

**AMERICAN INTERNATIONAL UNIVERSITY - BANGLADESH**

**Kuratoli road, Kuril, Dhaka-1229, Bangladesh**

**Faculty of Science & Technology (FST)**

**Department of Mathematics**

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| **Course Title:** Differential Calculus and Coordinate Geometry |
| **Course Code:** MAT 1102 |
| **Pre-requisite:** Remedial mathematics |
| **General/Major Course:** |
| **Course Description:**  Function: Domain and range, limit, continuity and differentiability of functions, Differentiation: Application: Tangent, normal, Taylor’s theorem, Analysis of function, Optimization problem, Indeterminate forms and L’Hopital rule. Coordinate Geometry of Two Dimension, Conic sections. identification of conics, Three-dimensional coordinate geometry: direction cosines and direction ratio of a line, scalar and vector products of vectors, plane and straight line using vectors. Functions of several variables: partial derivatives, homogeneous function, Euler’s theorem, maximum and minimum values. |
| **Course Objectives:**  We teach differential calculus, vector and geometry in this course. Students embarking on such courses diverse to different core subjects- engineering (EEE, chemical, civil etc.), -computer (COE, CSE, CIS, SE, CSSE) – biological (molecular and genetic) engineering-like those in UK and USA.  We have therefore revised and constituted a course syllabus that assume knowledge only of material that can be expected to be familiar to all the current generation of students starting physical science and engineering courses at universities.  We aimed at building up a basic foundation of mathematical precision and tools essential for growing engineers and also the hierarchy of mathematical materials for engineers of research in future. |
| **Knowledge:** To know how to apply different techniques and various methods of differentiation. |
| **Psychomotor Skill:** To identify the problems and use methods in solving problems in science and engineering. |

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| **Unit No** | **Name of Unit** | **Topics to be covered in the unit** |
| 01. | Functions | Representation of functions, Piece-wise defined functions,  Symmetry, Even & Odd function, Transformation of functions, Floor, Ceiling & Unit-step function, Graph sketching and finding domain & range of some basic functions using graph. Limit and continuity. |
| 02. | Differentiation | Differentiability of a function. Derivatives and its physical interpretation. Differentiation of basic functions. Differentiation using chain rules. Functions of function (composite function). Differentiation of implicit and parametric functions. Differentiation of other functions. Equations of tangent and normal lines. |
| 03. | Application of Differentiation | Expansion of functions: Rolle’s Theorem and Mean value Theorem. Expansion of functions: Taylor and Maclaurin series. Indeterminate forms and l’Hopital rule. |
| 04. | Analysis of functions and its application | Increasing/ decreasing, concavity and extreme values. Optimization problems using the idea of analysis of function. |
|  |  | **Mid-term examination** |
| 05. | Co-ordinate geometry in two dimensions | Rectangular co-ordinates in two dimensions. Transformation of coordinates (rectangular to polar and vice versa). Different types of conics, Translation and rotation of axes. Reduction of general equation of second degree to its standard form and identification of conics. |
| 06. | Vector, straight lines and planes in 3-space | Rectangular co-ordinates in three dimensions. Vector algebra. Equation of a straight line using vectors. Coplanar lines, intersection of two lines using vectors and shortest distance between two lines. Equation of a plane using vectors, angle between two planes, angle between line and plane, intersection of two planes. Applications of plane and straight line. |
| 07. | Function of several variables | Partial derivatives of multivariable functions. Homogeneous function, Euler’s theorem, chain rule, total differential and its applications. Optimum values and saddle point of a function. Applications of partial differentiation. |
|  |  | **Final examination** |

Text Book:

**Calculus by JAMES STEWART- 8th edition**

Reference Book/ Materials:

1) Calculus– H. Anton, I. C. Bivens and S. Davis

2) Differential and Integral Calculus-F.Ayres (Schaum’s Outline Series)

3) Lecture Notes will be provided.