Kathmandu University
Course of study

Course Title: Calculus
Course Code: AIMA 101
Level: Undergraduate
Credit: 3

Group: B.Tech in Artificial Intelligence (I Year - I Semester)

Total Lecture Hours: 45

Course Description:

The course covers the concepts of functions, Limits and Continuity of single and several Variables, Ordinary and partial differentiation, Integrals of single and several Variables, Infinite series.

Objectives:

Upon the completion of this course, students will have fundamental knowledge of calculus and they can apply this knowledge in their field.

Evaluation Scheme:

In-semester evaluation - 25 marks

- Assignment - 5 marks
- Internal Tests - 20 marks

End-semester evaluation - 75 marks

- 20 marks for objective (10 Q $\times$ 1 = 10 marks for 'fill-in-blank' and 10 Q $\times$ 1 = 10 marks for multiple choice questions)
- 55 marks for subjective (Long answer questions- 3 Q $\times$ 7 = 21 marks, Short answer questions - 6 Q $\times$ 4 = 24 marks, Very short answer questions - 5 Q $\times$ 2 = 10 marks)

Course Contents

Unit 1: Functions, Limits and Continuity [6 Hrs.]

- Function; Domain and Range of a function
- Concept of Limit, One sided limits, Existence of limit at a given point
- Limits involving infinity
- Limits of algebraic and transcendental functions
- Continuity of a function at an interior point and at end points of its domain, Types of discontinuities

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Approved Date: September 2, 2021

Unit 2: Differentiation [5 Hrs.]

- Derivative of a function, Existence of derivative
- Differentiation rules, Differentiation of algebraic and transcendental functions
- Tangent and normal lines, Angle between two curves
- Linearization and Differentials

Unit 3: Applications of Derivatives [6 Hrs.]

- Related rates
- Extreme values, The first derivative test for local extrema, concavity, The second derivative test for local extrema
- Curve sketching
- Indeterminate forms: L' Hôpital's rule

Unit 4: Integration [5 Hrs.]

- The fundamental theorems of integral calculus (Statements and their applications), Average value of a function
- Integration by parts, Substitution methods, Integrals involving a^2+x^2, $\sqrt{a^2-x^2}$, $\sqrt{a^2+x^2}$, $\sqrt{x^2-a^2}$, ax^2+bx+c
- Integration of rational functions by partial fractions

Unit 5: Applications of Integrals [6 Hrs.]

- Area between curves
- Volume of solid of revolution (Disk and Washer Method)
- Length of a plane curve, Surface area of solid of revolution

Unit 6: Infinite Series [5 Hrs.]

- Infinite series, Partial sums
- Infinite geometric series, The nth Term Test of a divergent series
- Integral test, Ratio test and Root test for the series of non-negative terms
- Taylor and Maclaurin Series of some simple functions like e^x, $\sin x$, $\cos x$, $\ln(1+x)$.

Unit 7: Partial Differentiation [7 Hrs.]

- Functions of two variables; Domain and Range
- Limits and continuity in two Dimensions
- Partial derivatives, The Chain rule, Implicit differentiation
- Local Extreme values and Saddle points

- Gradient of a function and Directional derivatives

Unit 8: Multiple Integrals [5 Hrs.]

- Double Integrals, Double Integrals as Area and Volume
- Finding Limits of Integration, Change of order of integration

Text Books

1. G. B. Thomas, M. D. Weir and J. R. Hass, Thomas' Calculus, Pearson Education Inc.

Reference Books

1. J. Stewart, Calculus - Early Transcendentals, Cengage Learning
2. C. C. Morris and R. M. Stark, Fundamentals of Calculus, John Wiley & Sons