Asian Educational Institute, Patiala (PB)

(An Autonomous College)

School of Science and Mathematics

SYLLABUS

M.Sc. (MATHEMATICS)

(Semester- I & II)

Session: 2025-2026

Programme Outcomes of M.Sc. (Mathematics)

PO1: To develop and conduct continuing education programs for Mathematics graduates with a view to update their fundamental knowledge base and problem solving capabilities in the various areas of Mathematics.

PO2: Enable students to enhance mathematical skills and understand the fundamental concepts of pure and applied mathematics.

PO3: To inculcate the curiosity for mathematics in students and to prepare them for future research.

PO4: Develop, design and implement research projects competently and independently.

PO5: Identify and define emerging problems related to one's area of interest.

M.Sc. (MATHEMATICS) Part-1

Semester-I

Course code	Course title	Credits	Marks Ext.	Marks Int.	Total Marks
MMATH1101T	Algebra-I	04	70	30	100
MMATH1102T	Real Analysis-I	04	70	30	100
MMATH1103T	Differential Geometry	04	70	30	100
MMATH1104T	Differential Equations	04	70	30	100
MMATH1105T	Introduction to computer and programming using C	03	35	15	50
MMATH1105P	Practical (Introduction to computer and programming using C)	02	35	15	50

Semester-II

Course code	Course title	Credits	Marks Ext.	Marks Int.	Total Marks
MMATH1201T	Algebra-II	04	70	30	100
MMATH1202T	Complex Analysis	04	70	30	100
MMATH1203T	Topology-I	04	70	30	100
MMATH1204T	Functional Analysis	04	70	30	100
MMATH1205T	Mathematical Statistics	04	70	30	100

SCHEME OF EXAMINATION

(Assessment and End-Semester Examination)

Theory Course

Sub-component	Weight age
Sessional Examination	10
Quiz/Tutorial	05
Assignment and Seminar	10
Attendance	05
End-Semester Examination	70

Practical courses

Examination	Sub-component	Weightage	Total
End-Semester Practical Exam (External examination)	Viva-voce + Written exam	25	50
	Practical record file	10	
	Attendance	15	

(Semester-I)

ALGEBRA-I

Paper Code: MMATH 1101T

Credits: 04

Max. Marks: 100

Total teaching hours: 55

External Exam: 70 Marks

Internal Assessment: 30 Marks

Passing Marks: 35%

Course Objective: The main goal of this course is to deliver basics of groups, rings and ideals. To know how to apply Sylow Theory to determine structure of groups of finite order.

Course Outcomes: The students will be able to

1. Understand the notion of group action and able to apply this to get some interesting results of Group actions like Class Equation etc.
2. Able to learn Lagrange's Theorem, structure theory of groups, solvability and nilpotency of groups.
3. To understand the Symmetric groups, Alternating Groups and their simplicity.
4. To understand the basic properties of Rings and Ideals.

INSTRUCTIONS FOR THE PAPER-SETTER

The question paper will consist of three sections: A, B and C. Sections A and B will have four questions each from the respective sections of the syllabus. Section C will consist of one compulsory question having ten short questions covering the entire syllabus uniformly. Each question in sections A and B will be of 10 marks each and section C will be of 30 marks.

INSTRUCTIONS FOR THE CANDIDATES

Candidates are required to attempt five questions in all selecting two questions from each sections A and B and compulsory question of section C.

SECTION-A

Review of groups, permutation groups, Even and odd permutation, conjugacy classes, permutation groups, Alternating group A_n, Simplicity of A_n, Normal and subnormal series, Solvable groups, Nilpotent groups, Composition Series, Jordan-Holder theorem for groups, Group action, Stabilizer, orbit, Class equation and its applications.

