SDM COLLEGE OF ENGINEERING & TECHNOLOGY, DHARWAD

Department of Mathematics

M.Tech in Digital Electronics (E&CE)

Applied Mathematics

Course Code: 18PDEC100 **CIE Marks: 50**
Contact Hours/Week: 04 **SEE Marks: 100**
Total Hours: 52 **Exam Hours: 03**
Semester: I **Credits: 04**

Course Learning Objectives: This course will enable students to:
Acquaint with principles of Linear Algebra, Calculus of Variations, Probability theory, Random process and apply the knowledge in the applications of Electronics and Communication Engineering Sciences.

Course Outcomes: At the end of this course, students should meet the learning objectives through following observable and measurable outcomes by undergoing various tests planned by the course teacher as a part of course plan.

CO-1	Apply the techniques of QR and singular value decomposition for data compression, least square approximation in solving inconsistent linear systems.
CO-2	Utilize the concepts of functionals and their variations in the applications of communication systems, decision theory, synthesis and optimization of digital circuits.
CO-3	Learn the idea of random variables (discrete/continuous) and probability distributions in analyzing the probability models arising in control systems and system communications.
CO-4	Apply transform method to solve one-dimensional wave equation, one-dimensional heat equation, Laplace equation, Poisson equation .
CO-5	Solve system of linear and non-linear equation.

Course content

CHAPTER-I

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**

CHAPTER-II

Calculus of Variations

Concept of functional-Eulers equation. functional dependent on first and higher order derivatives, functional dependent variables. Isoperimetric problems-variation problems with moving boundaries. **10 hrs.**

CHAPTER-III

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-examples. **10 hrs.**

CHAPTER-IV

Transform Methods

Laplace transform methods for one dimensional wave equation – Displacements in a 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.**

CHAPTER-V

Linear and Non Linear Programming

Simplex Algorithm- Two Phase and Big M techniques – Duality theory- Dual Simplex method. Non-Linear Programming –Constrained extremal problems- Lagranges multiplier method- Kuhn- Tucker conditions and solutions. **12 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. Elsgolts, L., "Differential Equations and Calculus of Variations", Mir, 1977.
4. Sneddon,I.N., "Elements of Partial differential equations", Dover Publications, 2006.
5. Sankara Rao, K., "Introduction to partial differential equations", Prentice – Hall of India, 1995
6. Taha H A, "Operations research - An introduction", McMilan Publishing co, 1982.

COs	**Description of the course outcomes**	**Mapping to Pos (1-6)**		
		Mastering 3	**Moderate 2**	**Introductory 1**
CO-1	Apply the techniques of QR and singular value decomposition for data compression, least square approximation in solving inconsistent linear systems.			
CO-2	Utilize the concepts of functionals and their variations in the applications of communication systems, decision theory, synthesis and optimization of digital circuits.			
CO-3	Learn the idea of random variables (discrete/continuous) and probability distributions in analyzing the probability models arising in control systems and system communications.			
CO-4	Apply transform method to solve one-dimensional wave equation, one-dimensional heat equation, Laplace equation, Poisson equation.			
CO-6	Solve system of linear and non-linear equation.			

Pos	1	2	3	4	5	6
Mapping Level	2.5					

1. Introductory (Slight); 2 . Reinforce (Moderate); 3. Mastering (Substantial)

HoD Mathematics

SDM COLLEGE OF ENGINEERING & TECHNOLOGY, DHARWAD

Department of Mathematics

M. Tech. Power System Engineering

Applied Mathematics (EEE)

Course Code: 18PMAC100 **CIE Marks: 50**
Contact Hours/Week: 04 **SEE Marks: 100**
Total Hours: 52 **Exam Hours: 03**
Semester: I **Credits: 04**

Course Learning Objectives:
Study Numerical methods to solve algebraic, transcendental equations. Learn to solve system of linear equations. Learn the idea of random variable and probability distribution. To prepare the students to formulate and solve linear programming problem. Introducing students to the fundamental concepts of Graph theory, linear algebra culminating in abstract vector spaces and linear transformations

Prerequisites: Knowledge of Elementary concepts of Algebra, Basic Probability theory, Basics of matrices.

