FACULTY OF SCIENCES

SYLLABUS FOR THE BATCH FROM THE YEAR 2024 TO YEAR 2026

Programme Code: MST

Programme Name: M.Sc. Statistics

(Semester I-II)

Examinations: 2024-2026

Department of Mathematics

Khalsa College, Amritsar

S.No.	PROGRAMME OBJECTIVES
1.	To enhance problem solving skills and develop logical thinking.
2.	To exhibit proficiency in application of statistics to solve daily life problems.

S.No.	PROGRAMME SPECIFIC OUTCOMES (PSOS)
PSO-1	understand basic theoretical and applied principles of statistics with adequate preparation to pursue a PhD or enter the job force as an applied statistician.
PSO-2	demonstrate technical and technological skills based on Statistical methods to meet the growing demand in the industrial, marketing, communication sectors.

COURSE SCHEME											
SEMESTER - I											
Course Code	**Course Name**	**Hours/Week**	**Credits**			**Total Credits**	**Max Marks**				**Page No.**
			L	**T**	**P**		**Th**	**P**	**IA**	**Total**	
Major Courses											
MST-411	Probability Theory -I	6	5	1	0	6	**75**	**-**	**25**	**100**	**4-5**
MST-412	Statistical Methods	6	5	1	0	6	**75**	**-**	**25**	**100**	**6-7**
MST-413	Linear Algebra & Numerical Analysis	6	5	1	0	6	**75**	**-**	**25**	**100**	**8-9**
MST-414	Object Oriented Programming Using 'C++'	6	4	0	2	6	**56**	**19**	**25**	**100**	**10-11**
MST-415	Computer Oriented Statistical Practicals -I	6	4	0	2	6	**75**	**-**	**25**	**100**	**12-13**
Total		30	23	3	4	30	**-**	**-**	**-**	**500**	

SEMESTER - II											
Course Code	**Course Name**	**Hours/Week**	**Credits**			**Total Credits**	**Max Marks**				**Page No.**
			L	**T**	**P**		**Th**	**P**	**IA**	**Total**	
Major Courses											
MST-421	Probability Theory-II	6	5	1	0	6	**75**	**-**	**25**	**100**	**14-15**
MST-422	Statistical Inference-I	6	5	1	0	6	**75**	**-**	**25**	**100**	**16-17**
MST-423	Sampling Theory	6	5	1	0	6	**75**	**-**	**25**	**100**	**18-19**
MST-424	Demography & Vital Statistics	6	5	1	0	6	**75**	**-**	**25**	**100**	**20-21**
MST-425	Computer Oriented Statistical Practicals -II	6	4	0	2	6	**75**	**-**	**25**	**100**	**22-23**
Total		30	24	4	2	30	**-**	**-**	**-**	**500**	

Khalsa College, Amritsar

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Syllabus for

PROGRAMME: M.Sc. Statistics

(Semester-I)

COURSE TITLE: PROBABILITY THEORY-I

COURSE CODE: MST-411

L	T	P	Credits
5	1	0	6

CREDIT HOURS:6

TOTAL HOURS: 90 hrs

Time: 3Hrs **MAXIMUM MARKS:100**

Medium: English **(Theory :75**

Internal Assesment:25)

INSTRUCTIONS FOR PAPER SETTERS:

1. The question paper will consists of five sections namely Section-A, which will be from entire syllabus (equally distributed from each unit), Section–B, C, D and E from Unit-I, II, III and IV, respectively.
2. Section–A will consists of eight short answer type questions, each of 2.5 marks. Students are to attempt any six.
3. Sections–B, C, D & E will consist of two questions each**(each question should be sudivided into two parts)**. Students are to attempt any four questions in total by selecting one question from each section. Each question carries 15marks.
4. Question paper should cover at least 40% article work from the recommended books.
5. Teaching time for this paper would be eight periods per week.

COURSE OBJECTIVE:

- Concept of probability
- Basics of discrete distributions and know their properties
- Basics of continuous distributions and know their properties

COURSE CONTENT:

UNIT-I

Random Experiment: Trial, Sample Point and Sample Space, Events, Operations on Events; Definition of Probability : Classical, Relative Frequency and Axiomatic Approach; Properties of Probability Function based on Axiomatic Approach; Combinatorial Problems, Addition Theorem, Conditional Probability, Multiplication Theorem.

UNIT-II

Independence of Events, Bayes Theorem; Random Variable: One & Two Dimensional Random Variable, Distribution Function of a Random Variable, Discrete and Continuous Random Variables and their Probability Distributions, Marginal and Conditional Distributions associated with a two Dimensional Distribution. Independence of Random Variables, Expectation of a Random Variable, Moments (Raw & Central) & their inter-relationship.