SECTION-B

Structure theory of groups, Fundamental theorem of finitely generated abelian groups, Invariants of a finite abelian group, Groups of Automorphisms of cyclic groups, homomorphism between two cyclic groups.
Fundamental Theorem for finite abelian groups, Sylow's theorems, Groups of order p^2, pq.
Review of rings and homomorphism of rings, Ideals, Algebra of Ideals, Maximal and prime ideals, Maximal and prime ideals, Ideal in Quotient rings, Field of Quotients of integral Domain, Matrix Rings and their ideals; Rings of Endomorphisms of Abelian Groups.

REFERENCES:

1. Surjeet Singh, Qazi Zameeruddin : Modern Algebra
2. Bhattacharya, Jain & Nagpaul : Basic Abstract Algebra, Second Edition (Ch. 6, 7, 8, 10)

(Semester-I)

Real Analysis-I

Paper Code: MMATH 1102T

Max. Marks: 100

External Exam: 70 Marks **Credits: 04**

Internal Assessment: 30 Marks **Total teaching hours: 55**

Passing Marks: 35%

Course Objective: The main goal of this course is to deliver basics of Metric spaces, compact sets. Perfect sets, convergent sequences, Continuous functions, Continuity and compactness, Continuity and connectedness, Properties of Integral.

Course Outcomes: The students will be able to learn

1. The theory of Riemann-Stieltjes integrals, to be aquainted with the ideas of the total variation.
2. Able to deal with functions of bounded variation.
3. Develop a reasoned argument in handling problems about functions, especially those that are of bounded variation.
4. Develop the ability to reflect on problems that are quite significant in the field of real analysis.

INSTRUCTIONS FOR THE PAPER-SETTER

The question paper will consist of three sections: A, B and C. Sections A and B will have four questions each from the respective sections of the syllabus. Section C will consist of one compulsory question having ten short questions covering the entire syllabus uniformly. Each question in sections A and B will be of 10 marks each and section C will be of 30 marks.

INSTRUCTIONS FOR THE CANDIDATES

Candidates are required to attempt five questions in all selecting two questions from each sections A and B and compulsory question of section C.

SECTION-A

Basic Topology : Finite, countable and uncountable sets. Metric spaces, compact sets. Perfect sets. Connected sets.

Sequences and series : Convergent sequences (in metric spaces). Subsequences. Cauchy sequences.

Upper and lower limits of a sequence of real numbers. Riemann's Theorem on Rearrangements of series of real and complex numbers.

Continuity : Limits of functions (in metric spaces). Continuous functions. Continuity and compactness, Continuity and connectedness. Monotonic functions.

SECTION-B

The Riemann-Stieltjes integral: Definition and existence of the Riemann-Stieltjes integral. Properties of the integral. Integration of vector-valued functions. Rectifiable curves.

Sequences and series of functions: Problem of interchange of limit processes for sequences of functions. Uniform convergence. Uniform convergence and continuity. Uniform convergence and integration. Uniform convergence and differentiation. Equicontinuous families of functions, The Stone- Weierstrass theorem.

REFERENCES:

1. H.L. Royden: Real analysis, Macmillan Pub. co. Inc. 4th Edition, New York, 1993. Chapters 3, 4, 5 and Sections 1 to 4 of Chapter 11.
2. Walter Rudin: Principles of Mathematical Analysis, 3rd edition, McGrawHill, Kogakusha, 1976, International student edition. Chapter 9 (Excluding Sections 9.30 to 9.43)
3. Shanti Narayan, A Course of Mathematical Analysis, S. Chand and Co. Ltd., New Delhi, Twelfth Revised Edition, 1986.

(Semester-I)

Differential Geometry
Paper Code: MMATH 1103T

Max. Marks: 100 **Credits: 04**

External Exam: 70 Marks **Total teaching hours: 55**

Internal Assessment: 30 Marks

Passing Marks: 35%

Course Objective: The main goal of this course is to calculate the curvature and torsion of curves and surfaces in the three-dimensional space. To have an idea about the surfaces of the constant mean and Gaussian curvature which have interesting physical interpretations.

