

**Draft Syllabus
for
Four-Year (Eight-Semester)
Undergraduate Program
in
Mathematics
Multidisciplinary Course
(as per NEP 2020)
(Effective from Academic Session 2024-2025)**



**University of Gour Banga
Malda-732103
West Bengal**

Name of Multidisciplinary Papers Semester I to III

(Each carries 3 credits)

Semester	Course Code	Course Name
I	MTM-MDC-101	Elementary Mathematics-I
II	MTM-MDC-201	Mathematics in Daily Life
III	MTM-MDC-301	Elementary Mathematics-II

NOTE: Each multidisciplinary paper is of 3 credits (50 marks, out of which 10 marks is allotted for Continuous Assessment (CA) and 40 marks is allotted for Semester-End (SE) examination).

SEMESTER I

MTM-MDC-101

Elementary Mathematics-I

Credit: 3
Full Marks: 50 (CA: 10, SE: 40)

Learning Objectives:

The objective of the course is to familiarise with the basic concepts of set theory, complex numbers, matrix and determinant so that students can apply them for solving problems.

Learning Outcomes:

On completion of this course, the students will be able to

1. Understand the basic concept of sets, finite sets, infinite sets, power sets and universal sets.
2. Get acquainted with the concept of complex numbers and apply De Moivre's theorem to solve problems involving complex variables.
3. Get basic knowledge of matrix and determinant and use them to solve related problems.
4. Understand the concept of relation and function and study the different types of functions.

Course Contents

Module 1: Set Theory and Complex Numbers

Introduction to sets and their representations. The empty set, finite and infinite sets, equal sets, subsets, power set, and Universal set. Union, intersection, difference, complement of sets, De-Morgan's laws, Symmetric difference, Cartesian product of sets. Simple problems based on set theory.

Venn-diagram and their applications.

Polar representation of complex numbers, De Moivre's theorem (without proof) for rational indices and their applications.

Module 2: Matrix and Determinant

Definition of a Matrix. Types of Matrices. Elementary operations on Matrices, Transpose and Adjoint of a matrix. Symmetric and Skew Symmetric Matrices, Inverse of a matrix. Solution of system of linear equations (up to third order) using matrix inversion method and Cramer's Rule. Determinant of a square matrix (up to third order). Properties of determinants. Cofactors and minor of a determinant.

Module 3: Relations and Functions

Relations, equivalence relations, congruence relations, simple application of congruence relation, functions, domain and co-domain, one-to-one and onto functions, bijective functions, inverse function; logarithmic, exponential functions and their elementary properties, periodic functions, trigonometric functions, permutation and combination.

References

- [1] A. Kumar, S. Kumaresan and B.K. Sarma, A Foundation Course in Mathematics, Narosa Publishing House, 2018.

- [2] S. Bernard and J.M. Child, Higher Algebra, 2nd Edition, Arihant Publications, 2023.
- [3] I. Stewart and D. Tall, The Foundations of Mathematics, 2nd Edition, Oxford University Press, 2015.
- [4] M.K. Sen, S. Ghosh and P. Mukhopadhyay, Topics in Abstract Algebra, 2nd Edition, University Press, 2006.
- [5] K.B. Dutta, Matrix and Linear Algebra, Prentice-Hall of India Pvt. Ltd., 2004.
- [6] S. Narayan and P.K. Mittal, A Textbook of Matrices, S Chand & Company, 2010.

SEMESTER II

MTM-MDC-201

Mathematics in Daily Life

Credit: 3
Full Marks: 50 (CA: 10, SE: 40)

Learning Objectives:

The objective of the course is to familiarise with the basic notions of mathematics to solve problems in our day to day life.

Learning Outcomes:

On completion of this course, the students will be able to

1. Demonstrate the knowledge of mathematics to solve problems involving ratio and proportion, time and distance and other similar problems, that we encounter in our day to day life.
2. Apply the knowledge of mathematics to solve problems in banking sector, such as calculation of EMI, simple interest etc
3. Apply the basic concept of statistics to calculate mean, median, mode etc.
4. Demonstrate the knowledge of probability theory to solve various types of problems.

Course Contents

Module 1: Arithmetic and Banking Ability

Unit conversion (length, mass, time); Number System; Decimal Fractions; Square Roots and Cube Roots; Problems on Numbers; Problems on Ages; Use of concepts of HCF and LCM; Percentage; Ratio and Proportion; Time and Distance; Allegations or Mixture; Area, Volume, Surface Areas; Trigonometric ratios; Height and Distance in our everyday life.

