PROGRAMME NAME: B.Sc. (Hons.) Mathematics
COURSE NAME : Multivariate Calculus
SEMESTER DURATION : July to December

WEEK	TOPIC(S)	Teaching Methodology Adopted /Continuous Internal Evaluation
1	Definition of functions of several variables, Graphs of functions of two variables – Level curves and surfaces, Limits and continuity of functions of two variables.	LECTURES
2	Partial differentiation, and partial derivative as slope and rate, Higher order partial derivatives. Tangent planes, incremental approximation, Total differential.	DISCUSSION
3	Differentiability, Chain rule for one parameter, Two and three independent parameters.	SELF -INSTRUCTION
4	Directional derivatives, The gradient, Maximal and normal property of the gradient, Tangent and normal lines.	ASSIGNMENTS
5	First and second partial derivative tests for relative extrema of functions of two variables, and absolute extrema of continuous functions.	TUTORIALS
6	Lagrange multipliers method for optimization problems with one constraint, Definition of vector field, Divergence and curl.	PRESENTATIONS
7	Double integration over rectangular and nonrectangular regions.	DEMONSTRATION
8	Double integrals in polar co-ordinates, and triple integral over a parallelopiped.	CASE STUDY
9	Triple integral over solid regions, Volume by triple integrals, and triple integration in cylindrical coordinates.	LECTURES
10	Triple integration in spherical coordinates, Change of variables in double and triple integrals.	DISCUSSION
11	Line integrals and its properties,	SELF -INSTRUCTIONS

	applications of line integrals: mass and work.	
12	Fundamental theorem for line integrals, Conservative vector fields and path independence	ASSIGNMENTS
13	Green's theorem for simply connected region, Area as a line integral, Definition of surface integrals.	TUTORIALS
14	Stokes' theorem and the divergence theorem.	PRESENTATIONS

Course Objectives: To understand the extension of the studies of single variable differential and integral calculus to functions of two or more independent variables. Also, the emphasis will be on the use of Computer Algebra Systems by which these concepts may be analyzed and visualized to have a better understanding. This course will facilitate to become aware of applications of multivariable calculus tools in physics, economics, optimization, and understanding the architecture of curves and surfaces in plane and space etc.

Course Learning Outcomes: This course will enable the students to:

i) Learn the conceptual variations when advancing in calculus from one variable to multivariable discussion.

ii) Understand the maximization and minimization of multivariable functions subject to the given constraints on variables.

iii) Learn about inter-relationship amongst the line integral, double and triple integral formulations.

iv) Familiarize with Green's, Stokes' and Gauss divergence theorems.