

Engineering Mathematics I
EG 1103 SH

Year: I
Semester: I

Total: 6 hours /week
Lecture: 4 hour/week
Tutorial: 2 hours/week
Practical: hours/week
Lab: hours/week

Course Description:

This course consists of five units namely: Set and Function, Trigonometry, Calculus, Algebra, Coordinate Geometry; which are basically necessary to develop mathematical knowledge and helpful for understanding as well as practicing their skills in the related engineering fields.

Course Objectives:

On completion of this course, students will be able to understand the concept of the following topics and apply them in the related fields of different engineering areas:

- Ideas of real number system and functional relation between parameters
- Trigonometric equations, inverse circular functions and properties of triangles
- Progressions, permutations and combinations, binomial theorem, exponential and logarithmic series
- Straight lines, pair of lines and circle, Limit and continuity, derivatives and anti-derivatives

Course Contents:

Unit 1: Set, Functions and Graphs **[7 Hrs.]**

- Cardinality of set, Power set, Properties of set algebra, De Morgan's laws,
- Real number systems, intervals and absolute value
- Relations and Functions, idea of domain and range
- Types of functions, exponential and logarithmic functions with their graphs

Unit 2: Trigonometry **[11 Hrs.]**

2.1. Revision: Basic trigonometric formulae, Identities and conditional identities, Height and distance

2.2. Trigonometric Equations and Inverse Circular Functions

- General solutions of the equations of type $\sin x = k$, $\cos x = k$ and $\tan x = k$
- Formulae involving inverse circular functions
- Simple identities and equations involving circular functions

2.3. Properties of Triangles

- The Sine, Cosine and projection laws (with proofs)
- The half angle formulae, Tangent laws and area of a triangle (without proofs)
- Simple cases on solution of triangles

Unit 3: Calculus **[18 Hrs.]**

3.1. Limit and Continuity

- Limit of functions, Indeterminate forms (only $\frac{0}{0}$, $\frac{\infty}{\infty}$ and $\infty - \infty$)
- Algebraic properties of limits (without proof)

- Theorems on limits (without proof)
 - Continuity and discontinuity of function, types of discontinuity
- 3.2. Derivatives**
- Definition, geometrical and physical meanings of derivative
 - Derivatives from definition of simple functions like:
 $x^n, (ax+b)^n, \sin(ax+b), e^{ax}, a^x$ and $\log x$
 - Rules of derivatives (sum, difference, product, quotient and chain rules)
 - Derivatives of trigonometric, parametric and implicit functions
 - Higher order derivatives
- 3.3. Integration**
- Definition and notation, Basic rules of integration
 - Fundamental integrals and Integration by substitution
 - Integration by parts and Definite integrals

Unit 4: Algebra

[12 Hrs.]

4.1. Progressions

- Arithmetic, Geometric and Harmonic Progressions
- Sum of infinite geometric series, Sum of First natural numbers
- Sum of squares and cubes of First n natural numbers (without proof)

4.2. Permutations and Combinations

- Principle of counting, Types of Permutation
- Combination and its properties (without proof)

4.3. The Binomial Theorem

- Binomial theorem (without proof)
- Expansion of binomial expressions, general terms, middle terms
and terms free from variables
- Expansion of binomial expression for any index
- Expansion of exponential and logarithmic functions (without proof)

Unit 5: Coordinate Geometry

[12 Hrs.]

5.1. Straight Lines

- Three standard forms of a line, general form: $ax + by + c = 0$, the line
through the intersection of two lines, the concurrency of lines, area of triangle
- Angle between two lines, bisector of angle between two lines
- and length of perpendicular from a point on a line

5.2. Pair of Lines

- Homogeneous equation of second degree
- General equation of second degree representing two lines
- Angle between a pair of lines and bisectors of the angles for a line pair (without proof)
- Condition for general equation of second degree to represent a line pair (without proof)
- Lines joining the origin to the points of intersection of a curve and a line

5.3. The Circle

- Standard and central forms
- General and Diameter forms (without proof)
- Tangent and normal to the circle
- Condition of tangency of a straight line to a circle (without proof)

Tutorial	[30 Hrs.]
1. Set, function and graphs	[2 Hrs.]
2. Trigonometry	[5 Hrs.]
• Trigonometric Equations and Inverse Circular Functions	[2 Hrs.]
• Properties of Triangles	[3 Hrs.]
3. Calculus	[10 Hrs.]
• Limit and Continuity	[2 Hrs.]
• Derivatives	[4 Hrs.]
• Integration	[4 Hrs.]
4. Algebra	[7 Hrs.]
• Progressions	[2 Hrs.]
• Permutations and Combinations	[2 Hrs.]
• The Binomial Theorem	[3 Hrs.]
5. Coordinate Geometry [6 Hrs.]	
• Straight Lines	[2 Hrs.]
• Pair of Lines	[2 Hrs.]
• The Circle	[2 Hrs.]

Evaluation Scheme

Unit wise Marks division for Final

S. N.	Units	Short questions (2 marks)	Long questions (4 marks)	Total Marks
1	Set, function and graphs	2x2=4	1x4=4	8
2	Trigonometry	3x2=6	2x4=8	14
3	Calculus	4 x 2 = 8	4 x 4 = 16	24
4	Algebra	3 x 2 = 6	3 x 4 = 12	18
5	Coordinate Geometry	2 x 2 = 4	3 x 4 = 12	16
		14 x 2 = 28	13 x 4 = 52	80

Reference Books

1. Thapa et al., Engineering Mathematics (Volume I, Three Years Diploma), Sukunda Pustak Bhawan, Bhotahity, Kathmandu, Nepal
2. Bajracharya et al., Basic Mathematics (Grade XI/XII), Sukunda Pustak Bhawan, Bhotahity, Kathmandu, Nepal
3. Nath et al., Engineering Mathematics I, Vidhyarthi Publisher and distributors, Bhotahity, Kathmandu, Nepal
4. Other references selected by the related lecturer(s) from among the texts available in the market that meet the content of this subject.