Tribhuvan University
Institute of Science and Technology
Course of Study for Four Year Mathematics

Course Title: Calculus   Full Marks: 75

Course No. Math 101   Pass Marks: 26.25

Nature of the Course: Theory   Year: I

Level: B.Sc.

Course Contents:

Unit 0. Review of Elementary Calculus: Functions, Graphs, Evaluations of limits, Continuity, Discontinuity, Test of continuity and properties of continuous functions.   6hrs

Unit 1. Tangents and Normals: Tangents and normals, Subtangents, Subnormal and their lengths, Derivatives of arc length, Polar equations of subtangents and subnormal, Angle between radius vector and tangent, Length of perpendicular from pole on tangent, Pedal equations and Angle between two curves.   6 hrs

Unit 2. Higher Order Derivatives and Mean Value Theorems: Higher order derivatives, Following theorems (without proofs): Rolle's theorem, Langrange's theorem Cauchy Mean Value theorem, Maclaurin's theorem and Taylor's theorem and their applications in solving problems.   8 hrs

Unit 3. Application of Derivatives: Indeterminateforms, L'Hospital's rule (without proof), Asymptotes, Types of asymptotes, Asymptotes of algebraic curves, Curve tracing techniques, Standard curves and their tracing, Curvature, Chord of curvature, Curvature at origin, Center and circle of curvature.   12 hrs

Unit 4. Partial Differentiations and Maxima and Minima of Functions of 2 and 3 Variable: Basic ideas of limits and continuity of functions of 2 and 3 variables, Partial derivatives and their geometrical interpretation, Higher order partial derivatives, Homogeneous functions, Euler's therorem (proof for 2 variables only), Total differentials, Extreme values, Stationary points, Criteria for maxima and minima, Subsidiary conditions, Lagrange's method of undetermined multipliers.   8 hrs

Unit 5. Integration and Definite Integrals: Integration concepts, Integration techniques and standard formulae, Integration of rational functions and hyperbolic functions, Integration as the limit of a sum, Definite integral and fundamental theorem of integral calculus (without proof), properties of definite integral.   6 hrs

Unit 6. Beta and Gamma Functions and Reduction formulae: Improper integrals, Beta and Gamma functions and their properties, Reduction formulae. 4 hrs

Unit 7. Rectification and Qudrature, Volume and Surface Area of Solid of Revolution: Rectification notion, Length formulae, Idea of quardrature and area formula, Volume and surface area of solid of revolution. 8 hrs

Unit 8. Double Integrals: Double and iterated integrals in rectangular coordinates, Changes of variables in double integrals(to polar coordinates and curvilinear coordinates), Computing area and volume using double integrals, Application of double integrals in mechanics: mass and static moments of a lamina, centre of gravity, moments of inertia of a lamina. 8 hrs

Unit 9. Differential Equations of the First Order and the First Degree: Introduction, standard form, Variables-separable equations, Homogeneous equations, Equations reducible to homogeneous equations, Non-homogeneous equation of the first order, Exact differential equation, Condition for exactness, Integrating factors first order, Exact differential equation, Condition for exactness, Integrating factors and techniques, Linear differential equations and equations reducible to linear forms. 6 hrs

Unit 10. Differential Equations of the First Order but not the First Degree: Equations solvable for p, Equations solvable for y, Equations solvable for x, Equations solvable for x and y, Equations homogeneous in x and y, Clairaut's equation. 6 hrs

Unit 11. Linear Differential Equations with Constant Coefficient: Linear equations with constant coefficients, Linear equations solvable using symbolic operators, Symbolic operation techniques, Particular integrals and complementary function, Homogeneous linear equations, Equations reducible to homogeneous form. 6 hrs

Unit 12. Applications of the First Order and the First Degree Differential Equations: Formulation of problems into differential equations, Initial and boundary conditions, Solution technique. 6 hrs

Books Suggested:

1. M.B. Singh and B.C. Bajracharya; Differential Calculus, Sukunda Pustak Bhandar, Kathmandu, 1995.
2. G.D. Pant and G.S. Shrestha; Integral Calculus and Differential Equations, Sunita Prakashan, Kathmandu 1994.
3. D.A. Murray; Introductory Course in differential Equations, Oriental Longman.
4. T.M. Apostal; Calculus Vol I & II, Wiley Eastern Ltd, New Delhi, 1986.
5. Das and Mukherjee; Differential Calculus, U.N. Dhar and Sons, Calcutta.
6. Das and Mukherjee; Integral Calculus, U.N. Dhar and Sons, Calucutta.
7. S.M. Maskey; Calculus, Ratna Pustak Bhandar, Kathmandu, 2008.