Bachelors with Mathematics as Major

1st Semester

MMT123J: Mathematics/Applied Mathematics: Calculus - I

Credits: 4 THEORY + 2 TUTORIAL **Theory: 60 Hours & Tutorial: 30 Hours**

Course Objectives: (i) To study and understand the notions of differential calculus and to imbibe the acquaintance for using the techniques in other sciences and engineering. (ii) To prepare the students for taking up advanced courses of mathematics.

Course Outcome: (i) After the successful completion of the course, students shall be able to apply differential operators to understand the dynamics of various real life situations. (ii) The students shall be able to use differential calculus in optimization problems.

Theory: 4 Credits

Unit –I

Limits and infinitesimals, Continuity ($\epsilon - \delta$ definition), types of discontinuities of functions, Differentiability of functions, Successive differentiation and Leibnitz theorem, Partial differentiation, Total differentiation, Homogenous functions and Euler's theorem.

Unit –II

Indeterminate forms, Tangents and normals (polar coordinates only), Angle between radius vector and tangent, Perpendicular from pole to tangent, angle of intersection of two curves, polar tangent, polar normal, polar sub-tangent, polar sub-normal.

Unit –III

Curvature and radius of curvature, Pedal Equations, lengths of arcs, Asymptotes, Singular points, Maxima and minima of functions. Bounded functions, Properties of continuous functions on closed intervals, Intermediate value theorem, Darboux theorem.

Unit –IV

Rolle's theorem and mean value theorems (with proofs) and their geometrical interpretation, Taylor's theorem with Lagranges and Cauchy's form of remainder, Taylor's series, Maclaurin's series of $\sin x,\ \cos x,\ e^x,\ \log x,\ (1+x)^m$.Envelope of a family of curves involving one and two parameters.

Tutorial: 2 Credits

Unit –V

Examples of discontinuous functions, nth derivative of product of two functions, involutes and evolutes, bounds of function (Supremum and infimum).

Unit –VI

Tracing of cartesian equations of the form $y = f(x),\ y^2 = f(x)$, tracing of the parametric equations.

Recommended Books:

1. Shanti Narayan and P.K. Mittal, Differential Calculus, S. Chand, 2016.
2. S. D. Chopra, M. L. Kochar and A. Aziz, Differential Calculus, Kapoor Sons.
3. Schaums outline of Theory and problems of Differential and Integral Calculus, 1964.
1. H. Anton, I. Birens and S. Davis, Calculus, John Wiley and Sons, Inc. 2002.
2. T.M. Apostal, Calculus Vol. I, John Wiley & Sons Inc, 1975.
3. S. Balachandra Rao and C. K. Shantha, Differential Calculus, New Age Publication, 1992.
4. S. Lang, A First Course in Calculus, Springer-Verlag, 1998.
5. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 2008.
6. G.B. Thomas and R.L. Finney, Calculus, Pearson Education, 2007.
7. Suggestive digital platforms web links: NPTEL/ SWAYAM/ MOOCS.