **10 Hrs.**

REFERENCE BOOKS

1. Verma, Foundation Mathematics for Computer Science, 1986.
2. K. Trivedi. Probability and Statistics with Reliability, Queuing, and Computer Science Applications. Wiley.
3. Kenneth Hoffman and Ray Kunze, "Linear Algebra", 2^{nd} Edition, PHI,2011.
4. *Richard Bronson, "*Schaum's Outlines of Theory and Problems of Matrix Operations*",* McGraw-Hill,1988.

HoD Mathematics

SDM COLLEGE OF ENGINEERING & TECHNOLOGY, DHARWAD

Department of Mathematics

20PMECC100	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	-	-	-	-

Pre requisites: 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 Publication 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.

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HoD Mathematics

SDM COLLEGE OF ENGINEERING & TECHNOLOGY, DHARWAD

Department of Mathematics

20PMEEC100	**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:

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) 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-Lagrange's 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.

HoD Mathematics

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Department of Mathematics

20PMEAC100	**Computational Methods in Engineering**	**(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	Formulate mathematical models for the simple physical systems and evaluate the errors due to approximations.	3	--	1
CO-2	Determine the roots of nonlinear equations and polynomials in Science and Engineering problems.	3	2	--
CO-3	Establish numerical solutions for differentials and integrals functions.	3,4	2	--
CO-4	Establish the numerical solutions solution for simultaneous linear algebraic equations.	3,4	2	--
CO-5	Apply the concepts of optimization for constrained and un-constrained engineering problems.	3	2	--

PO's	**1**	**2**	**3**	**4**
Mapping Level	1.0	2.0	3.0	3.0

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

Course content:

1. **Mathematical modelling & Error analysis:** Mathematical modelling in engineering problem solving, approximations & round-off errors – error definition, accuracy, precision, round-off errors, truncation errors. Use of programing skills and software for engineering computations. **10 Hrs.**

2. **Roots of equations:** Mathematical background, Solution of non-linear algebraic equations- Bracketing method, graphical method, bisection method, Newton's Rapson method, Secant method. Use of programming skills and software for establishing the numerical solutions for simple problems. **10 Hrs.**

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

   Numerical solutions for differential equations: Mathematical basis, need for numerical solutions, Numerical solution of differential equations Ordinary Differential Equations – Euler's Method, second order, third and fourth order Runge-Kutta methods. **12 Hrs.**

4. **Numerical Methods in Linear Algebra:** Direct and iterative solution techniques for simultaneous linear algebraic equations – Gauss elimination, Gauss-Jordon, LU Decomposition, QR Method, Jacobi and Gauss-Seidel Method, Eigenvalues and Eigenvectors – Power method, householder transformation, physical interpretation of Eigenvalues and Eigenvectors. **12 Hrs.**

5. **Optimization:** One dimensional unconstrained optimization –, Constrained Optimization-Linear programming, and non-linear constrained optimization. **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. David C. Lay, Linear Algebra and its applications, 3rd edition, Pearson Education, 2002.
5. Taha H A, “Operations research- An Introduction", Mc Milan Publishing Co,1982.

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