UNIT-III

Generating Functions : Probability Generating Functions & Moment Generating Functions; Study of Various Discrete Distributions: Rectangular, Hyper Geometric, Binomial, Poisson, Negative Binomial , Geometric, Multinomial .

UNIT-IV

Study of Various Continuous Distributions: Uniform, Normal, Gamma, Beta, Exponential, Laplace, Cauchy, Bivariate Normal Distribution and its Marginal and Conditional Distributions. Sampling Distribution, Mean and Standard Error of a Sampling Distribution. Derivation of the Sampling Distributions of Chi. Square, T, F (Null Case Only), Sample Mean and Sample Variance for Sampling from a Normal Population and their Properties.

TEXT BOOKS

1. Meyer, P.L.Introductory Probability and Statistical Applications, 2017 Oxford & IBH publishing , 2nd Edition.
2. Gun,A.M., Gupta, M.K. and Dasgupta, B. An Outline of Statistical Theory. Vol. I, 2016, 3rd ed. World Press.

REFERENCE READINGS

1. Rohatgi, V.K. and Saleh Ehsanes Md. A. K. An introduction to Probability theory and Mathematical Statistics, 3rd Edition, Wiley Eastern Ltd, 2015
2. Gupta, S.C. and zKapoor, V.K. Fundamentals of Mathematical Statistics, 2014 Sultan Chand and Sons, 4th Edition

COURSE OUTCOME: On completion of the course the learner should be able to:

- comprehend the concept of probability and random variables.
- understand the properties and uses of various discrete distributions (Rectangular, Hyper Geometric, Binomial, Poisson, Negative Binomial, Geometric, Multinomial).
- understand the properties and uses of various continuous distributions (Normal, Gamma, Beta, Exponential, Laplace, Cauchy, Bivariate Normal Distribution).

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Syllabus for

PROGRAMME: M.Sc. Statistics

(Semester-I)

COURSE TITLE: STATSTICAL METHODS

COURSE CODE: MST-412

L	T	P	Credits
5	1	0	6

CREDIT HOURS:6

TOTAL HOURS: 90 hrs

Time: 3Hrs **MAXIMUM MARKS:100**

Medium: English **(Theory :75**

Internal Assesment:25)

INSTRUCTIONS FOR PAPER SETTERS:

1. The question paper will consists of five sections namely Section-A which will be from entire syllabus (equally distributed from each unit), Section–B, C, D and E from Unit-I, II, III and IV, respectively.
2. Section–A will consists of eight short answer type questions, each of 2.5 marks. Students are to attempt any six.
3. Sections–B, C, D & E will consist of two questions each**(each question should be sudivided into two parts)**. Students are to attempt any four questions in total by selecting one question from each section. Each question carries 15marks.
4. Question paper should cover at least 40% article work from the recommended books.
5. Teaching time for this paper would be eight periods per week.

COURSE OBJECTIVE:

- To introduce the technique of data collection and its presentation.
- To emphasize the need for numerical summary measures for data analysis.

COURSE CONTENT:

UNIT-I

Basic concepts of Statistics, Concepts of central tendency, dispersion, skewness and kurtosis and their respective measures upon quantiles and moments, Sheppard's correction for moments.

UNIT-II

Bivariate data : Concept of Correlation, regression and errors in regression, Coefficient of correlation & its properties, coefficient of determination, Principle of least square, fitting of linear regression & related properties.

UNIT-III

Multivariate data : Multiple linear regression, Partialand Multiple correlation. Correlation ratio, rank correlation and intra-class correlation. Categorical data: Basic concepts, consistency of data, independence & association of attributes, various measures of association.

UNIT-IV

Concept of fixed effect model, Analysis of variance for one way, two way classification with equal and unequal number of observations per cell under the fixed effects models. Assumptions and applications of t, chi-square, F and Z statistics. Large samples test for means, proportions, goodness of fit and independence of attributes in contingency tables.

TEXT BOOKS

1. Gun, A.M., Gupta M.K., Dasgupta, B. — Fundamentals of Statistics. Vol. 1. 2016, World Press. Calcutta.
2. Gupta, S.C. and Kapoor, V.K. — Fundamentals of Mathematical Statistics, **2019**. Sultan Chand and Sons, 4th Edition.
3. Freund J.E. — Mathematical Statistics, Prentice Hall Of India,2001.

COURSE OUTCOMES: On completion of the course the learner should be able to:

1. use various techniques of data collection and presentation.
2. understand different summary measures of location (averages) used for data analysis and the basis for their selection.
3. choose appropriate methods to present data.
4. select and calculate appropriate averages to represent data sets
5. use of statistical tools to carry out elementary categorical data analysis.

