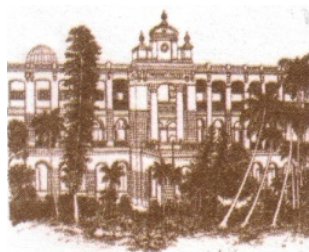


PRESIDENCY UNIVERSITY

DEPARTMENT OF MATHEMATICS

Syllabus for Generic Elective (GE) Courses offered by the
Department of Mathematics
(under the Choice Based Credit System as proposed by UGC)
Approved by the Board of Studies (BoS) of the Department of Mathematics



Department of Mathematics
(Faculty of Natural and Mathematical Sciences)
Presidency University, Kolkata
Hindoo College (1817-1855), Presidency College (1855-2010)
86/1, College Street, Kolkata - 700 073
West Bengal, India

Generic Electives (to be offered to the students of other departments) (GE):

Course Structure

Semester	Course Code	Name of the Course	Marks
I	MATH 01GE1	Differential Calculus	100
II	MATH 02GE2	Integral Calculus and Differential Equations	100
III	MATH 03GE3	Algebra I	100
IV	MATH 04GE4	Algebra II	100

NOTE: The division of marks for GE would be $100 = 80$ (theory exam.) + 20 (internal assessment).

GE 1: Differential Calculus

Subject Code: MATH 01GE1

Credits: 6 (5 Theory lectures + 1 Tutorial per week)

Module 1: Real Numbers: Axiomatic definition, Archimedean property, limit supremum, limit infimum.

Module 2: Sequence of real numbers: convergence, Cauchy criteria and other elementary properties. Series of real number, Absolute and conditional convergence of series.

Module 3: Real-valued functions defined on an interval : Limit of a function (Cauchy's definition). Algebra of limits. Continuity of a function at a point and in an interval. Acquaintance with the important properties of continuous functions on closed intervals.

Module 4: Derivative its geometrical and physical interpretation. Sign of derivative, Monotonic increasing and decreasing functions. Relation between continuity and differentiability.

Module 5: Successive derivative (Leibnitz's Theorem and its application).

Module 6: Rolle's theorem; Mean Value Theorems and expansion of functions like e^x ; $\sin x$; $\cos x$; $(1+x)^n$; $\ln(1+x)$ (with validity of regions).

Module 7: Applications of Differential Calculus : Maxima and Minima, Tangents and Normals.

Module 8: Indeterminate Forms: L'Hôpital's Rule.

Books Recommended:

1. R. G. Bartle and D. R. Sherbert, Introduction to Real Analysis, John Wiley & Sons, Inc.
2. T. M. Apostol, Calculus (Vol. I), Wiley.
3. D. V. Widder, Advanced Calculus, Dover Publications.
4. S. Narayan, Differential Calculus, S. Chand.

GE 2: Integral Calculus and Differential equations

Subject Code: MATH 02GE2

Credits: 6 (5 Theory lectures + 1 Tutorial per week)

Module 1: Integration of the form $\int \frac{dx}{a + b \cos x}$, $\int \frac{l \sin x + p \cos x}{m \sin x + n \cos x} dx$ and integration of rational functions. Reduction formulae of $\int \sin^m x \cos^n x dx$; $\int \tan^n x dx$ and $\int \frac{\sin^m x}{\cos^n x} dx$ and associated problems (m and n are non-negative integers).

Module 2: Evaluation of definite integrals. Preliminaries of Riemann integration. Integration as the limit of a sum.

Module 3: Definition of Improper Integrals: Statements of (i) μ -test, (ii) Comparison test. Use of Beta and Gamma functions.

Module 4: (Applications of integral calculus) rectification, quadrature, finding c.g. of regular objects, volume and surface areas of solids formed by revolution of plane curve and areas.

Module 5: Introduction to differential equations; Order and solution of an ordinary differential equation (ODE) in presence of arbitrary constants; Formation of ODE.

Module 6: First order differential equations: (i) Variables separable, (ii) Homogeneous equations and equations reducible to homogeneous forms, (iii) Exact equations and those reducible to such equation, (iv) Euler's and Bernoulli's equations (Linear), (v) Clairaut's Equations: General and Singular solutions; Orthogonal Trajectories.

Module 7: Second order linear equations: Second order linear differential equations with constant coefficients. Euler's Homogeneous equations.

Books Recommended

1. S. Narayan, Integral Calculus, S. Chand.
2. T. M. Apostol, Calculus (Vol. I), Wiley.

3. S. L. Ross, Differential Equations, John Wiley and Sons.
4. G. F. Simmons, Differential Equation with Applications and Historical Notes, CRC Press.

GE 3: Algebra I

Subject Code: MATH 03GE3

Credits: 6 (5 Theory lectures + 1 Tutorial per week)

Module 1: (Complex Numbers) De Moivre's Theorem and its applications. Exponential, Sine, Cosine and Logarithm of a complex number. Definition of e^z , Inverse circular and Hyperbolic functions.

Module 2: (Theory of Equations) Fundamental Theorem of Algebra. Polynomials with real coefficients: Descartes's Rule of sign and its applications. Relation between roots and coefficients. Symmetric functions of roots, Transformations of equations. Solution of a cubic and biquadratic.

Module 3: (Introduction to Group Theory) Definition and examples, Cyclic group, Symmetric group, Alternating group. Elementary properties of groups. Order of an element in the group, Subgroup, Quotient group, Normal subgroup, Homomorphism and isomorphism.

Module 4: (Rings and Integral Domains) Definition and examples. Subrings and ideals. Quotient ring. Homomorphism and isomorphism of rings.

Module 5: (Fields) Definition and examples, its relation with integral domain.

Books Recommended

1. S. K. Mapa, Classical Algebra, Levant.
2. J. B. Fraleigh, First Course in Abstract Algebra, Narosa.
3. M. K. Sen, S. Ghosh and P. Mukhopadhyay, Topics in Abstract Algebra, University Press.

GE 4: Algebra II

Subject Code: MATH 04GE4

Credits: 6 (5 Theory lectures + 1 Tutorial per week)

Module 1: Vector (Linear) space over a field. Subspaces. Linear combinations. Linear dependence and independence of a set of vectors. Linear span. Basis. Dimension. Replacement Theorem. Extension theorem. Deletion theorem.

Module 2: Row Space and Column Space of a Matrix. Determinant and Trace of a matrix. Rank of a matrix. $\text{Rank}(AB) \leq \min(\text{Rank } A; \text{Rank } B)$.

Module 3: System of Linear homogeneous equations: Solution space of a homogeneous system and its dimension. System of linear non-homogeneous equations: Necessary and sufficient condition for the consistency of the system. Method of solution of the system of equations.

Module 4: Linear Transformation (L.T.) on Vector Spaces: Null space. Range space. Rank and Nullity, Sylvester's law of Nullity. Inverse of Linear Transformation. Non-singular Linear Transformation. Change of basis by Linear Transformation. Vector spaces of Linear Transformation.

Module 5: Characteristic equation of a square matrix. Eigen-value and Eigen-vector. Invariant subspace. Cayley-Hamilton Theorem. Simple properties of Eigen value and Eigen vector, diagonalization.

Books Recommended

1. S. Kumaresan, Linear Algebra: A Geometric Approach, PHI.
2. B. Rao, Linear Algebra, HBA (TRIM).
3. S. H. Friedberg, A. Insel and L. E. Spence, Linear Algebra, Pearson.