C:\Users\sau\Downloads\facultyofchemicalsciences_webpageMathematics (Basic)- II: Topics in Elementary Algebra and Vectors

Faculty: FMS
Course Code: MTH104
Course Title: Topics in Elementary Algebra and Vectors
Number of Credits: 4 (4+0+0)

Course objectives: To introduce some of the basic topics in algebra and vectors to those who did not study mathematics in Classes XI and XII. The topics covered include complex numbers, quadratic equations, matrices and determinants.

Minimum prerequisites for taking this course, if any: Class X pass with Mathematics

Course structure with units, if applicable:

UNIT I: Complex Numbers and Quadratic Equations:
Need for complex numbers, especially $\sqrt{-1}$, to be motivated by inability to solve some of the quadratic equations. Algebraic properties of complex numbers. Argand plane.

UNIT II: Linear Inequalities
Linear inequalities. Algebraic solutions of linear inequalities in one variable and their representation on the number line.

UNIT III: Matrices and Determinants
Definition, notation, order, equality, types of matrices, zero and identity matrix, transpose of a matrix, symmetric and skew symmetric matrices. Operations on matrices: Addition and multiplication and multiplication with a scalar. Simple properties of addition, multiplication and scalar multiplication. Noncommutativity of multiplication of matrices and existence of non-zero matrices whose product is the zero matrix (restrict to square matrices of order 2). Invertible matrices and proof of the uniqueness of inverse, if it exists; (Here all matrices will have real entries).

Determinant of a square matrix (up to 3 x 3 matrices), minors, co-factors and applications of determinants in finding the area of a triangle. Adjoint and inverse of a square matrix. Consistency, inconsistency and number of solutions of system of linear equations by examples, solving system of linear equations in two or three variables (having unique solution) using inverse of a matrix.

UNIT IV: Vectors
Vectors and scalars, magnitude and direction of a vector. Direction cosines and direction ratios of a vector. Types of vectors (equal, unit, zero, parallel and collinear vectors), position vector of a point, negative of a vector, components of a vector, addition of vectors, multiplication of a vector by a scalar, position vector of a point dividing a line segment in a given ratio. Definition, Geometrical Interpretation, properties and application of scalar (dot) product of vectors, vector (cross) product of vectors.

Reading suggestions:

1. Stroud, K.A. and Booth, D.J. (2020). Engineering mathematics. Bloomsbury Publishing.
2. Andreescu, Titu & Andrica, D. (2014). Complex numbers from A to...Z. (2nd ed.) Birkhäuser.
3. Strang, G. (2012). Linear algebra and its applications.
4. Kreyszig, E. (2007). Advanced engineering mathematics, 9th edition with Wiley plus set (Vol. 334). US: John Wiley & Sons.

Evaluation:

Mid-semester Written Examination: 40% Marks
End-semester Written Examination: 40% Marks
Quiz / Assignment/Presentation (oral / poster)/other: 20% Marks