UG Semester II

Paper 3: Integral Calculus

Credit: 4 **T:04**

Course Outcomes:

1. Some of the families and properties of Riemann integrable functions, and the applications of the fundamental theorems of integration.
2. Beta and Gamma functions and their properties.
3. The valid situations for the inter-changeability of differentiability and integrability with infinite sum, and approximation of transcendental functions in terms of power series.
4. Compute area of surfaces of revolution and the volume of solids by integrating over cross-sectional areas.

UNIT I

Definite integrals as limit of the sum, Riemann integral, Integrability of continuous and monotonic functions, Fundamental theorem of integral calculus, Mean value theorems of integral calculus, Differentiation under the sign of Integration.

UNIT II

Improper integrals, their classification and convergence, Comparison test, μ- test, Abel's test, Dirichlet's test, quotient test, Beta and Gamma functions.

UNIT III

Rectification, Volumes and Surfaces of Solid of revolution, Pappus theorem, Multiple integrals, change of order of double integration, Dirichlet's theorem, Liouville's theorem for multiple integrals.

UNIT IV

Vector Differentiation, Gradient, Divergence and Curl, Normal on a surface, Directional Derivative, Vector Integration, Theorems of Gauss, Green, Stokes and related problems.

References:

Text Books:

1. T.M. Apostol, Calculus Vol. II, John Wiley Publication.
2. Shanti Narayan, P.K. Mittal, Integral Calculus, S. Chand.

Suggested Readings:

1. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.

Web References:

1. Digital platforms web links: NPTEL/SWAYAM/ MOOCS/Openstax.org
2. https://openlearninglibrary.mit/edu/courses
3. http://heecontent.upsdc.gov.in/SearchContent.aspx
4. https://www.lkouniv.ac.in/en/article/e-content-faculty-of-science

Paper 4: Geometry

Credit: 4 **T: 04**

Course Outcomes:

1. To learn and visualize the fundamental ideas of coordinate geometry.
2. To describe some surfaces by using analytical geometry.
3. To gain knowledge about regular geometrical figures and their properties.

UNIT I

General equation of second degree, System of conics, Tracing of conics, Confocal conics, Polar equation of conics and its properties.

UNIT II

Three-Dimensional Coordinates, Projection and Direction Cosine, Plane (Cartesian and vector form), Straight line in three dimension (Cartesian and vector form).

UNIT III

Sphere, Cone and Cylinder.

UNIT IV

Central conicoids, Paraboloids, Plane section of conicoids, Generating lines, Confocal conicoids, Reduction of second degree equation.

References:
Text Books:
1. P. R. Vittal, Analytical Geometry
2. S. L. Loney, The Elements of Coordinate Geometry, Macmillan Suggested

Suggested Readings:

1. Robert J.T. Bell, Elementary Treatise on Coordinate Geometry of three dimensions, Macmillan India Ltd

Web References:

1. Digital platforms web links: NPTEL/SWAYAM/ MOOCS/Openstax.org
2. https://openlearninglibrary.mit/edu/courses
3. http://heecontent.upsdc.gov.in/SearchContent.aspx
4. https://www.lkouniv.ac.in/en/article/e-content-faculty-of-science

(For students with Mathematics as a minor subject)

Paper Q2: Applicable Mathematics– II

Credit: 2 **T:02**

Course Outcomes:

1. To understand the concepts of vector calculus
2. To understand application and techniques of solving various types of ordinary differential equations.
3. To learn sequences and various tests to check convergence of an infinite series.

UNIT I

Vector differentiation, gradient, divergence and curl with their physical interpretations, tangent and normal on a surface, directional derivative, line, surface and volume integrals, applications of Green's, Stoke's and Gauss' divergence theorems (without proofs). Application and properties of Beta and Gamma function, Dirichlet and Liouville theorems.

UNIT II

Ordinary differential equations - Bernoulli's equation, exact differential equations and integrating factors, special integrating factors and transformations, differential equations of order one and degree more than one, Clairaut's equation, singular solutions and orthogonal trajectories.

UNIT III

Linear differential equations with constant coefficients, homogeneous Linear differential equations, series solutions of Legendre's, Bessel's and hypergeometric equations and their basic properties.

UNIT IV

Sequences, limit of a sequence, convergence, divergence and oscillation of a sequence, infinite series and its convergence, geometric and harmonic series, tests for convergence and divergence - comparison test, Cauchy integral test, D'Alembert's ratio test, Cauchy's nth root test, Raabe's logarithmic test, DeMorgan and Bertrand's test, alternating series, absolute and conditional convergence, Leibnitz's theorem (without proof).

References:
Textbooks

1. G.F.Simmons: Differential Equations with Applications and HistoricalN, Tata McGraw Hill.
2. R.G. Bartle : Introduction to Real Analysis, Wiley.
3. M.R. Spiegel: Theory and Problems of Vector Analysis, Schaum Outline Series, MgGraw Hill Book Company.

Suggested books:

1. B. Rai, D.P. Choudhary & H.J. Freedman, A Course in Differential Equations.
2. S. L Ross, Differential Equations, 3rd Edition, Wiley

Vocational Course in Mathematics

Paper VC-1: Vedic Mathematics
(Pre-requisites: Mathematics in Class 12)

Credit: 2 **T:02**

Course Outcomes:

1. To understand the concepts of Vedic arithmetic as in Indian knowledge system.
2. To understand application and techniques of Vedic algebra as in Indian knowledge system.

UNIT I

Vedic Arithmetic: Base and complement, addition and subtraction, some important vedic sutras, Multiplication- Ekadhikenpurven method (multiplication of two numbers oftwo digits), Ekununenpurven method (multiplication of two numbers of three digits), Urdhvatiragbhyam method (multiplication of two numbers of three digits), Nikhilam Navtashchramam Dashtaha (multiplication of two numbers of three digits), Combined Operations.

UNIT II

Division- Nikhilam Navtashchramam Dashtaha (two digits divisor), Paravartya Yojyet method (three digits divisor), Divisibility- Ekadhikenpurven Method (two digits divisor), Eknunenpurven method (two digits divisor), LCM and HCF, Power- Square and Cube of two digit numbers, Square root of four digit numbers and Cube root of six digit numbers, calendar.

UNIT III

Vedic Algebra: Multiplication (Quadratic expressions of single variable)- Urdhvatiragbhyam Method, Combined Operations.

UNIT IV

Division (Divisor: Linear expression of single variable), Factorization (Quadratic expression of single variable), Solution of linear simultaneous expressions.

Recommended Books:

1. Vedic Mathematics, Motilal Banarsi Das, New Delhi.
2. Vedic Ganita: Vihangama Drishti-1, Siksha Sanskriti Uthana Nyasa, New Delhi.
3. Vedic Ganita Praneta, Siksha Sanskriti Uthana Nyasa, New Delhi.
4. Vedic Mathematics: Past, Present and Future, Siksha Sanskriti Uthana Nyasa, New Delhi.
5. Leelavati, Chokhambba Vidya Bhavan, Varanasi.
6. Bhartiya Mathematicians, Sharda Sanskrit Sansthan, Varanasi.
7. Beejganitam, Chokhambba Vidya Bhavan, Varanasi.