Khalsa College, Amritsar

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Syllabus for

PROGRAMME: M.Sc. Statistics

Semester-I

COURSE TITLE: LINEAR ALGEBRA AND NUMERICAL ANALYSIS

COURSE CODE: MST-413

L	T	P	Credits
5	1	0	6

CREDIT HOURS:6

TOTAL HOURS: 90 hrs

Time: 3Hrs **MAXIMUM MARKS:100**

Medium: English **(Theory :75**

Internal Assesment:25)

INSTRUCTIONS FOR PAPER SETTERS:

1. The question paper will consists of five sections namely Section-A, which will be from entire syllabus (equally distributed from each unit), Section–B, C, D and E from Unit-I, II, III and IV, respectively.
2. Section–A will consists of eight short answer type questions, each of 2.5 marks. Students are to attempt any six.
3. Sections–B, C, D & E will consist of two questions each**(each question should be sudivided into two parts)**. Students are to attempt any four questions in total by selecting one question from each section. Each question carries 15marks.
4. Question paper should cover at least 40% article work from the recommended books.
5. Teaching time for this paper would be eight periods per week.

COURSE OBJECTIVE:

- To understand the concepts of vector spaces, subspaces, bases, dimension and their properties.
- To get familiar with Quotient space, Direct sum, linear span and linear independence.
- To understand the concept of Rank and nullity of linear transformations.
- To relate matrices and linear transformations
- The content of this course is designed to make the students understand the use of: Bi-section method, Regula-falsi method, and Newton-Raphson method
- It will help the students to understand the difference between Difference and shift operators
- It enable the students to solve linear and non-linear equations, in numerical integration.

COURSE CONTENT:

UNIT-I

Fields, Vector Spaces: Linear dependence and independence, Basis and dimension of a vector space, examples of vector spaces. Linear transformations, row and column spaces of a matrix, elementary matrices, determinant, rank and inverse of a matrix, null space and nullity.

UNIT-II

Orthogonal Transformations and Orthogonal matrix, Gram-Schmidt Orthogonalisation process, characteristic roots and characteristic vectors, Diagonalization of a matrix, triangular form of a matrix, Real quadratic forms, reduction and classification of quadratic forms .

UNIT-III

Difference and shift operators, identities involving separation of symbols and differences of zero, Newton's forward and backward interpolation formulae and estimation of the missing terms. Divided differences, Newton's and Lagrange's interpolation formulae for unequal intervals.

UNIT-IV

Solution of Transcendental and polynomial equations: Bi-section method, Regula-falsi method, Newton-Raphson method, Secant method. Numerical Integration : Simpson's one-third and three eighth & Weddle's formulae. Solution to simultaneous linear and Algebraic equations : Gauss elimination method, pivoting, ill-conditioned equations, Gauss-Seidal iterative method.

TEXT BOOKS

1. Hadley,G — Linear Algebra, **Addison Wesley, 2002**.
2. Saxena. H.C. — Calculus of Finite differences and Numerical Analysis, S Chand and Co., New Delhi, IXth Ed, **2010.**
3. B.S. Grewal — Numerical Methods, Khanna Publishers, **2015**.

REFERENCE READINGS

1. Bala Guruswamy : Computer Oriented Numerical Methods, **McGraw Hill Education, 2017.**
2. B. D. Gupta : Numerical Analysis, Konark Pub. Ltd., 2001.

COURSE OUTCOMES: On completing the course, the students will be able to:

- have the knowledge of the study of algorithms that use numerical approximation for the problems of mathematical analysis.
- apply numerical analysis in all the fields of engineering, physical sciences, life sciences, social sciences, medicine, business and even the arts have adopted elements of scientific computations.
- check the linear independence of vectorsand Form the linear combination of vectors.
- find the matrix corresponding to a linear transformation and vice versa.

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Syllabus for

PROGRAMME: M.Sc. Statistics (Semester-I)

Object Oriented Programming Using 'C++'

COURSE CODE: MST-414

L	T	P	Credits
4	0	2	6

TOTAL HOURS: 90 hrs

Time: 3Hrs **MAXIMUM MARKS:100**

Medium: English **(Theory: 56**

Internal Assesment Theory Marks:18

Practical Marks:19

Medium : English **Practical Internal Assesment Marks: 07)**

INSTRUCTIONS FOR PAPER SETTERS:

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1. The question paper will consists of five sections namely Section-A, which will be from entire syllabus (equally distributed from each unit), Section–B, C, D and E from Unit-I, II, III and IV, respectively.
2. Section–A will consists of eight short answer type questions, each of 2 marks. Students are to attempt any six.
3. Sections–B, C, D & E will consist of two questions each**(each question should be sudivided into atmost two parts)**. Students are to attempt any four questions in total by selecting one question from each section. Each question carries 11marks.
4. Teaching time for this paper would be six periods per week.

