Course Name:
Advanced Engineering Mathematics

Course Number:
20014

Credit:
3

Course Content (outline):

1. Systems of numbers.
2. Complex numbers, complex arithmetic, methods for representing complex numbers, regions & curves in the complex plane, complex functions, important complex functions, limit, continuity and derivative of complex functions, analytic functions, Cauchy-Riemann equations, Laplace's equation, complex integration, definite and indefinite integration, properties of definite integration, Cauchy integral theorem, calculation of definite integrals using indefinite integrals, Cauchy's integral formula.
3. Sequences and series, convergence and divergence tests of sequences and series, power series, functions given by power series, Taylor and Maclaurin series, uniform convergence, Laurent series, singularities & zeroes, infinity.
4. Residue integration method, residue integration of real integrals.
5. Fourier series, periodic functions, arbitrary period, even and odd functions, half-range extensions, Fourier coefficients, approximation by trigonometric polynomials, Sturm–Liouville Problems. orthogonal functions, orthogonal series, generalized Fourier series.
6. Fourier integrals, applications of Fourier integrals, residue theorem for calculating the Fourier integral, Fourier Cosine and Sine transforms, Fourier Transform.
7. Partial differential equations (PDEs), modeling vibrating string, one-dimensional wave form equation, solution by separating Variables, use of Fourier series, D'Alembert's solution of the wave equation, one-dimensional heat equation, solution by Fourier series, two-dimensional heat Equation, Dirichlet problem, heat equation: modeling very long bars, solution by Fourier integrals and transforms, modeling vibrating membrane, two-dimensional wave equation, rectangular membrane, double Fourier series, Laplace equation, potential theory, Laplacian in polar coordinates, circular membrane, Fourier–Bessel series, Laplace's equation in cylindrical and spherical coordinates, Legendre equation, solution of partial differential equations by Laplace transformation.
8. Optimization methods, unconstrained optimization, method of steepest descent, constrained optimization, linear programming, simplex method, simplex method difficulties, nonlinear programing, Lagrange multipliers.
9. Combinatorial optimization, graphs and digraphs, shortest path problems, complexity of algorithms, Bellman's principle, Dijkstra's algorithm, shortest spanning trees, greedy algorithm, Prim's algorithm, flows in network, maximum flow, Ford–Fulkerson algorithm, bipartite graphs, matching Problems.

References:

1. Hildebrand, Francis, Advanced Calculus for Applications, 2nd Edition, Englew Hall, 1976.
2. Fulks, Watson, Advanced Calculus, 2nd Edition, John Wiley & Sons, 1969.
3. Hildebrand, Francis, Methods of Applied Mathematics, 2nd Edition, Prentice Hall, 1965.
4. Kreyzig, Erwin, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

5. Wylie, C.R. and Baryet, L.C., Advanced Engineering Mathematics, 9th Edition, McGrew-Hill, 1995.
6. Bradley, S.P., Hax, A., C. and Magnanti, T.L., Applied Mathematical Programming, Addison Wesley, 1977.
7. Lecture notes, PowerPoint and articles presented or distributed in the classroom.