Department Of Computer Science and Engineering
Kathmandu University
Dhulikhel, Kavre

Subject: Calculus and Linear Algebra   **Course: MATH – 101**

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

The objectives of this course are just to provide enough mathematical facts to cope with a wide variety of problems in Engineering and Science. The course demands explaining the fundamental ideas and showing how they are applied in different other disciplines mentioned above.

The course in Calculus includes the following topics:

1. **Increments [3]**
   - Average and instantaneous rates of change
   - The slope of a curve $y = f(x)$
   - Derivatives as the instantaneous rate of change
   - Velocity and other rates of change

2. **Limits and continuity [4]**
   - Properties of limits
   - One sided limits, existence of limit at a given point
   - Infinity as a limit
   - Limits of exponential and logarithmic functions
   - Types of discontinuity

3. **Differentiation [5]**
   - Formal definition
   - Polynomial functions and their derivatives
   - Product, Power and quotient rules
   - Implicit differentiation and fractional power
   - The chain rule and parametric equations
   - Angle between two curves
   - Derivatives of trigonometric functions, hyperbolic functions and their inverses
   - Derivative of Logarithmic functions and exponential functions and their applications
   - Differentials

4. **Applications of derivatives [7]**
   - Curve sketching, the sign of first derivatives
   - Concavity and points of inflection
   - Asymptotes and symmetry
   - Maxima and minima; Theory and problems
   - Related rates
   - Rolle's Theorem and Mean value theorem
   - Indeterminate forms: L' hospital's rule

5. **Integration [8]**
   - Introduction
   - Indefinite integration
   - Applications of determining constants of integration
   - Integrals of trigonometric functions including examples of product of powers of trigonometric functions
   - Definite integrals
   - Calculating areas as limits
   - The fundamental theorem of integral calculus (Statement and its application)
   - Basic integration formulas
   - Substitution methods:
       i. $a2 + u2, a2\ u\ 2\ , a2\ u\ 2\ , u\ 2\ a2$
       ii. Integrals involving $ax2+bx+c$
       iii. $z = \tan(x/2)$
   - Integration by parts
   - Improper integrals

6. **Application of Definite integrals [5]**
   - Area between curves
   - Average value of a function
   - Length of a plane curve
   - Calculating volume by slicing
   - Area of surface of revolution
   - The course in Linear Algebra includes the following topics

7. **System of Linear equations [3]**
   - Linear system, Consistent or inconsistent, row rank, unique or parametrically represented solutions.

8. **Sequence and infinite Series [5]**
   - Sequence of numbers
   - Limits that arise frequently
   - Infinite series
   - Test for convergence of series with non-negative terms
   - Absolute convergence
   - Alternating series, Conditional convergence

9. **Vector spaces [5]**
   - Introduction to vectors
   - Linear combinations
   - Spans of vectors
   - Linear dependence and independence
   - Bases and basis selection
   - Dimension and rank

10. **Eigenvalues, Eigenvectors and Linear Mapping [3]**
   - Characteristic equations
   - Eigenvalue and Eigenvectors
   - Linear transformation (upto R3) and its properties

Text Books		
S.N.	**Writer**	**Book**
1	Thomas / Finney	Calculus and Analytical Geometry, 9th Editions Narosa Publishing House, New Delhi
2	J. W. Brown/ D. R. Sherbert	Introductory Linear AlgebraBindle, Weber and Schmidt
3	D. T. Finkbeiner	Introduction to Matrices and Linear Transformations 3rd edition CBS publisher and distributors, Delhi.
Reference Book		
1	S. S. Sastry	Engineering Mathematics by S. S. Sastry, PHI.
2	H. K. Dass	Advanced Engineering Mathematics, S. Chand, New Delhi