COURSE OBJECTIVE:

The learning objectives of this course are:

1. To understand how C++ improves C with object-oriented features.

2. To learn how to design C++ classes for code reuse.

3. To learn how to implement copy constructors and class member functions.

4. To understand the concept of data abstraction and encapsulation.

5. To learn how to overload functions and operators in C++.

6. To learn how containment and inheritance promote code reuse in C++.

7. To learn how inheritance and virtual functions implement dynamic binding with polymorphism.

8. To learn how to design and implement generic classes with C++ templates.

COURSE CONTENT:

UNIT-I

Evolution of OOP, OOP Paradigm, Advantages of OOP, Comparison between Functional Programming and OOP Approach, Characteristics of Object Oriented Language-objects, Classes, Inheritance, Reusability, User defined Data Types, Polymorphism , Overloading.

Introduction to C++ , Identifier and keywords, Constants, C++ Operators, type conversion, Variable declaration, statements, expressions, features of iostream.h and iomanip.h, input and output, conditional expression loop statements, breaking control statements.

UNIT-II

Defining a function, types of functions, storage class specifiers, recursion, pre- processor, header files and standard functions, Arrays, pointer arithmetic's, structures, pointers and structures, unions, bit fields typed, enumerations.

UNIT-III

Classes, member functions, objects, arrays of class objects, pointers and classes, nested classes, constructors, destructors, inline member functions, static class member, friend functions, dynamic memory allocation.

Inheritance, single inheritance, types of base classes, types of derivation, multiple inheritance, container classes, member access control.

UNIT-IV

Function overloading, operator overloading, polymorphism, early binding, polymorphism with pointers, virtual functions, late binding, pure virtual functions, opening and closing of files, stream state member functions, binary file operations, structures and file operations, classes and file operations, random access file processing.

REFERENCES

1. Robert Lafore, "Object Oriented Programming in C++", Pearson Education India, 4th Edition, 2008.

2. D. Ravichandran, "Programming with C++", Edition, 2017.

COURSE OUTCOMES:

Course Outcomes:

Upon completion of this course, the students will be able to:

- **CO-1.** Understand the difference between the top-down and bottom-up approach.
- **CO-2.** Describe the object-oriented programming approach in connection with C++.
- **CO-3.** Apply the concepts of object-oriented programming.
- **CO-4.** Illustrate the process of data file manipulations using C++.
- **CO-5.** Apply virtual and pure virtual function & complex programming situations.

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Syllabus for

PROGRAMME: M.Sc. Statistics (Semester-I)

COURSE TITLE: COMPUTER ORIENTED STATISTICAL PRACTICALS –I

COURSE CODE: MST-415

L	T	P	Credits
4	0	2	6

TOTAL HOURS: 90 hrs

Time:3Hrs **MAXIMUM MARKS:100**

Medium:English **(Theory :75**

Internal Assesment:25)

INSTRUCTIONS FOR THE PAPER-SETTERS

1. The paper will be set in two separate parts PART-A and PART-B .The setting and evaluation will be done by a Board of examiners consisting of Head (Chairman), External Examiners and Teacher (S) involved with the teaching of this paper.
2. PART-A of this paper will be set on the spot and will be of one and a half hours duration. This part will consist of two problems. The problems will be **based on theory papers COURSE CODE: MST411, COURSE CODE: MST 412 & COURSE CODE: MST 413** using Programming in "C++" or Statistical Software packages such as R, MINITAB , SPSS , STATGRAF, STATISTICA, etc.
3. PART-B of the paper will be of one and a half hours duration. This part will consist of FOUR questions **based on theory papers COURSE CODE: MST 411, COURSE CODE: MST 412 & COURSE CODE: MST 413** with at least one question from each of these papers. The candidates will be required to attempt any TWO questions using electronic device.
4. The division of marks out of a total of 75 and Minimum pass Marks, will be as follows :

Maximum Marks	75
Minimum pass Marks	30(40%)
Sessional work	15
Viva	12
Exercises based on Part A	20
Exercises based on Part B	28

COURSE OBJECTIVES:

- To understand the patterns in the data of large populations using Programming in "C++".
- To obtain the central location and dispersion of the data using s R language, SPSS, STATGRAF, STATISTICA.