Description of the course outcomes the student will be able to

CO-1	Use Numerical methods to solve algebraic, transcendental equations and Calculate Eigen values and Eigen vectors of real symmetric matrices.
CO-2	Solve system of linear and non-linear equation.
CO-3	Learn the idea of random variables (discrete/continuous) and probability distributions in analyzing the probability models.
CO-4	Learn the Concept of graph theory and apply for Engineering problems.
CO-5	Compute rank, Nullity of linear transformation and represent through matrices.

Contents:

CHAPTER-I

Numerical Methods

Solution of algebraic and transcendental equations Muller method (no derivation), Chebyshev method, polynomial equations Birge –Vieta method and Bairstow's method.

Eigen value problems

Gerschgorian circle, Eigen values and Eigen vectors of real symmetric matrices –Jacobi method, Givens method. **10 Hrs.**

CHAPTER-II

Linear and Non-Linear Programming

Linear programming- formulation of the problem, graphical method, simplex method, artificial variable technique -M-method. Non-Linear Programming –Constrained extremal problems- Lagranges multiplier method- Kuhn-Tucker conditions and solutions. **10Hrs.**

CHAPTER-III

Probability

Review of basic probability theory. Definitions of random variables and probability distributions, probability mass and density functions, expectation, characteristic functions Binomial, Poisson, Exponential examples, Marginal and conditional distribution, Elements of stochastic processes. **12Hrs**.

CHAPTER-IV

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, applications of graphs.

10 Hrs.

CHAPTER-V

Linear Algebra: Vector spaces, linear dependent, independence, basis and dimension, elementary properties, examples.

Linear Transformations: Definition, properties, range and null space,
rank and nullity, algebra of linear transformations- invertible, singular and non-singular transformations, representation of transformations by matrices. **10Hrs.**

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", 2ndEdition, PHI, 2011.

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 3 and mention any additional POs)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	Use Numerical methods to solve algebraic, transcendental equations and Calculate Eigen values and Eigen vectors of real symmetric matrices.	1		2
CO-2	Solve system of linear and non-linear equation.	1		2
CO-3	Solve linear and non-linear equation.	1	3	2
CO-4	Learn the idea of random variables (discrete/continuous) and probability distributions in analyzing the probability models.	1		2
CO-5	Learn the Concept of graph theory in engineering problems.	1	3	2
CO-6	Compute rank, Nullity of linear transformation and represent through matrices.	1	3	2

Pos	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11
Mapping Level	3	1	2								

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HoD Mathematics

SDM COLLEGE OF ENGINEERING & TECHNOLOGY, DHARWAD

Department of Mathematics

M. Tech in Data Mining & Machine Learning (Inf. Sc)

Applied Mathematics

Course Code: 18PITEC101 **CIE Marks: 50**
Contact Hours/Week: 04 **SEE Marks: 100**
Total Hours: 52 **Exam Hours: 03**
Semester: I **Credits: 04**

Course Learning Objectives: This course will enable students to Acquaint with principles of Linear Algebra, Probability and its distribution, Random Process and apply the knowledge in the applications of Data mining and Machine Learning Engineering sciences.

Course Outcomes (COs): Upon the completion of the course, the student should be able to

CO-1	Solve problems involving basic probability and apply to measure information quality and quantity.
CO-2	Apply the knowledge of different probability distribution in machine learning and Data mining Concepts.
CO-3	Calculate correlation, regression coefficients.
CO-4	Use Least squares method to compute time series and also uses the concept of SVD in PCA.

Contents:

CHAPTER-I

Probability: Definitions of probability, Addition theorem, Conditional probability, Multiplication theorem, Bayes theorem of probability. **10Hrs**

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CHAPTER-II

Random variables and their properties: Discrete Random variable, Continuous Random variable, Probability Distribution joint probability distributions their properties, Transformation variables, Mathematical expectations, probability generating functions.