Course Outcomes: The students will be able to

1. Study the geometry of curves and surfaces in three-dimensional space using calculus techniques.
2. To have a thorough knowledge about the effect of the Gauss's remarkable theorem on the bending of the surface without stretching.
3. To apply the theory of geodesics to study geodesic curvature, geodesic equations and the surfaces of revolution.

INSTRUCTIONS FOR THE PAPER-SETTER

The question paper will consist of three sections: A, B and C. Sections A and B will have four questions each from the respective sections of the syllabus. Section C will consist of one compulsory question having ten short questions covering the entire syllabus uniformly. Each question in sections A and B will be of 10 marks each and section C will be of 30 marks.

INSTRUCTIONS FOR THE CANDIDATES

Candidates are required to attempt five questions in all selecting two questions from each sections A and B and compulsory question of section C.

SECTION-A

Curves in the planes and in space: arc length, unit speed curves, regular curves, closed curves. plane curves, curvature, space curves, torsion, Serret-Frenet formulae.
Surfaces in three dimensions: smooth surfaces, regular and allowable surface patches, transition maps, smooth maps, tangent space, derivatives of smooth maps, normals and orientability.
The first fundamental form: Lengths of curves on surfaces, Isometries of surfaces in relation to symmetric bilinear forms.
Curvature of surfaces: The second fundamental form, The Gauss and Weingarten maps, Normal and geodesic curvatures, Gauss equation. The Gaussian and mean curvature, principal curvature of a surface, Euler's theorem.

SECTION-B

Geodesics: Definition and basic properties, geodesic equations, geodesics of surfaces of revolution, geodesics as shortest paths, Gauss' Theorem, The Gauss and Codazzi-Mainardi equations, Gauss equation in terms of Gaussian curvature of the surface patch. Gaussian curvature in terms of the coefficients of the first fundamental form. Gauss' Remarkable theorem and applications.

REFERENCES:

1. Andrew Pressley, Elementary Differential Geometry, Springer, Fourth Indian Reprint 2009.
2. T.J.Willmore, An Introduction to Differential Geometry, Dover Publications, 2012.
3. B. O'Neill, Elementary Differential Geometry, 2ndEd., Academic Press, 2006.
4. C.E.Weatherburn,DifferentialGeometryofThreeDimensions,CambridgeUniversityPress 2003.

(Semester-I)

Differential Equations

Paper Code: MMATH 1104T

Max. Marks: 100 **Credits: 04**

External Exam: 70 Marks **Total teaching hours: 55**

Internal Assessment: 30 Marks

Passing Marks: 35%

Course Objective: The main goal of this course is to analyze the dependence of solutions on initial conditions and parameters. Know the concepts of existence, uniqueness and continuity of the solutions of first order ordinary differential equations.

Course Outcomes: The students will be able to

1. Identify the properties of the zeros of solutions of linear order ordinary differential equations.
2. Analyze the dependence of solutions on initial conditions and parameters.
3. Demonstrate the knowledge of eigen values and eigen functions of sturm liouville systems.
4. Know the concepts of existence, uniqueness and continuity of the solutions of first order ordinary differential equations.

INSTRUCTIONS FOR THE PAPER-SETTER

The question paper will consist of three sections: A, B and C. Sections A and B will have four questions each from the respective sections of the syllabus. Section C will consist of one compulsory question having ten short questions covering the entire syllabus uniformly. Each question in sections A and B will be of 10 marks each and section C will be of 30 mark

INSTRUCTIONS FOR THE CANDIDATES

Candidates are required to attempt five questions in all selecting two questions from each sections A and B and compulsory question of section C.

SECTION-A

Existence and uniqueness of solution of first order equations. Boundary value problems and Strum-Liouville theory. ODE in more than 2-variables.

SECTION-B

Partial differential equations of first order. Partial differential equations of higher order with constant coefficients. Partial differential equations of second order and their classification

REFERENCES:

1. Sneddon I.N : Elements of Partial Differential Equations, Ch. I, II, III, McGraw Hill, 1957.

2.Tyn Mying-U : Differential Equations of Mathematical Physics.

