Department Of Computer Science and Engineering
Kathmandu University
Dhulikhel, Kavre

Subject: Advanced Calculus **Course: MATH – 104**

Level: BE/B.Sc/1st Year/2nd Semester **Credit Hours: 3**

1. **Coordinates Systems**
   - Polar coordinates, Graphs of polar equations, Polar equations of conics and other curves, Polar integrals.
   - Cylindrical coordinate, Spherical Coordinates, Equations relating Cartesian and cylindrical coordinates, Equations relating Cartesian and cylindrical coordinates to spherical.

2. **Functions of several variables and Their Derivatives**
   - Functions of two or more variables, Limits and continuity, Partial derivatives, Derivatives of composite and implicit functions, Chain rules, Non-independent variables, Gradients, Directional derivatives and tangent planes, Higher order derivatives, Maxima, Minima and saddle points, Lagrange multipliers, Exact differentials

3. **Multiple Integrals**
   - Introduction, Double integrals, Area, Changing Cartesian integral to polar integrals, Triple integrals in rectangular, cylindrical and spherical coordinates and their relations, Surface area, Change of order of integration

4. **Beta and Gamma Functions**
   - Beta and Gamma functions, Properties if the function, Transformations of Gamma functions Relation between the functions

5. **Applications of the Theory of Integration**
   - Area of curves in Cartesian coordinates, Area between two Cartesian curves, Area of the curves in polar coordinates, Volume of solid of revolutions, Surface of solids of revolutions

6. **Vector Functions and Their Derivatives**

- Introduction of scalar and vector functions, parametric representations, Continuity and differentiability of vector functions, Tangent vectors, Motion of a body or particle on a curve, Unit tangent vector, Unit normal vector and components, Arc length for space curves, Curvature, Derivatives of vector products

7. **Vector Integral Calculus**
    - Vector fields, Surface integrals, Line integrals and work, Two-dimensional fields, Flux across a plane curve, Green's theorem, Gauss's theorems, Stoke's theorem and their verifications

8. **Fourier Series and Integrals**
    - Periodic functions, Trigonometric series, Fourier series, Euler's formulae, Convergence theorem (proof not required), Functions having arbitrary period, Even and odd functions, Half-range expansions, Fourier integral, Fourier transform

Recommended Text books:

1. G. B. Thomas and R. L. Finney: Calculus and Analytic Geometry, 9th Edition, Pearson Education.
2. E. Kreyszig: Advanced Engineering Mathematics, Wiley Eastern Ltd.

References:

1. H. K. Dass: Advanced Engineering Mathematics, S. Chand, New Delhi.
2. S. M. Maskey: Calculus, Ratna Pustak Bhandar
3. D. V. Wider: Advanced Calculus, Prentice Hall of India.
4. S. S. Sastry: Engineering Mathematics, 4th Edition, Prentice Hall of India.
5. Jain and Iyenger: Advanced Engineering Mathematics, Narosa Publishing House
6. Potter and Goldberg: Mathematical Methods, Prentice Hall of India