10 Hrs

CHAPTER-III

Probability Distributions / Discrete distributions: Binomial, Poisson Negative binominal distributions and their properties. (Definition, mean, variance, moment generating function. Additive properties, fitting of the distribution.) Continuous distributions: Uniform, Normal, exponential distributions and their properties. **10Hrs**

CHAPTER-IV

Curve fitting using Principle of Least Squares. Multivariate Analysis: Correlation, correlation coefficient, Rank correlation, Regression Analysis, Multiple Regression, Attributes, coefficient of Association, $\chi 2$ – test for goodness of fit, test for independence. **12Hrs**

CHAPTER-V

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 Book:

1. Probability & Statistics with Reliability, Queuing and Computer Applications by Kishor S. Trivedi, Prentice Hall of India ,1999
2. An Introduction to Probability and Statistics by V.K. Rohatgi & A.K. Md. E. Saleh.
3. Richard Bronson, "Schaum's Outlines of Theory and Problems of Matrix Operations", McGraw-Hill, 1988.
4. Probability, Statistics and Random Processes by T. Veerarajan, Tata McGraw Hil

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs (1 to 3 and mention any additional POs)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Solve problems involving basic probability and apply to measure information quality and quantity.	1		
CO-2	Apply the knowledge of different probability distribution in machine learning and Data mining Concepts.	2	1	
CO-3	Calculate correlation, regression coefficients.	1	2	
CO-4	Use Least squares method to compute time series	3	1	

POs	**PO-1**	**PO-2**	**PO-3**
Mapping Level	2.5	2.5	3

1. Introductory (Slight); 2 . Reinforce (Moderate); 3. Mastering (Substantial)

HoD Mathematics

SDM COLLEGE OF ENGINEERING & TECHNOLOGY, DHARWAD

Department of Mathematics

Detailed Syllabus

I Semester (Mech)

18PEADC100	**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:

1. Formulation of mathematical models to simple physical systems.
2. Establishing numerical solutions based on extensive computational mathematics for the mathematical models developed.
3. Forming the basic algorithms for framing the basis for computer-based solutions in modern systems science.

Course Outcomes (COs):

Description of the course outcome: At the end of the course the student will be able to:		**Mapping to POs (1-4)**		
		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	Apply the fundamentals of linear algebra for engineering problems.	3	2	--
CO 5	Establish the numerical solutions for ordinary differential equations and partial differential equations.	3,4	2	--
CO 6	Apply the concepts of optimization for constrained and un-constrained engineering problems.	3	2	--

POs	PO1	PO2	PO3	PO4
Mapping Level	1	2	3	3

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 programming skills and software for engineering computations **8 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 integration. **9 Hrs.**

4. **Linear algebra 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 and inverse power method, householder transformation, physical interpretation of eigenvalues and eigenvectors. **10 Hrs.**

5. **Numerical solutions for differential equations:** Mathematical basis, need for numerical solutions, Numerical solution of differential equations Ordinary Differential Equations – Euler, Heun's method and Stability criterion, second order, third and fourth order Runge-Kutta methods, Partial Differential Equations – Classification of PDEs, Elliptic equations, Parabolic equations (Transient diffusion equation). **8 Hrs.**

6. **Optimization – One dimensional unconstrained optimization:** Golden section search Newton's method, Constrained optimization- Linear programming, and non-linear constrained optimization. **7 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. Pervez Moin, Fundamentals of Engineering Numerical Analysis, Cambridge, 2010.
5. David C. Lay, Linear Algebra and its applications, 3rd edition, Pearson Education, 2002.
6. Joe D Hoffman, Numerical Methods for Engineers and Scientists, Second Edition, Marcel Dekker (2001)
7. Gilbert Strang, Computational Science and Engineering, Wellesley-Cambridge Press-2007.

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HoD Mathematics