3. Coddington E.A., An Introduction to Ordinary Differential Equations. Ch. V., Prentice Hall of India Pvt. Ltd., New Delhi 1987.

(Semester-I)

Introduction to Computer and Programming using C

Paper Code: MMATH 1105T

Max. Marks: 50 **Credits: 03**

External Exam: 35 Marks **Total teaching hours: 40**

Internal Assessment: 15 Marks

Passing Marks: 35%

Course Objective: The main goal of this course is to write, compile and debug programs in C language. Design programs involving decision control statements, loop control statements and case control statements.

Course Outcomes: The students will have

1. Basic knowledge of computer hardware and software.
2. Use different data types, operators and I/O functions in computer program.
3. Design programs involving decision control statements, loop control statements and case control statements.
4. Understand the implementation of arrays, pointers and functions. Use the file operations, character I/O, strings and pre-processor directives.

INSTRUCTIONS FOR THE PAPER-SETTER

The question paper will consist of three sections: A, B and C. Sections A and B will have four questions each from the respective sections of the syllabus. Section C will consist of one compulsory question having eleven short questions covering the entire syllabus uniformly. Each question in sections A and B will be of 6 marks each and section C will be of 11 marks.

INSTRUCTIONS FOR THE CANDIDATES

Candidates are required to attempt five questions in all selecting two questions from each sections A and B and compulsory question of section C.

SECTION-A

Basics of Computer: memory unit, input-output unit, arithmetic logic unit, control unit, central processing unit, RAM, ROM, PROM, EPROM. Input-Output Devices, Types of computer, Computer generations.
Computer Software: Introduction, types of software: application and systems software. Networking: Basics, types of networks (LAN, WAN, MAN), topologies, communication media, Operating System, Definition, functions and types of operating system.

Computer Languages: Machine Language, assembly language, high level language, 4GL, assembler, compiler and interpreter.

C Programming: character set, Identifiers and keywords, Data types, Declarations, Statement and symbolic constants, Input-output statements, Preprocessor commands.

Operators and Expressions: Arithmetic, relational, logical, unary operators, others operators, Bitwise operators: AND, OR, complement precedence and Associating bitwise shift operators, Input-Output: standard, console and string function.

SECTION-B

Control statements: Branching, looping using for, while and do-while Statements, Nested control structures, switch, break, continue statements.

Functions: Declaration, Definition, Call, passing arguments, call by value, call by reference, Recursion, Use of library functions; Storage classes: automatic, external and static variables.

Arrays: Defining and processing arrays, Passing array to a function, Using multidimensional arrays, Solving matrices problem using arrays.

Strings: Declaration, Operations on strings.

Pointers: Pointer data type, pointers and arrays, pointers and functions.

REFERENCES:

1. Computers Today: Suresh K. Basandra, Galgotia, 1998.
2. Kerninghan B.W. and Ritchie D.M., The C programming language, PHI (1989)
3. Kanetkar Yashawant, Let us C, BPB (2007).

(Semester-I)

Software Laboratory-I (C-Programming)

Paper Code: MMATH 1105P

Max. Marks: 50 **Credits: 02**

External Exam: 35 Marks

Internal Assessment: 15 Marks

Passing Marks: 35%

This laboratory course will mainly comprise of exercises on what is learnt under the paper," Computer Programming using C".

(Semester-II)

Algebra-II
Paper Code: MMATH 1201T

Credits: 04

Max. Marks: 100

Total teaching hours: 55

External Exam: 70 Marks

Internal Assessment: 30 Marks

Passing Marks: 35%

Course Objective: The main goal of this course is to understand the connection between PID, ED and UFD. To know about the concepts Simple Modules, Artinian Modules, Noetherian Modules and their simple characterizations.

Course Outcomes: The students will be able to

1. Understand the connection between PID, ED and UFD.
2. To understand the division algorithm in Polynomial Rings.
3. Able to understand the concepts of modules, submodules and their properties.
4. To understand the difference of Modules and Vector Spaces and can see Modules as generalization of Vector Spaces.

