

Mathematics Generic Elective

MTMG-2

(Pre-requisite: Mathematics in Higher secondary level)

Ordinary Differential Equation and Calculus

Full Marks: 100, Credit: 6

Marks distribution:

End semester: 75, Midterm: 20, Attendance: 5

Course Outcome: A student will learn the solution techniques of first order ordinary differential equations, second order linear ordinary differential equation and orthogonal trajectories. Also the students will learn the basic concept of differential and integral calculus which may be useful for their honours courses.

Group-A (Marks assigned for end semester: 25, 20L)

Ordinary Differential Equation

1. Solution of first order equations:

- (i) Separation of variables.
- (ii) Homogeneous equations and equations reducible to homogeneous form.
- (iii) Exact equations and those reducible to such equation.
- (iv) Euler's and Bernoulli's equations (Linear).
- (v) Clairaut's Equations: general and singular solutions [12L]

2. Second order linear equations: second order linear differential equations with constant coefficients, Euler's Homogeneous equations. [6L]

3. Simple applications: orthogonal trajectories (in Cartesian co-ordinates). [2L]

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Group-B (Marks assigned for end semester: 50, 40L)

Calculus

1. Sequence of real numbers: bounded sequence and monotone sequence, limit of a sequence, algebra of limits, divergence, statement of Cauchy's general principle of convergence and its application. [3L]

2. Infinite series of real numbers: convergence and divergence (definitions), Cauchy's principle of convergence (statement and applications only), condition of convergence of p-series and geometric series (proof not required), series of positive terms: statements and applications of comparison test, D'Alembert's ratio test, Cauchy's root test. [4L]

3. Real valued functions defined on an interval, limit of a function, algebra of limits, continuity of a function at a point and in an interval, properties of continuous functions on closed intervals (statements only). [4L]

4. Derivative of a function at a point, differentiability implies continuity but not conversely, successive derivatives - Leibnitz's theorem and its application, statement of Rolle's theorem and its geometrical interpretation, mean value theorems of Lagrange and Cauchy, L' Hopital's Rule (statement and problems only). Statement and simple problems of Taylor's series. [7L]

5. Functions of two and three variables: limit and continuity of functions of two variables (definition and simple problems), partial derivatives, knowledge and use of chain rule, functions of two variables - successive partial derivatives, statement of Schwartz's theorem for mixed derivatives, Euler's theorem on homogeneous functions of two and three variables. [8L]

6. Definition of Improper Integrals, Beta and Gamma functions, convergence and important relations statement only. [2L]

7. Working knowledge of double integrals. [2L]

8. Applications of differential calculus: curvature of plane curves, rectilinear asymptotes (Cartesian co-ordinates only), envelope of family of straight lines and curves (problems only) [6L]

9. Applications of integral calculus: rectification, quadrature, volume and surface areas of solids formed by revolution of plane curve and areas – problems only in Cartesian co-ordinates. [4L]

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References:

1. Differential Calculus- B.C. Das and B.N. Mukherjee
2. Integral Calculus- Differential equations- B.C. Das and B.N. Mukherjee
3. Integral Calculus- Maity and Ghosh
4. Differential Calculus- Maity and Ghosh
5. An introduction to Differential equations- Maity and Ghosh
6. College Mathematics, Vol-3 , Differential Equations- Bidyut Guha Thakurta