COURSE CONTENT:

SYLLABUS DETAILS FOR PAPER-V (PRACTICAL)

PART-A: Programming in "C" Applying statistical software packages for problems based on Theory papers **COURSE CODE: MST 411, COURSE CODE: MST 412 & COURSE CODE: MST 413**

Use of Statistical Software packages such as MINITAB , SPSS , Statgraf etc.

PART-B: Practical Exercises for Statistical techniques based on topics in papers **COURSE CODE: MST 411, COURSE CODE: MST 412 & COURSE CODE: MST 413.**

RECOMMENDED READINGS

Stoodly. K.: Applied and computational Statistics, Ellis Howard.

COURSE OUTCOMES:

- Derive important statistical programme for moment generating function, joint probability mass functions, marginal densities, conditional distributions.
- Possess deeper understanding of the properties and uses of various computer languages to develop programme for discrete distributions and continuous distributions.

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Syllabus for

PROGRAMME: M.Sc. Statistics

(Semester-II)

COURSE TITLE: PROBABILITY THEORY–II

COURSE CODE: MST-421

L	T	P	Credits
5	1	0	6

TOTAL HOURS: 90 hrs

Time: 3Hrs **MAXIMUM MARKS:100**

Medium: English **(Theory :75**

Internal Assesment:25)

INSTRUCTIONS FOR PAPER SETTERS:

1. The question paper will consists of five sections namely Section-A, which will be from entire syllabus (equally distributed from each unit), Section–B, C, D and E from Unit-I, II, III and IV, respectively.
2. Section–A will consists of eight short answer type questions, each of 2.5 marks. Students are to attempt any six.
3. Sections–B, C, D & E will consist of two questions each**(each question should be sudivided into two parts)**. Students are to attempt any four questions in total by selecting one question from each section. Each question carries 15marks.
4. Question paper should cover at least 40% article work from the recommended books.
5. Teaching time for this paper would be eight periods per week.

COURSE OBJECTIVE:

- To understand the Graphical representation of distribution function.
- To understand the Moment inequalities.
- To know the relationship between Central Limit Theorems: De Moivre's –Laplace, Lindeberg-Levy, Liapounov and their applications.

COURSE CONTENT:

UNIT-I

Distribution functions, Decomposition of a distribution function into discrete, absolutely continuous and singular components. Graphical representation of distribution function. Distribution function of n-dimensional random variable, marginal and conditional distribution functions, independence of two or more sets of random variables. Product moments and moments of marginal and conditional distributions (conditional expectation and conditional variance)

UNIT-II

Moment inequalities : Cauchy-Schwarz and its extension, **Cr** - inequality, Holder- inequality, Minkowiski, Basic- inequality, Jensen inequality (statement only) Liapounov Inequality. Probability inequalities : Markov, Chebyshev and one sided Chebyshev. Various modes of convergence: in probability, almost sure, in distribution and in mean square and their inter-relationship .

UNIT-III

Law of Large Numbers : Weak Law of Large Numbers (Chebyshev's, Khinchin's, Bernoulli's & Poisson's). Kolmogorov SLLN (only statement). Characteristic function : Definition and its elementary property, Inversion and Uniqueness Theorem .

UNIT-IV

Continuity Theorem, necessary and sufficient condition for a function to be a characteristic function (only statement and applications). Central Limit Theorems: De Moivre's –Laplace, Lindeberg-Levy, Liapounov and their applications.

TEXT BOOKS

1. Gun,A.M., Gupta, M.K. and Dasgupta, B. An Outline of Statistical Theory. Vol. I, 2016 , 3rd Edition, World Press.
2. Bhat,B.R. Modern Probability theory : An Introductory Text Book, 2014, New Age International Private Limited.
3. Rohtagi V.K. and Saleh Ehsanes Md. A. K. An introduction to Probability theory and Mathematical Statistics, 3rd Edition, Wiley Eastern Ltd, 2015

REFERENCE READINGS

1. Chung, K.L. A Course in Probability theory, 2000, 3rd Edition, Academic Press.
2. Rao, C.R Linear Statistical Inference and its applications,
2009, 2nd Edition, Wiley Eastern.

COURSE OUTOCOMES:

- Derive important statistical functions of variables, moment generating function, joint probability mass functions, marginal densities, conditional distributions.
- Possess deeper understanding of the Distribution function of n- dimensional random variable, marginal and conditional distribution functions, and independence of two or more sets of random variables.
- Have a deeper understanding of the properties, uses and applications of Law of Large Number; know the central limit theorem and its applications.