INSTRUCTIONS FOR THE PAPER-SETTER

The question paper will consist of three sections: A, B and C. Sections A and B will have four questions each from the respective sections of the syllabus. Section C will consist of one compulsory question having ten short questions covering the entire syllabus uniformly. Each question in sections A and B will be of 10 marks each and section C will be of 30 marks.

INSTRUCTIONS FOR THE CANDIDATES

Candidates are required to attempt five questions in all selecting two questions from each sections A and B and compulsory question of section C.

SECTION-A

Division in Rings, Unique Factorization Domains, Principal Ideal Domains, Euclidean Domains, Polynomial Rings over UFD, Modules, Unital Modules, Submodules, Direct sum and Direct Summand, Quotient modules Homomorphism, Simple modules, Isomorphic Theorems.

SECTION-B

Free modules, Difference between modules and vector spaces, Modules over PID.
Modules with chain conditions: Artinian Modules, Noetherian Modules, Artinian Rings, Noetherian Rings, Composition series of a module, Length of a module, Hilbert Basis Theorem, Cohen Theorem.

REFERENCES:

1. Bhattacharya, Jain and Nagpaul: Basic Abstract Algebra, Second Edition.
2. Musili C., Introduction to Rings and Modules, Second Revised Edition.

(Semester-II)

Complex Analysis
Paper Code: MMATH 1202T

Max. Marks: 100

Credits: 04

External Exam: 70 Marks

Total teaching hours: 55

Internal Assessment: 30 Marks

Passing Marks: 35%

Course Objective: The main goal of this course is to study the theory of complex variable with reference to the real variables. To deal with the concept of analytic continuation by extending the domain of analyticity.

Course Outcomes: The students will be able to

1. Analyse the behavior of derivative of a function of a complex variables.
2. To deal effectively with the numerical concepts related to analytic functions and harmonic functions.
3. Construction of various methods to deal with complex integration.
4. To investigate the behavior of a function at the singularities through various series expansions.

INSTRUCTIONS FOR THE PAPER-SETTER

The question paper will consist of three sections: A, B and C. Sections A and B will have four questions each from the respective sections of the syllabus. Section C will consist of one compulsory question having ten short questions covering the entire syllabus uniformly. Each question in sections A and B will be of 10 marks each and section C will be of 30 marks.

INSTRUCTIONS FOR THE CANDIDATES

Candidates are required to attempt five questions in all selecting two questions from each sections A and B and compulsory question of section C.

SECTION-A

Function of complex variable, Analytic function, Cauchy-Riemann equations, Harmonic function and Harmonic conjugates, Conformal Mapping. Complex Integration, Cauchy's theorem, Cauchy Goursat theorem, Cauchy integral formula, Morera's theorem, Liouville's theorem, Fundamental theorem of Algebra, Maximum Modulus Principle, Schwarz lemma.

SECTION-B

Taylor's theorem. Laurent series in an annulus. Singularities, Meromorphic function. Cauchy's theorem on residues. Application to evaluation of definite integrals. Principle of analytic continuation, General definition of an analytic function. Analytic continuation by power series method, Natural boundary.

REFERENCES:

1. H.S. Kasana, Complex Variables, Prentice Hall of India
2. E.T. Copson, An introduction to Theory of Functions of a Complex Variable.
3. Herb Silverman, Complex Variables, Houghton Mifflin Company Boston.

(Semester-II)

Topology-I

Paper Code: MMATH 1203T

Max. Marks: 100 **Credits: 04**

External Exam: 70 Marks **Total teaching hours: 55**

Internal Assessment: 30 Marks

Passing Marks: 35%

Course Objective: The main goal of this course is to deliver basics of countable, uncountable sets and understand the concept of open-sets, closed set, interior and exterior points. Can understand the topological properties like compactness, connectedness and the countability axioms and find their numeroususes in the course.

