Engineering Mathematics II
EG 1201 SH

Year: I **Total: 6 hours /week**
Semester: I **Lecture: 4 hour/week**
Tutorial: 2 hours/week
Practical: hours/week
Lab: hours/week

Course Description:
This course consists of five units namely: Algebra, Conic sections, Geometry, Vectors, Statistics and Probability; 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 algebraic relations between variables, complex number system, Matrices and determinants, linear equations and inequalities, linear programming
- Two- and three-dimensional geometry, Vectors and their products
- Statistics and Probability

Unit 1: Algebra **[18 Hrs.]**

1.1 Polynomial equations
Quadratic equations, nature and relation between two roots, formation of quadratic equation, condition of common roots

1.2 Complex numbers
Definition, algebra, geometric representation, modulus, conjugate of complex numbers, square root, polar form, product and quotient of complex numbers, De Moivre's theorem and its applications to find the roots of complex numbers, properties of cube root of unity

1.3 Matrices and Determinants
Definitions, orders, types, algebraic operations, transpose of matrices and their properties without proofs. Definition, expansion and properties of determinants (without proofs), inverse of matrix

1.4 Solution of system of linear equations
Cramer's rule, inverse matrix method, row equivalent method

1.5 Linear inequalities and graphs up to two variables

1.6 Linear programming by graphical method

Unit 2: Conic Sections **[6 Hrs.]**

2.1 Parabola

- Standard equation of parabola
- Equation of parabola vertex at any point (without proof)
- General equation (simple problems to find vertex, focus and equation of directrix)

2.2 Ellipse and Hyperbola

- Standard equation of ellipse and hyperbola (without proof)
- Equation of ellipse and hyperbola center at any point (without proof)
- Center, vertex, foci, directories of ellipse and hyperbola

Unit 3: Geometry **8hrs**

3.1 Coordinate in Space

- Rectangular Cartesian co-ordinates
- Distance and section formulas (without proofs)
- Direction cosine and ratio of a line, Projections
- Angle between two lines

3.2 Planes

- General equation of plane (without proofs)
- Equation of plane in intercept and normal forms (without proofs)
- Equation of plane through a point
- Angle of between two planes
- Length of perpendicular from a point on a plane

Unit 4: Vectors **10hrs**

4.1 Definitions and Algebra of Vectors

- Definitions, notations and representations of vectors
- Modulus and direction cosines of a vector
- Algebra of vectors, Types of vectors
- Linear dependent and independent vectors, Coplanar vectors

4. 2 Product of Two Vectors

- Scalar product of two vectors, geometrical meaning, properties and angle between two vectors without proofs, simple applications in plane trigonometry
- Vector product of two vectors, geometrical meaning, properties and angle between two vectors without proofs, determinant form of vector product, simple applications in plane trigonometry, vector equation of a straight line

Unit 5: Statistics and Probability **[18 Hrs.]**

5.1 Statistics

- Revision: measures of central tendency (Mean, median, mode. quartiles, deciles and percentiles)
- Measure of dispersion (Range, mean deviation, quartile deviation and standard deviation)
- Skewness, Correlation (Karl Pearson's method), Regression analysis

5.2 Probability

- Basic terms of probability theory
- Concept of mutually exclusive events
- Definitions and basic laws of probability (without proofs)
- Probability in terms permutation and combination

5.3 Theoretical Probability Distributions

- Random and discrete random variables
- Binomial and normal distributions

Tutorial

1. **Algebra** **[12 Hrs.]**
    - Polynomial equations [2 Hrs.]
    - Complex numbers [3 Hrs.]
    - Matrices and Determinants [4 Hrs.]
    - Solution of system of linear equations [2 Hrs.]
    - Linear inequalities and graphs up to two variables and linear programming by graphical method [1Hr]

2. **Conic Sections** **[3 Hrs.]**
   - Parabola [2 Hrs.]
   - Ellipse and Hyperbola [1 Hrs.]
3. **Geometry** **[4 Hrs.]**
   - Coordinate in Space [2 Hrs.]
   - Planes [2 Hrs.]
4. **Vectors** **[5 Hrs.]**
   - Definitions and Algebra of Vectors [2 Hrs.]
   - Product of Two Vectors [3 Hrs.]
5. **Statistics and Probability** **[6 Hrs.]**
   - Statistics [3 Hrs.]
   - Probability [2 Hrs.]
   - Theoretical Probability Distributions [1 Hrs.]

Evaluation Scheme

Unit wise Marks division for Final

S. No.	Units	Short questions (2 marks)	Long questions (4 marks)	Total Marks
1	Algebra	4 x 2 = 8	4 x 4 = 16	24
2	Conic Sections	2 x 2 = 4	2 x 4 = 8	12
3	Geometry	2 x 2 = 4	2 x 4 = 8	12
4	Vectors	3 x 2 = 6	2 x 4 = 8	14
5	Statistics and Probability	3 x 2 = 6	3 x 4 = 12	18
		14 x 2 = 28	**13 x 4 = 52**	**80**

Reference Books

1. Thapa G. B. et al., Engineering Mathematics (Volume II, Three Years Diploma), Sukunda Pustak Bhawan, Bhotahity, Kathmandu, Nepal
2. Bajracharya D. R. et al., Basic Mathematics (Grade XI/XII), Sukunda Pustak Bhawan, Bhotahity, Kathmandu, Nepal
3. Bajracharya B. C., Mathematics and Statistics for Economics, M K publishers and distributors, Bhotahity, Kathmandu, Nepal
4. A Text book of Statistics – B.C. Bajracharya
5. Elementary Statistics – H. C. Saxena
6. Nath et al., Engineering Mathematics II, Vidhyarthi Publisher and distributors, Bhotahity, Kathmandu, Nepal
7. Other references selected by the related lecturer(s) from among the texts available in the market that meet the content of this subject.