Khalsa College, Amritsar

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Syllabus for

PROGRAMME: M.Sc. Statistics

(Semester-II)

COURSE TITLE: STATISTICAL INFERENCE-I

COURSE CODE: MST-422

L	T	P	Credits
5	1	0	6

TOTAL HOURS: 90 hrs

Time: 3Hrs **MAXIMUM MARKS:100**

Medium: English **(Theory :75**

Internal Assesment:25)

INSTRUCTIONS FOR PAPER SETTERS:

1. The question paper will consists of five sections namely Section-A, which will be from entire syllabus (equally distributed from each unit), Section–B, C, D and E from Unit-I, II, III and IV, respectively.
2. Section–A will consists of eight short answer type questions, each of 2.5 marks. Students are to attempt any six.
3. Sections–B, C, D & E will consist of two questions each**(each question should be sudivided into two parts)**. Students are to attempt any four questions in total by selecting one question from each section. Each question carries 15marks.
4. Question paper should cover at least 40% article work from the recommended books.
5. Teaching time for this paper would be eight periods per week.

COURSE OBJECTIVE: To study:

- Method of moments, method of maximum likelihood and also properties of ML estimator.
- Testing of hypotheses.
- Tests for the mean and variance of a Normal distribution.

UNIT-I

Problem of point estimation. Consistent estimators, Sufficient statistics. Neyman-Fisher Factorization theorem, unbiasedness and uniformly minimum variance unbiased estimator, Rao-Blackwell theorem, complete family of distributions . Lehman-Scheffe's theorem and its applications in finding UMVU estimators. Cramer-Rao inequality and most efficient estimator.

UNIT-II

Methods of Estimation: Method of moments, method of maximum likelihood (also properties of ML estimator), method of least squares and method of minimum chi-square and modified minimum chi- square.

UNIT-III

Concept of statistical hypothesis, simple and composite hypothesis, null and alternative hypothesis. Critical region, two types of errors, level of significance, size of the test, power and power function, Neyman-Pearson theory of testing of hypotheses: Neyman-Pearson fundamental lemma (existence and sufficient condition); Construction of most powerful (MP) and uniformly most powerful (UMP) tests using Neyman-Pearson lemma. MP, UMP and UMPU regions in random sampling from a Binomial, Poisson and Normal Exponential distributions, Definitions & Construction of type A and type A1 critical regions. Optimum regions and sufficient statistics, Randomized tests.

UNIT-IV

Composite hypothesis and similar regions, similar regions and complete sufficient statistics, Neyman structure, construction of most powerful similar regions. Tests for the mean and variance of a Normal distribution, Monotonicity, Consistency and invariance properties of a test. Likelihood ratio tests and their optimum properties. Confidence interval and confidence coefficient. General method of obtaining confidence limits, shortest confidence interval. Confidence interval for the parameters of univariate Normal and two independent Normal populations.

TEXT BOOKS

1. Gun, AM.,Gupta, M.K. Dasgupta, B. — An Outline of Statistical Theory, Vol.II, The World press, Calcutta, 2013.
2. Rohatgi, V.K. and Saleh Ehsanes Md. A. K. — An introduction to Probability theory and Mathematical Statistics, 3rd Edition, Wiley Eastern Ltd, 2015

REFERENCE READINGS

1. Lehman, E.L., Romano, J.P., Testing Statistical Hypotheses, Springer, 3rd Edition, 2008.
2. Lehman, E.L., Casella, G. Testing of point Estimation, Springer, 2nd Edition, 1998
3. Rao, C.R. Linear Statistical Inference and its Applications, Wiley Eastern, 2nd ed. 1994

COURSE OUTCOMES:

- Students are able to identify some basic Problem of point estimation, Consistent estimators and are cognizant of their properties.
- Students are knowledgeable about the Methods of estimation and uses.
- Students are knowledgeable in general about the concept of Composite hypothesis and similar regions.

Khalsa College, Amritsar

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Syllabus for

PROGRAMME: M.Sc. Statistics

(Semester-II)

COURSE TITLE: SAMPLING THEORY

COURSE CODE: MST-423

L	T	P	Credits
5	1	0	6

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TOTAL HOURS: 90 hrs

Time: 3Hrs **MAXIMUM MARKS:100**

Medium: English **(Theory :75**

Internal Assesment:25)

INSTRUCTIONS FOR PAPER SETTERS:

1. The question paper will consists of five sections namely Section-A, which will be from entire syllabus (equally distributed from each unit), Section–B, C, D and E from Unit-I, II, III and IV, respectively.
2. Section–A will consists of eight short answer type questions, each of 2.5 marks. Students are to attempt any six.
3. Sections–B, C, D & E will consist of two questions each**(each question should be sudivided into two parts)**. Students are to attempt any four questions in total by selecting one question from each section. Each question carries 15marks.
4. Question paper should cover at least 40% article work from the recommended books.
5. Teaching time for this paper would be eight periods per week.