Course Outcomes: The students will be able to

1. Understand the topological properties like compactness, connectedness and the countability axioms and find their numerous uses in the course.
2. The concepts of basis and sub-basis of a space, of interior and closure set the stage for the most general study of continuity.
3. Enables the student to understand the special characters of the metric spaces as an important special case of a topological space.
4. Enables the student to use these concepts in other areas of their studies whenever needed and establishing the importance of rigorous proof in mathematics.

INSTRUCTIONS FOR THE PAPER-SETTER

The question paper will consist of three sections: A, B and C. Sections A and B will have four questions each from the respective sections of the syllabus. Section C will consist of one compulsory question having ten short questions covering the entire syllabus uniformly. Each question in sections A and B will be of 10 marks each and section C will be of 30 marks.

INSTRUCTIONS FOR THE CANDIDATES

Candidates are required to attempt five questions in all selecting two questions from each sections A and Band compulsory question of section C.

SECTION-A

Cardinals: Equipotent sets, Countable and Uncountable sets, Cardinal Numbers and their Arithmetic, Bernstein's Theorem and the Continumm Hypothesis.

Basic topology: Definition and Examples, Topologizing of Sets; Sub-basis, Equivalent Basis, Euclidean spaces as topological spaces, Basis for a given topology.

Basic concepts: Closure, Interior, Frontier and Dense Sets, Topologizing with pre-assigned elementary operations, Subspaces. Maps and Product spaces: Continuous Maps, Characterization of Continuity, Continuity at a point, Piecewise definition of Maps and Neighborhood finite families. Open Maps and Closed Maps, Homeomorphisms and Embeddings.

SECTION-B

Cartesian product topology: Elementary Concepts in Product Spaces, Continuity of Maps in Product Spaces. Connectedness: Connectedness and its characterizations, Continuous image of connected sets, Connectedness of Product Spaces, Applications to Euclidean spaces. Components. Path Connectedness. Compactness and Countability: Compactness and Countable Compactness, Local Compactness, One-point Compactification, T 0, T 1 , and T 2 spaces, T 2 spaces and Sequences and Hausdorfness of One-Point Compactification. Axioms of Countablity and Separability, Equivalence of Second axiom, Separable and Lindelof in Metric Spaces. Equivalence of Compact and Countably Compact Sets in Metric Spaces.

REFERENCES:

1. James Munkres: Topology, 2nd Edition Pearson

2. Steen and Seebach : Counterexamples in Topology, Dover Books

3. Stephen Willard: General Topology Addison Wesley.

(Semester-II)
Functional Analysis
Paper Code: MMATH 1204T

Max. Marks: 100 **Credits: 04**

External Exam: 70 Marks **Total teaching hours: 55**

Internal Assessment: 30 Marks

Passing Marks: 35%

Course Objective: The main goal of this course is to understand Hilbert spaces including orthogonality, orthonormal sets, Bessel's inequality, Parseval's theorem. Differentiate between Banach Space and Hilbert Space.

Course Outcomes: The students will be able to

1. Understand and apply fundamental theorems Hahn-Banach theorem in Normed linear spaces and its applications, uniform boundedness principle, open mapping theorem, closed graph theorem.
2. Use and derive basic definitions and theorems of functional analysis.
3. Apply contraction and approximation theory in differential equations and integral equations.

INSTRUCTIONS FOR THE PAPER-SETTER

The question paper will consist of three sections: A, B and C. Sections A and B will have four questions each from the respective sections of the syllabus. Section C will consist of one compulsory question having ten short questions covering the entire syllabus uniformly. Each question in sections A and B will be of 10 marks each and section C will be of 30 marks.

INSTRUCTIONS FOR THE CANDIDATES

Candidates are required to attempt five questions in all selecting two questions from each sections A and Band compulsory question of section C.

SECTION-A

Normed Linear spaces, Banach spaces, Examples of Banach spaces and subspaces. Continuity of Linear maps, Equivalent norms. Normed spaces of bounded linear maps. Bounded Linear functional. Hahn-Banach theorem in Linear Spaces and its applications.

