

SEMESTER – 1st
MAJOR/MINOR COURSE
MATHEMATICS / APPLIED MATHEMATICS

Course Title: Calculus-I

Course Code: BMA22C101

Theory: 4 Credits (60 Hours)

Tutorial: 2 Credits (30 Hours)

Objectives: The aim of this course is to prepare the students for the following.

- (1) To study and understand the notions of calculus and to imbibe the acquaintance for using the techniques in other sciences and engineering.
- (2) To prepare the students for taking up advanced courses of mathematics.

Note: The external paper will be for first 4 units and internal assessment for tutorials (5th and 6th unit).

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, Curvature and radius of curvature, Pedal Equations, Lengths of arcs, Asymptotes, Singular points, Maxima and minima of functions.

UNIT – III

Bounded functions, Properties of continuous functions on closed intervals, 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 , $\log x$, $(1 + x)^m$.

UNIT – IV

Envelope of a family of curves involving one and two parameters, Tracing of cartesian equations of the form $y = f(x)$, $y^2 = f(x)$, Tracing of the parametric equations: $(x = a \cos^3 \theta, y = b \sin^3 \theta)$, $(x = 1 - e^{-t}, y = t^2 + 1)$, Tracing of polar curves: $r = a(1 + \cos \theta)$, $r = a \sin 3\theta$.

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

Miscellaneous problems on tangents and normals, Point of inflexion, Miscellaneous problems on Tracing of curves.

Recommended Books

1. Shanti Narayan and P.K. Mittal, Differential Calculus, S. Chand.
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.

Reference Books

1. H. Anton, I. Birens and S. Davis, Calculus, John Wiley and Sons, Inc. 2002.
2. T.M. Apostol, Calculus Vol. I, John Wiley & Sons Inc.
3. S. Balachandra Rao and C. K. Shantha, Differential Calculus, New Age Publication.
4. S. Lang, A First Course in Calculus, Springer-Verlag.
5. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
6. G.B. Thomas and R.L. Finney, Calculus, Pearson Education, 2007.
7. Suggestive digital platforms web links: NPTEL/ SWAYAM/ MOOCS.