Mathematical Methods in Mechanical Engineering - ME5015

Approved Details

Description

To provide adequate foundation on basic mathematical skills to PhD scholars in Mechanical Engineering. The contents of this course is aligned with the candidacy examination of the Mechanical Engineering Department. The students taking this course will be well-equipped to tackle the mathematical challenges related to their research problem.

Course Content

Module 1: Linear Algebra and Systems: Introduction to Matrices and Linear Systems Matrix Operations, Inverses, and Determinants Eigenvalues and Eigenvectors Linear Transformations and Diagonalization

Module 2: Vector Calculus Gradient, Divergence, and Curl (Cartesian and cylindrical coordinate systems) Line and Surface Integrals Theorems of Green, Gauss, and Stokes

Module 3: Differential Equations First-Order ODEs: Solutions and Applications; Second-Order Linear ODEs with constant coefficients; Introduction to PDEs and Classification Solution Techniques for PDEs; Separation of Variables; Fourier series and Fourier transformations

Module 4: Probability and Statistics for Engineers Basics of Probability; Theory Random Variables; and Probability Distributions; Hypothesis Testing and Confidence Intervals; Regression Analysis and Curve Fitting

Module 5: Numerical Methods Numerical Solutions of Linear Equations. Numerical Solutions of Non-linear Equations Integration by Trapezoidal and Simpson's rule

Text Books

(1) Kreyszig, Erwin. Advanced Engineering Mathematics 8th Edition Wiley India, 2006.

(2) Dasgupta, Bhaskar. Applied Mathematical Methods Pearson Education India, 2006

Reference Books

(1) Strang, Gilbert. Linear Algebra and its Applications 4th Edition, Cengage India, 2012.

(2) Montgomery, Douglas C., and George C. Runger. Applied statistics and probability for engineers. John wiley & sons, 2020.

(3) Zachmanoglou, Eleftherios C., and Dale W. Thoe. Introduction to partial differential equations with applications. Courier Corporation, 1986.

(4) Jain, Mahinder Kumar, Satteluri RK Iyengar, and Rajinder Kumar Jain. Numerical methods: problems and solutions. New Age International, 2007