SDM COLLEGE OF ENGINEERING & TECHNOLOGY, DHARWAD

Department of Mathematics

Detailed Syllabus

M. Tech in Digital Electronics (E&CE)

16PMAC100	Applied Mathematics	(4- 0- 0) 4 : 52 Hrs.

Course Objectives:

Learn to solve the linear system of equations by Eigen value and Eigen vector factorization. Learn to solve partial differential equation using Laplace transforms and Fourier transforms. Learn the concepts of calculus of functional and Linear programming.

Course outcome: At the end of course, the students will be able to

CO-1	To apply Eigen value-Eigen vector factorization of a positive definite matrix to solve system of linear equation.
CO-2	To evaluate Maximum or Minimum value of a definite integral involving certain functions.
CO-3	To apply Laplace transform method and Fourier transform methods to solve one-dimensional wave equation and one-dimensional heaat equation.
CO-4	To apply Fourier transform to solve Laplace equation and Poisson equation.
CO-5	To solve linear and non-linear equation.
CO-6	Apply to solve physical and engineering problems.

Course contents:

1)Matrix Theory

QR EL Decomposition -Eigen values using shifted QR algorithm Singular Value Decomposition - Pseudo inverse- Least square approximations. **12 Hours.**

2)Calculus of Variations

Concept of Functionals- Euler's equation -functional dependent on first and higher order derivatives – Functionals on several dependent variables – Iso perimetric problems- Variational problems with moving boundaries.

12 Hours

3)Transform Methods

Laplace transform methods for one dimensional wave equation – Displacements in a string – Longitudinal vibration of an elastic bar – Fourier transform methods for one dimensional heat conduction problems in infinite and semi-infinite rod.
6 Hours

4)Elliptic Equation

Laplace equation – Properties of harmonic functions – Fourier transform methods for laplace equations. Solution for Poisson equation by Fourier transforms method.
8 Hours

5) Linear and Non-Linear Programming

Simplex Algorithm- Two Phase and Big M techniques – Duality theory- Dual Simplex method. Non-Linear Programming –Constrained extremal problems- Lagrange's multiplier method- Kuhn- Tucker conditions and solutions.
12 Hours

Reference Books:1

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.

Course Outcomes (CO):

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.

COs	**Description of the course outcomes**	**Mapping to Pos (1-12)**		
		Mastering **3**	**Moderate** **2**	**Introductory** **1**
CO-1	To apply Eigen value-Eigen vector factorization of a positive definite matrix to solve system of linear equation.	1		
CO-2	To evaluate Maximum or Minimum value of a definite integral involving certain functions.	1		
CO-3	To apply Laplace transform method and Fourier transform methods to solve one-dimensional wave equation and one-dimensional heat equation.		1	
CO-4	To apply Fourier transform to solve Laplace equation and Poisson equation.		1	
CO-5	To solve linear and non-linear equation.	1		

POs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	2.5															

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

Jenifer .K

HoD Mathematics

SDM COLLEGE OF ENGINEERING & TECHNOLOGY, DHARWAD

Department of Mathematics

Detailed Syllabus

M. Tech in Power System Engineering(E&E)

16PMAC100	Applied Mathematics	(4- 0- 0) 4 : 52 Hrs.

Course Objectives:

Study Numerical methods to solve algebraic, transcendental equations, partial differential equations and system of linear equations. Learn different interpolating methods. To prepare the students to formulate and solve linear programming problem. Introducing students to the fundamental concepts of *linear algebra* culminating in abstract vector spaces and *linear transformations*.

Course outcome: At the end of the course learners will be able to

CO 1	Use Numerical methods to solvealgebraic and transcendental equations.
CO 2	Apply Numerical solution to solve partial differential equations.
CO 3	Calculate eigen values and eigen vectors of real symmetric matrices. Solve system of linear Algebraic equations.
CO 4	Discuss interpolation. Formulation of LPP problem and solve LPP problem.
CO 5	Define and discuss concepts of graph theory.
CO 6	Explain Algebra of linear transformations

Contents:

1) **Numerical Methods:** Solution of algebraic and transcendental equations- iterative methods based on second degree equation – Muller method (no derivation), Chebyshev method, general iteration method (first order), acceleration of convergence, system of non-linear equations and complex roots – Newton-Raphson method, polynomial equations Birge –Vieta method and Bairstow's method. **12Hrs.**

2) **Numerical Solution of Partial Differential Equations:** Classification of second order equations, parabolic equations solution of one-dimensional heat equation, explicit method, Crank-Nicolson method and Du Fort-Frankel method, hyperbolic equations- solution of one-dimensional wave equation**.** **10Hrs.**

3) **System of Linear Algebraic Equations and Eigen Value Problems:** Iterative methods - Gauss-Seidal method, SOR method, Eigen value problems – Gerschgorian circle, Eigen values and Eigen vectors of real symmetric matrices –Jacobi method, Givens method.
Interpolation: Hermite interpolation, spline interpolation, numerical solution of differential equations Numerov method. **10Hrs.**

4) **Optimization**: Linear programming- formulation of the problem, graphical method, general linear programming problem, simplex method, artificial variable technique - M-method.