COURSE OBJECTIVE:

- Understand the techniques for data collection and its analysis.
- Understand the Need of Sampling, Planning and organization of a survey.
- Basic techniques of double sampling and Cluster sampling.

COURSE CONTENT:

UNIT-I

Basic concepts: Need of Sampling, Planning and organization of a survey, Sources of errors in surveys, non-response and measurement errors, Ordered and unordered sampling designs, Sampling scheme, procedure of selecting a sample, Estimator and its desirable properties and Sampling strategy, Horvitz-Thompson estimator, its variance and unbiased estimator of the variance.

Simple random sampling (SRS) with and without replacement: Estimation of various parameters for quantitative and qualitative characteristics; estimation of sample size for specified precision.

UNIT-II

Stratified random sampling (StRS): Arbitrary, proportional and optimum allocations, relative precision of stratified and simple random sampling, stratified sampling for proportions, Effect of deviations from the optimum allocation, construction of strata, estimation of gain due to stratification, estimation of variance with one unit per stratum.

Bivariate Population under SRS: Estimation of covariance and the ratio of two means (or totals), Estimation of mean using auxiliary information: usual ratio, product, regression and unbiased ratio type estimator of Hartley and Ross and approximate expressions for variances and biases, condition for its being BLUE. Double sampling: Ratio and regression methods of estimation of mean.

UNIT-III

Bivariate Population under StRS: Estimate for the ratio of two means (or totals), ratio and regression estimates of mean in stratified sampling and their comparison.

Systematic sampling (excluding circular systematic sampling): Estimation of population mean, and its application to structured populations.

Cluster sampling: Equal clusters and its efficiency relation between the variance of the mean of a single cluster and its size, Jesson's cost function and determination of optimum sampling unit. Sampling with unequal clusters, estimator of the means and their variances.

UNIT-IV

Two stage sampling: With equal first stage units, estimator of the population mean and its variance, optimum allocation for fixed cost, comparison with one stage sampling.

Unequal probability sampling with and without replacement: PPS sampling procedure (cumulative total and Lahiri's methods) and estimation of mean of finite population: Desraj's estimator for a generalized sample size and Murthy's estimator for sample size two.

TEXT BOOKS

1. Cochran, W. G. (**2007**). Sampling techniques (3rd Edition). John Wiley & Sons(INDIA).
2. Mukhopadhyay, Parimal **(2008).** Theory and Methods of Survey Sampling, (2nd Edition), Prentice Hall of India, New Delhi.
3. Murthy, M.N. (1967). Sampling Theory and Methods, Statistical Publishing Society, Calcutta.
4. Sukhatme, P.V., Sukhatme,B.V., Sukhatme, S. and Asok, C.(1984) Sampling Theory of Surveys with Applications (3rd Edition)Iowa State University Press, USA and ISAS, Delhi.
5. Singh, S. (2003). Advanced Sampling Theory With Applications: How Michael"" Selected"" Amy (Vol.1, 2). Springer Science & Business Media.
6. Thompson, Steven K. (2002). Sampling, John Wiley and Sons, New York.

COURSE OUTCOMES: On completing the course, the students will be able to:

- Students are knowledgeable about various sampling methods available to estimate parameters of the population.
- Students are able to prove the various properties of the each sampling scheme.
- Students are able to compare various sampling methods a view to select an appropriate one.

Khalsa College, Amritsar

(An Autonomous College)

Syllabus for

PROGRAMME: M.Sc. Statistics

(Semester-II)

COURSE TITLE: DEMOGRAPHY & VITAL STATISTICS

COURSE CODE: MST-424

L	T	P	Credits
5	1	0	6

TOTAL HOURS: 90 hrs

Time: 3Hrs **MAXIMUM MARKS:100**

Medium: English **(Theory :75**

Internal Assesment:25)

INSTRUCTIONS FOR PAPER SETTERS:

1. The question paper will consist of five sections namely Section-A which will be from entire syllabus (equally distributed from each unit), Section–B, C, D and E from Unit-I, II, III and IV, respectively.
2. Section–A will consists of eight short answer type questions, each of 2.5 marks. Students are to attempt any six.
3. Sections–B, C, D & E will consist of two questions each**(each question should be sudivided into two parts)**. Students are to attempt any four questions in total by selecting one question from each section. Each question carries 15marks.
4. Question paper should cover at least 40% article work from the recommended books.
5. Teaching time for this paper would be eight periods per week.

COURSE OBJECTIVE:

- To understand the concept of Vital statistics, measurement of mortality and measurement of fertility.
- To get familiar with population theory and rate of growth.
- To have knowledge about the method of projection ans use of life tables.

