Department of Materials Science and Engineering
Indian Institute of Technology Kanpur

Course Name: *Mathematics and Computational Methods*
Credits: 3-0-0-0-4
Course No: MSE 617

Prerequisite: None
Category: Compulsory course for all M.Tech. students of MSE Department, to be offered in odd semester

Course Content

S. No	Topics	# of Lectures
1	Introduction of functions, vectors, matrices	1
2	Partial Differentiation (Total differentiation, Maximum and minimum: method of Lagrange multipliers, Change of variables: Legendre transformation, Differentiation of integral; Leibniz rule)	2
3	Multiple Integration (Change of variable: Jacobian, Surface and volume integrals)	2
4	Vectors (Geometry: Lines and planes, Directional derivative, gradients (fields, equipotential, grad, normal to surface, curl, div), Line integration (conservative fields, potential, exact differentiation), Green, Stokes, Div and Curl theorems	4
5	Coordinate Transformation (Linear transform, Orthogonal transform, Eigen values: diagonalization of matrix)	3
6	Ordinary differential equations (Linear first order, Second order: constant coefficient and zero right hand side, Second order: constant coefficient and non zero right hand side)	4
7	Statistics a. Introduction to random experiment, computing probability of an event,	12

	conditional probability and independence of events
	    b. Optimum design of experiments; smoothening and reconciliation of data
	    c. Concept of distribution, parameters of distributions; moment generating functions
	    d. Regression analysis (linear and non linear)
	    e. Confidence intervals, Hypothesis testing
	    f. Error analysis	

8	Numerical Techniques a. Roots of a equation (Bisection, Newton raphson) (1L) b. Integration (1L) c. Solution of linear equations (one exact, one iterative method) (3L) d. Interpolation and extrapolation (1L) e. Solution of a differential equation by finite difference method (4L)	12
Total		**40**

Suggested Books:
1. Mathematical Methods in Physical Sciences, Mary L. Boas
2. Numerical Methods in Engineering, S. K. Gupta