Syllabi of Mathematics DSM Courses

Semester* : **I**
Course Type : DSM
Course Code** : MATDSM101
Name of the Course : Calculus
Learning level*** : 100
Credits : 3
Contact Hours : 50
Total Marks : 100
End Semester Marks : 70
Internal Marks : 30

Course Objective

The main objective of this course is

1. To introduce the concept of limits, continuity, differentiability of functions and their various applications.
2. To learn the techniques of L'Hospital rule for evaluation of limit.
3. To explain the concept of definite integral and various types of reduction formula for integration of trigonometric function.
4. To explain the applications in finding the area and rectification of plane curves; the volume and surface area of revolution of curve.

Unit – I

Limit (ε - δ definition), Cauchy's criterion for existence of limit (without proof), problems on limits. Continuity (ε - δ definition), related theorems and problems, types of discontinuities. Differentiability of a function, problems on differentiability, relation between continuity and differentiability. Successive differentiation, Leibnitz's theorem and its application.

Unit –II

Rolle's theorems, Lagrange's mean value theorem, Cauchy's mean value theorem. Statement and applications of Taylor's and Maclaurin's theorems, Taylor's and Maclaurin's series, expansions of functions $\sin x$, $\cos x$, e^x, $(1+x)$ (assuming $R_n \to 0$ as $n \to \infty$). Maxima and minima for functions of one variable, necessary and sufficient condition for maxima and minima. Indeterminate forms: $\frac{0}{0}$, $\frac{\infty}{\infty}$, $0 \times \infty$, $\infty - \infty$, 0^0, 1^∞, ∞^0.

Unit –III

Partial differentiation. Euler's theorem on homogeneous functions (two variable). Tangents, normals: Equations and properties of tangents and normals, subtangents and subnormals of cartesian and polar curves.

Unit – IV

Definition and properties of definite integrals, Fundamental theorem (without proof), Reduction formulae of the type $\int sin^n x dx$, $\int cos^n x dx$, $\int tan^n x dx$, $\int sec^n x dx$, $\int (logx)^n dx$, $\int sin^m x cos^n x dx$, $\int sin^m x cosnx dx$.

Unit – V

Area bounded by plane curves (cartesian and polar), rectification of plane curves (cartesian and polar), volumes and surface of solid of revolution about axes: Cartesian curves.

Textbooks:

1. B.C. Das and B.N. Mukherjee, Differential Calculus, 55th ed., U.N. Dhur and Sons, 1949. [Unit – I to Unit – III]
2. B.C. Das and B.N. Mukherjee, Integral Calculus with Differential Equations, 57th ed., U.N. Dhur and Sons, 1938. [Unit – IV to Unit – V]

Reference books:

1. S.C. Malik and S. Arora, Mathematical Analysis, 4th ed., New Age International, 2010.
2. R.K. Ghosh and S.K. Maity, An Introduction to Analysis: Differential Calculus,13th ed., New Central Book Agency, 2011.
3. R.K. Ghosh and S.K. Maity, An Introduction to Analysis: Integral Calculus, 12th ed. New Central Book Agency, 2013.
4. Shanti Narayan and P.K. Mittal, Differential Calculus, 15th ed., S. Chand, 1942.
5. Shanti Narayan and P.K. Mittal, Integral Calculus,35th ed., S. Chand, 2005.

Course Learning Outcome

After completion of this course, the learners will be able to

1. Solve the problems of limits, continuity, derivative and integration.
2. Apply Calculus in real life problems.