Interest - Concept of Present value and Future value, Simple interest, Compound interest, Nominal and Effective rate of interest; Depreciation and discount; Annuity - Ordinary annuity, sinking fund, annuity due, present value and future value of annuity; Equated Monthly Installments (EMI) by Interest of Reducing Balance and Flat Interest methods - examples and problems.

Module 2: Data Interpretation and Statistics

Classification of data - Frequency distribution, Tabulation; Graphical representation of data - Bar Graphs, Pie Charts, Line Graphs; Calendar and Clocks.

Measures of Central Tendency: mean, weighted mean, median, mode.

Measures of Dispersion: range, mean deviation, standard deviation, coefficient of variation, moments, skewness and kurtosis.

Module 3: Probability Theory

Events, probability of an event, conditional probability, Bayes' theorem (without proof) and their applications, discrete random variable and its probability distribution, expectation (mean) and variance of a single random variable.

References

- [1] N.G. Das, Statistical Methods, Combined Edition (volumes I & II), McGraw Hill Education, 2017.
- [2] R.V. Hogg, J.W. McKean and A.T. Craig, Introduction to Mathematical Statistics, 7th Edition, Pearson Education, 2012.
- [3] A.M. Gun, M.K. Gupta and B. Dasgupta, An Outline of Statistical Theory, Vol 1 & Vol 2, World Press, 2003.
- [4] A. Gupta, Ground work of Mathematical Probability and Statistics, Academic publishers, 1983.
- [5] R.S. Aggarwal, Quantitative Aptitude, S. Chand Publishing, 2022.
- [6] M.K. Bhowal, Fundamentals of Business Mathematics, Asian Books, 2009.
- [7] S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand & Sons, 2020.
- [8] A.S. Posamentier and C. Spreitzer, The Mathematics of Everyday Life, Prometheus Books, 2018.

SEMESTER III

MTM-MDC-301

Elementary Mathematics-II

Credit: 3

Full Marks: 50 (CA: 10, SE: 40)

Learning Objectives:

The objective of the course is to introduce with the various concepts of two dimensional geometry, differential calculus, integral calculus and apply them to solve problems.

Learning Outcomes:

On completion of this course, the students will be able to

1. Solve problems on two dimension co-ordinate geometry, such as calculation of slope of a line, angle between lines, etc.
2. Familiar with basic notions of continuity and differentiability, and apply them to find derivative of several sort of real valued functions and find their extremum.

3. Apply the concept of integral calculus to evaluate different kind of integrals.
4. Learn how to solve polynomial equations.

Course Contents

Module 1: Two-dimensional Coordinate Geometry

Distance between two points, Slope of a line and angle between two lines. Various forms of equations of a line: parallel to axes, point-slope form, slope-intercept form, two-point form, intercepts form and normal form. General equation of a line. Equation of family of lines passing through the point of intersection of two lines. Distance of a point from a line.

Module 2: Differential and Integral Calculus

Continuity and differentiability, derivative of composite functions, chain rule, derivatives of inverse trigonometric functions, derivative of implicit function. Derivatives of exponential, logarithmic functions. Derivative of functions expressed in parametric forms. Second order derivatives. Increasing/decreasing functions, Maxima and minima of function of single variable.

Integration of a variety of functions by substitution, by partial fractions and by parts. Definite integrals as a limit of a sum. Fundamental Theorem of Calculus (without proof). Basic properties of definite integrals and evaluation of definite integrals.

Module 3: Theory of Equations

Polynomials: Fundamental theorem of algebra (Statement only). Polynomials with real coefficients, nature of roots of an equation (surd or complex roots occur in pairs). Statement of Descartes rule of signs and its applications. Relation between roots and coefficients.

References

- [1] S.L. Loney, The Elements of Coordinate Geometry (Part-I), Arhant Prakashan Ltd., 2016.
- [2] S. Narayan and P.K. Mittal, Differential Calculus, S. Chand & Co. Ltd., 2005.
- [3] S. Narayan and P.K. Mittal, Integral Calculus, S. Chand & Co. Ltd., 2005.
- [4] B.C. Das and B.N. Mukherjee, Differential Calculus, U.N. Dhur & Sons Pvt. Ltd., 1949.
- [5] S.K. Mapa, Higher Algebra: Classical, Sarat Book House, 2014.
- [6] W.S. Burnstine and A.W. Panton, Theory of Equations, Wentworth Press, 2016.
- [7] P.R. Vittal, Analytical Geometry 2D and 3D, Pearson, 2013.