Advanced Engineering Mathematics - Video course

COURSE OUTLINE

This is a course suitable for B.Tech / M.Tech students of various discipline. It deals with some advanced topics in Engineering Mathematics usually covered in a degree course.

CONTENTS:- Linear Algebra:- Review of Groups, Fields, and Matrices; Vector Spaces, Subspaces, Linearly dependent/independent, Basis, Dimensions; Isomorphism, Linear transformations and their matrix representations; Rank, Inverse of Matrices, System of Equations; Inner-product spaces, Cauchy- Schwarz Inequality; Orthogonality, Gram-Schmidt orthogonalisation process ; Eigenvalue, Eigenvectors, Eigenspace; Cayley-Hamilton Theorem; Diagonalisation of matrices, Jordan canonical form; Spectral representation of real symmetric, hermitian and normal matrices, positive definite and negative definite matrices.

Theory of Complex variables:-A review of concept of limit, continuity, differentiability & analytic functions. Cauchy Riemann Equations, Line Integral in the complex plane, Cauchy Integral Theorem & Cauchy Integral Formula & its consequences, Power series & Taylor Series(in brief) ,Zeros & Singularity, Laurent' Series, Residues, Evaluation of Real Integrals

Transform Calculus:- Concept of Transforms, Laplace Transform(LT) and its existence, Properties of Laplace Transform, Evaluation of LT and inverse LT, Evaluation of integral equations with kernels of convolution type and its Properties, Complex form of Fourier Integral, Introduction to Fourier Transform, Properties of general (complex) Fourier Transform, Concept and properties of Fourier Sine Transform and Fourier Cosine Transform, Evaluation of Fourier Transform, Solution of ordinary differential equation and one dim. Wave equation using Transform techniques, Solution of heat conduction equation and Laplace equation in 2 dim. Using Transform techniques

Probability & Statistics : - A review of concepts of probability and random variables: Classical, relative frequency and axiomatic definitions of probability, addition rule, conditional probability, multiplication rule, Bayes' Theorem. Random Variables: Discrete and continuous random variables, probability mass, probability density and cumulative distribution functions, mathematical expectation, moments, moment generating function. Standard Distributions: Uniform, Binomial, Geometric, Negative Binomial, Poisson, Exponential, Gamma, Normal. Sampling Distributions: Chi-Square, t and F distributions. Estimation: The method of moments and the method of maximum likelihood estimation, confidence intervals for the mean(s) and variance(s) of normal populations. Testing of Hypotheses: Null and alternative hypotheses, the critical and acceptance regions, two types of error, power of the test, the most powerful test, tests of hypotheses on a single sample, two samples.

COURSE DETAIL

Module	Lectures/Topics
Module I	**Linear Algebra** **Lecture** 1. Review: Groups, Fields, & Matrices 2. Vector Spaces, Subspaces, Linearly dependent / independent of vectors 3. Basis, Dimension, Rank and Matrix Inverse 4. Linear Transformation, Isomorphism & Matrix Representation 5. System of Linear Equations, Eigenvalues and Eigenvectors

NP-TEL

NPTEL

http://nptel.iitm.ac.in

Mathematics

Pre-requisites:

Calculus , Real Analysis

Additional Reading:

R.S.L.Srivastava :- Engineering Mathematics , Tata Mc-Graw Hill

Coordinators:

Dr. P. Panigrahi
Department of MathematicsIIT Kharagpur

Prof. J. Kumar
Department of MathematicsIIT Kharagpur

Prof. P.D. Srivastava
Department of MathematicsIIT Kharagpur

Prof. Somesh Kumar
Department of MathematicsIIT Kharagpur

	6. Method to find Eigenvalues and Eigenvectors, Diagonalization of Matrices 7. Jordan Canonical Form, Cayley Hamilton Theorem 8. Innerproduct Spaces, Cauchy-Schwarz Inequality 9. Orthogonality, Gram-Schmidt Orthogonalization Process 10. Spectrum of Special Matrices, Positive / Negative Definite Matrices
Module II	**Theory of Complex Variables** **Lecture** 1. Concept of Domain, Limit, Continuity & Differentiability 2. Analytic Functions, C-R Equations 3. Harmonic Functions 4. Line Integral in the complex 5. Cauchy Integral Theorem 6. Cauchy Integral Theorem (contd.) 7. Cauchy Integral Formula 8. Power & Taylor's Series of Complex Numbers 9. Power & Taylor's Series of Complex Numbers (Contd.) 10. Taylor's Laurent Series of f(z) & Singularities 11. Classification of Singularities , Residue and Residue Theorem
Module III	**Transform Calculus** **Lecture** 1. Laplace Transform and its Existence 2. Properties of Laplace Transform 3. Evaluation of Laplace and Inverse Laplace Transform 4. Applications of Laplace Transform to Integral Equations and ODEs 5. Applications of Laplace Transform to PDEs 6. Fourier Series 7. Fourier Series (Contd.) 8. Fourier Integral Representation of a Function 9. Introduction to Fourier Transform 10. Applications of Fourier Transform t PDEs
Module IV	**Probability & Statistics** **Lecture** 1. Laws of Probability – 1 2. Laws of Probability – 2 3. Problems in Probability 4. Random Variables 5. Special Discrete Distributions 6. Special Continuous Distributions 7. Joint Distributions and Sampling Distributions 8. Point Estimation 9. Interval Estimation 10. Basic Concepts of Testing of Hypothesis 11. Tests for Normal Populations

References:

Kreyszig, : Engineering Mathematics