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. **12Hrs.**

5) **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. **8 Hrs.**

REFERENCE BOOKS

1. M K Jain, S R K Iyengar and R K Jain, "Numerical Methods for Scientific and Engineering Computations", NewAge International, 2004.
2. M K Jain, "Numerical Solution of Differential Equations", 2nd Edition, New Age International, 2008.
3. Dr. B.S. Grewal, "Numerical Methods in Engineering and Science", Khanna Publishers, 1999.
4. Dr. B.S. Grewal, "Higher Engineering Mathematics", 41stEdition, Khanna Publishers, 2011.
5. NarsinghDeo, "Graph Theory with Applications to Engineering and Computer Science", PHI, 2012.
6. Kenneth Hoffman and Ray Kunze, "Linear Algebra", 2ndEdition, PHI, 2011.

Multilevel mapping

Cos	Description of the course outcomes	Mapping to POs(1-11)		
		Mastering 3	Moderate 2	Introduction 1
CO-1	Use Numerical methods to solve algebraic and transcendental equations.		1	
CO-2	Apply Numerical solution to solve partial differential equations.	1	3	
CO-3	Calculate eigen values and eigen vectors of real symmetric matrices. Solve system of Linear Algebraic equations.	1		
CO-4	Discuss interpolation. Formulation of LPP problem and solve LPP problem.	1	3	
CO-5	Define and discuss concepts of graph theory.			1
CO-6	Explain Algebra of linear transformations			1

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	2		2.25								

HoD Mathematics

SDM COLLEGE OF ENGINEERING & TECHNOLOGY, DHARWAD

Department of Mathematics

Detailed Syllabus

M. Tech in Engineering Analysis & Design/Industrial Automation & Robotics (MECH)

16PMAC100	Applied Mathematics	(4- 0- 0) 4: 52 Hrs.

Course Objectives:

The main objectives of the course are to enhance the knowledge of various methods in finding the roots of an algebraic, transcendental or simultaneous system of equations and also to evaluate integrals numerically and differentiation of complex functions with a greater accuracy. These concepts occur frequently in their subjects like finite element method and other design application-oriented subjects.

Course outcome: At the end of the course learners will be able to

CO 1	Model some simple mathematical models of physical Applications.
CO 2	Find the roots of polynomials in Science and Engineering problems.
CO 3	Differentiate and integrate a function for a given set of tabulated data, for Engineering. Applications
CO 4	Calculate eigen values and eigen vectors of real symmetric matrices.
CO 5	Solve system of linear Algebraic equations.
CO 6	Explain Algebra of linear transformations

Course Content:

1. **Approximations and round off errors**: Significant figures, accuracy and precision, error definitions, round off errors and truncation errors. Mathematical modeling and Engineering problem solving: Simple mathematical model, Conservation Laws of Engineering. **08 Hours.**

2. **Roots of Equations:** Bracketing Methods-Graphical method, Bisection method, False position method, Newton- Raphson method, Secant Method. Multiple roots, Simple fixed-point iteration. Roots of polynomial-Polynomials in Engineering and Science, Muller's method, Bairstow's Method Graeffe's Roots Squaring Method. **12 Hours**

3. **Numerical Differentiation and Numerical Integration**: Newton –Cotes and Guass Quadrature Integration formulae, Integration of Equations, Romberg integration, Numerical Differentiation Applied to Engineering problems, High Accuracy differentiation formulae. **06 Hours**

4. **System of Linear Algebraic Equations and Eigen Value Problems:** Introduction, Direct methods, Cramer's Rule, Gauss Elimination Method, Gauss-Jordan Elimination Method, Triangularization method, Cholesky Method, Partition method, error Analysis for direct methods, Iteration Methods. Eigen values and Eigen Vectors: Bounds on Eigen Values, Jacobi method for symmetric matrices, Givens

method for symmetric matrices, Householder's method for symmetric matrices, Rutishauser method for arbitrary matrices, Power method, Inverse power method.
14 Hour

5. **Linear Transformation:** Introduction to Linear Transformation, The matrix of Linear Transformation, Linear Models in Science and Engineering. Orthogonality and Least Squares: Inner product, length and orthogonality, orthogonal sets, Orthogonal projections, The Gram-schmidt process, Least Square problems, Inner product spaces. **12 Hours.**

Text 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 engg computation, New Age International, 2003.

Reference Books:

1. Pervez Moin, Fundamentals of Engineering Numerical Analysis, Cambridge, 2010.
2. David. C. Lay, Linear Algebra and its applications, 3rd edition, Pearson Education, 2002.

Multilevel mapping

Cos	**Description of the course outcomes**	**Mapping to POs (1-11)**		
		Mastering 3	**Moderate 2**	**Introduction 1**
CO-1	Model some simple mathematical models of physical Applications.			3
CO-2	Find the roots of polynomials in Science and Engineering problems.	1		3
CO-3	Differentiate and integrate a function for a given set of tabulated data, for Engineering Applications		1	
CO-4	Calculate eigen values and eigen vectors of real symmetric matrices.		1	3
CO-5	Solve system of linear Algebraic equations.		1	
CO-6	Explain Algebra of linear transformations			1

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	2		2.25								

Jenifer ·K

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