Hahn-Banach theorem in normed linear spaces and its applications. Uniform boundedness principle, Open mapping theorem, Projections on Banach spaces, Closed graph theorem.

SECTION-B

The conjugate of an operator. Dual spaces of lp and C [a,b], Reflexivity. Hilbert spaces, examples, Orthogonality, Orthonormal sets, Bessel's inequality, Parseval's theorem. The conjugate space of a Hilbert spaces. Adjoint operators, Self-adjoint operators, Normal and unitary operators. Projection operators. Spectrum of an operator, Spectral Theorem.

REFERENCES:

1. George Bachman & Lawrence Narici: Functional Analysis.
2. E. Kreyszig, Introductory Functional Analysis with applications
3. Abul Hasan Siddiqi , Applied Functional Analysis. Marcel Dekker.

(Semester-II)

Mathematical Statistics
Paper Code: MMATH 1205T

Max. Marks: 100 **Credits: 04**

External Exam: 70 Marks **Total teaching hours: 55**

Internal Assessment: 30 Marks

Passing Marks: 35%

Course Objective: The main goal of this course is to to understand the axiomatic approach to probability with reference to the conceptual details of the set theory. To obtain various generating functions for different discrete and continuous distributions and derive their properties.

Course Outcomes: The students will be able to

1. Understand the theory of statistics through mathematical techniques.
2. Demonstration of the uses of specific parametric families of univariate density functions in day to day life.
3. To understand the concept of sampling and some important sampling distributions to make inferences about the population.
4. To apply the knowledge of two important aspects of statistical inference-estimation and test of hypothesis in various feasible statistical and mathematical spheres.

INSTRUCTIONS FOR THE PAPER-SETTER

The question paper will consist of three sections: A, B and C. Sections A and B will have four questions each from the respective sections of the syllabus. Section C will consist of one compulsory question having ten short questions covering the entire syllabus uniformly. Each question in sections A and B will be of 10 marks each and section C will be of 30 marks.

INSTRUCTIONS FOR THE CANDIDATES

Candidates are required to attempt five questions in all selecting two questions from each sections A and Band compulsory question of section C.

SECTION-A

Algebra of sets, fields, limits of sequences of subsets, sigma-fields generated by a class of subsets. Probability measure on a sigma-field, probability space. Axiomatic approach to probability.

Real random variables, distribution functions, discrete and continuous random variables, decomposition of a distribution function, Independence of events. Expectation of a real random variable. Linear properties of expectations, Characteristic functions, their simple properties

Discrete probability distributions: Binomial distribution, Poisson distribution, negative binomial distribution, geometric distribution.

Continuous probability distributions: Normal distribution, rectangular distribution, gamma distribution, beta distribution of first and second kind, exponential distribution.

SECTION- B

Theory of Estimation: Population, sample, parameter and statistic, sampling distribution of a statistic, standard error. Interval estimation, Methods of estimation, properties of estimators, confidence intervals.

Exact Sampling Distributions: Chi-square distribution, Student's t distribution, Snedecor's F-distribution, Fisher's – Z distribution .

Hypothesis Testing: Tests of significance for small samples, Null and Alternative hypothesis , Critical region and level of significance. Tests of hypotheses, Tests of significance based on t, Z and F distributions, Chi square test of goodness of fit. Large Sample tests, Sampling of attributes, Tests of significance for single proportion and for difference of proportions, Sampling of variables, tests of significance for single mean and for difference of means and for difference of standard deviations.

REFERENCES:

1. Goon, A. M., Gupta, M. K., & Dasgupta, B. (2003). *An outline of statistical theory(Vol 1 & 2)*. World Press Pvt Limited.
2. Lehmann, E. L., & Casella, G. (1998). *Theory of point estimation* (Vol. 31). Springer
3. Science & Business Media.
4. Lehmann, E. L., & Romano, J. P. (2006). *Testing statistical hypotheses*. Springer Science & Business Media.