COURSE CONTENT:

UNIT-I

Vital Statistics : Definition, uses and methods of obtaining vital statistics, rates and ratios, measurement of population at a given time, measurement of Mortality: crude death rate, specific rates, infant mortality rate, prenatal mortality rate, standard death rates. Life tables: Construction of a complete life table and its uses.

UNIT-II

Abridged life tables: Kings method, Reed and Merrell's method, Greville's method, Keyfitz and Frauenthal's method and Chiang's method. Measurement of fertility: Crude birth rate, general fertility rate, age specific fertility rate, total fertility rate, relation between TFR and CBR, gross reproduction rate and net reproduction rate, replacement index, standardized fertility rate.

UNIT-III

Structure of populations: Stable and quasi-stable populations, Fundamental equation of stable population theory, intrinsic rate of growth, intrinsic birth and death rates, intrinsic age distribution, Leslie's model of population growth .

UNIT-IV

Population Projection : Projected values & estimates, method of Projection, populationsize, population composition. Survival rates: UN model life table, model life tables of Coale and Demeny, Ledermann's model life tables. Fertility Rates: Pearson's Type-I curve,
Romanink's model and Coale's model fertility schedules.

TEXT BOOKS

1. R. Ramakumar, Y. S. Gopal (1986): Technical Demography. , Wiley, Eastern Limited.

2. S. C. Gupta and V. K. Kapoor (2014): Fundamentals of Applied Statistics, 4th Edition, Sultan Chand & Sons.

REFERENCE READINGS

1. Benjamin, B. (1975): Demographic Analysis, George, Allen and Unwin Limited.
2. Cox, P. R. (1970): Demography, Cambridge University Press. 5th Edition.
3. Keyfitz, N. (1985): Applied Mathematical Demography, Springer Science + Business Media, LLC. 2nd Edition.

COURSE OUTCOMES: On completing the course, the students will be able to:

- Deal with the problems of death rate and birth rate.
- Solve the practical problems based on population.

Khalsa College, Amritsar

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Syllabus for

PROGRAMME: M.Sc. Statistics

(Semester-II)

COURSE TITLE: COMPUTER ORIENTED STATISTICAL PRACTICALS –II

COURSE CODE: MST-425

L	T	P	Credits
4	0	2	6

TOTAL HOURS: 90 hrs

Time: 3Hrs **MAXIMUM MARKS:100**

Medium: English **(Theory :75**

Internal Assesment:25)

INSTRUCTIONS FOR THE PAPER-SETTERS

1. The paper will be set in two separate parts PART-A and PART-B .The setting and evaluation will be done by a Board of examiners consisting of Head (Chairman), External Examiners and Teacher (S) involved with the teaching of this paper.
2. PART-A of this paper will be set on the spot and will be of one and a half hours duration. This part will consist of two problems. The problems will be based on theory papers **COURSE CODE: MST 422, COURSE CODE: MST 423 & COURSE CODE: MST 424** using Programming in " c " & / or Statistical Software packages such as MINITAB , SPSS , STATGRAF, STATISTICA, SAS, etc.
3. PART-B of the paper will be of one and a half hours duration .This part will consist of FOUR questions **based on theory papers COURSE CODE: MST 422, COURSE CODE: MST 423 & COURSE CODE: MST 424** with at least one question from each of these papers. The candidates will be required to attempt any TWO questions using electronic device.
4. The division of marks ,out of a total of 75 and Minimum pass Marks, will be as follows :

Maximum Marks	:	75
Minimum pass Marks	:	30(40%)
Sessional work	:	15
Viva	:	12
Exercises based on Part A	:	20
Exercises based on Part B	:	28

COURSE CONTENT:

SYLLABUS DETAILS FOR PAPER-COURSE CODE: MST 425 (PRACTICAL)

PART-A : Programming in " C " &/or Applying statistical software packages for problems based on Theory papers **COURSE CODE: MST 422, COURSE CODE: MST 423 & COURSE CODE: MST 424.**

Use of Statistical Software packages such as MINITAB , SPSS , Statgraf etc.

PART-B :Practical Exercises for Statistical techniques based on topics in papers **COURSE CODE: MST 422, COURSE CODE: MST 423 & COURSE CODE: MST 424.**

RECOMMENDED READINGS

Stoodly. K.: Applied and computational Statistics, Ellis Howard.

COURSE OUTCOMES:

- Derive important statistical programme for moment generating function, joint probability mass functions, marginal densities, conditional distributions.
- Possess deeper understanding of the properties and uses of various computer languages to develop programme for discrete distributions and continuous distributions.