NATIONAL UNIVERSITY OF ENGINEERING
COLLEGE OF GEOLOGICAL, MINING AND METALLURGICAL ENGINEERING
GEOLOGICAL ENGINEERING PROGRAM

BMA03 – LINEAR ALGEBRA

I. GENERAL INFORMATION

CODE	**:**	BMA03 Linear Algebra
SEMESTER	**:**	2
CREDITS	**:**	4
HOURS PER WEEK	**:**	5 (Theory–Practice)
PREREQUISITES	**:**	-
CONDITION	**:**	Compulsory

II. COURSE DESCRIPTION

The course prepares students for the analysis sequences and series and determining their properties and convergence. Students also complete operations with complex numbers and find the real and complex roots of a given polynomial, compute and interpret the eigenvalues and eigenvector of matrices, and construct the quadratic form of real functions. The course provides students with the principles of series, complex number and matrix transformations to be applied to solve engineering problems.

III. COURSE OUTCOMES

At the end of the course, students:

1. Analyze the properties of sequences and series determining their convergence and properties.
2. Carry put operations with complex numbers in different representations.
3. Find the roots of a polynomial using exact or numeric methods.
4. Calculate and interpret the eigenvalues and eigenvectors of a matrix.
5. Construct matrix representation of functions.

IV. LEARNING UNITS

1. SEQUENCES IN R

Real sequences / Limit of a sequence / Notable limits / Convergence theorems / Divergent sequences / Increasing and decreasing sequences / Bounded sequences.

2. SERIES IN R

Real series / Convergence and divergence of series / Notable series. Geometric series / Series properties / Addition of series / Convergence criteria / Absolut convergence / Power series / Convergence (divergence) of power series / Convergence radius / Differentiation and integration of series.

3. COMPLEX NUMBER AND POLYNOMIAL ROOTS

System of complex numbers / Real part and imaginary part / Magnitude and angle of complex numbers / Polar form / Exponential form / Operation with complex numbers / Moivre formula / Roots of a complex numbers / Root of grade 3 polynomials / Roots of a polynomial / Algebra fundamental theorem / Solution of polynomial equations / Synthetic division method / Numeric method: Newton method bisection method / Interpolation / Lagrange formula.

4. EIGENVALUES AND EIGENVECTORS

Linear transformations / Translation. Rotation. Dilation. Contraction / Nonsingular transformations / Characteristic polynomial of a matrix / Eigenvalues of a matrix / Eigenvectors of a matrix / Matrix diagonalization. Necessary conditions / Orthogonal matrix / Gram Schmidt process.

5. QUADRATIC FORMS

Matrix representation of a quadratic form / Diagonalization of quadratic forms / Identification of conic sections / Identification of quadratic surfaces.

6. VECTOR SPACES

Vector spaces / Core / Image / Matrix representation of linear transformations.

V. PRACTICAL EXPERIENCES

Session 1: Sequences and series
Session 2: Complex numbers and polynomial roots
Session 3: Eigenvalues and eigenvectors
Session 4: Quadratic forms
Session 5: Vector spaces

VI. METHODOLOGY

The course takes place in theory and practice sessions. In theory sessions, faculty presents the concepts, methods and principles. In practice sessions, students, under the guidance of faculty, solve diverse problems on series, complex numbers, eigenvalues and eigenvector, quadratic forms. Student active participation is promoted.

VII. GRADING FORMULA

The Final Grade PF is calculated as follow:

PF = (EP + EF + PP) / 3

EP: Mid-Term Exam EF: Final Exam PP: Average of 4 Practical Works

VIII. BIBLIOGRAPHY

1. KOLMAN, BERNARD.
   Linear Algebra, Pearson Ed., 2016
2. GORDON FULLER, DALTON TARWATER.
   Analytic Geometry, Pearson Ed., 2015