Mathematics for Engineers

Course No ME 681

Instructor Basant Lal Sharma

Department Mechanical Engineering

Units (L-T-P-D-[C]) 3-0-0-0-[4]

Contents

Linear algebra: System of linear algebraic equations, matrix and matrix algebra, echelon form. Linear space, subspace, basis, linear transformation, null and range space, invertibility and matrix representation, orthogonalization, eigenvalues and eigenvectors of a linear transformation.
Vector Calculus: Cartesian tensor notation, scalar field, vector field, and tensor field, gradient, divergence, and curl, integration along a curve, on a surface, and in a region, localization theorem, divergence theorem, and stokes' theorem.
Differential equations: First and second order ODEs. Linear differential equations with constant coefficients and equidimensional equations. Second order linear homogenous differential equations and their solutions, methods of Taylor and Frobenius. Laplace and Fourier transforms, Fourier series. Legendre and Bessel functions; Sturm-Louville Theory. Classification of PDEs; analytical solution of linear PDEs.
Miscellaneous topics (Introductory): Numerical Methods. Optimization. Variational Methods.

Grading

There will be two mid-semester exams (15% each 1 hr) and one end-semester exam (45% and 3 hrs) in addition to 3 quizzes (5% each) and 5 assignments (total 10%).

Books for General Reading

1. Kreyszig, E., Advanced Engineering Mathematics[1], John Wiley & Sons.
2. Courant, R., Hilbert, D., Methods of Mathematical Physics, Vol. 1, 2. John Wiley & Sons.
3. Dasgupta, B., Applied Mathematical Methods. Dorling Kindersley.
4. Simmons, G. F., Differential equations, with applications and historical notes. McGraw-Hill.
5. Jeffrey, A., Advanced Engineering Mathematics. Harcourt/Academic Press.

Books for Details

1. Halmos, P. R., Finite-dimensional vector spaces. Springer-Verlag.
2. Golub, G. H., Loan, C. F. V., Matrix computations, Johns Hopkins University Press.
3. Gel'fand, I. M., Lectures on Linear algebra. Interscience Publishers.
4. Bowen, R. M., Wang, C.-C., Introduction to vectors and tensors: I, II. Springer-Verlag.
5. Birkhoff, G. and Gian-Carlo Rota, Ordinary differential equations. Ginn.
6. Bender, C. M. and Orszag, S. A., Advanced mathematical methods for scientists and engineers, McGraw-Hill.
7. Petrovskii, I. G., Lectures on Partial Differential Equations, Interscience Publishers.
8. Bracewell, R., The Fourier Transform and Its Applications. McGraw Hill.
9. Gelfand, I. M., Fomin, S. V., Calculus of variations. Prentice-Hall.

[1]Latest edition is recommended for a general reading as textbook, though access to *any* edition is also acceptable.