

**P.G AND RESEARCH
DEPARTMENT OF STATISTICS
THANTHAI PERIYAR GOVERNMENT
ARTS&SCIENCE COLLEGE (AUTONOMOUS)
TIRUCHIRAPPALLI – 620 023.**



**SYLLABI
B.Sc (Statistics)**

From 2023-24 onwards

Question Paper Pattern

(For Part I, II, III, IV and V)

For all Language, Core and Allied courses .

Section - A (10 x 2 = 20 Marks)

(Answer all the questions and two questions from each unit)

Section - B (5 x 5 = 25 Marks)

(Answer all the questions with internal choice and one set of questions from each unit)

Section - C (3 x 10 = 30 Marks)

Answer any **THREE** questions

(Answer any three out of five questions and one question from each unit)

Part - III - Additional Credit Courses(For Competitive Exam Purpose-Multiple Choice Pattern).

Thirty Questions from each unit and covering all the five units.

(150 x 0.5 = 75 marks)

Part - IV - NME, SBE, Environmental Science, Soft Skill Development and Value Education

Five out of Eight questions covering all the five units. (5 x 15 = 75 marks)

Part - V - Gender Equality.

Five out of Eight questions covering all the five units.

(5 x 15 = 75 marks)

Duration for all Practical examinations: 3 Hours

For Practical:

Internal		External	
Continuous Performance	20 Marks	Record	10 Marks
Model Exam	10 Marks	Examination	50 Marks
Record	05 Marks		
Attendance	05 Marks		
Total	40 Marks	Total	60 Marks

GENERAL COURSE PATTERN FOR UG - STATISTICS - 2023-2024 ONWARDS

SL. NO.	PART	COURSE		Sub-Code	COURSE TITLE	Hrs.	Credits	CIA	Semester Exam	Total
I SEMESTER										
1	P - I	TAMIL	I		LT - I : TAMIL LANGUAGE	6	3	25	75	100
2	P - II	ENGLISH	I		LE - I : ENGLISH LANGUAGE	6	3	25	75	100
3	P – III	CORE	I		C-I :DESCRIPTIVE STATISTICS	6	5	25	75	100
		CORE	II*-P		C-II :PRACTICAL - I COMPUTATIONAL STATISTICS -I (NS)	2	-	-	-	-
4		FIRST ALLIED	I	GE-I	GENERIC ELECTIVE-I: MATHEMATICS – I (OR)MATRIX & LINEAR ALGEBRA	4	4	25	75	100
		FIRST ALLIED	II*-P		GENERIC ELECTIVE-II: MATHEMATICS – II (OR) REAL ANALYSIS	2	-	-	-	-
5	P - IV	SBE	I		PCSEC : OFFICIAL STATISTICS (OR) VITAL STATISTICS	2	2	25	75	100
6		VE			VE : VALUE EDUCATION	2	2	25	75	100
TOTAL						30	20	150	450	600
II SEMESTER										
7	P - I	TAMIL	II		LT-II : TAMIL LANGUAGE	6	3	25	75	100
8	P - II	ENGLISH	II		LE - II : ENGLISH LANGUAGE	4	3	25	75	100
9	P - III	CORE	II-P		C-II : COMPUTATIONAL STATISTICS – I	4	4	40	60	100
10		CORE	III		C-III : PROBABILITY THEORY	5	5	25	75	100
11		FIRST ALLIED	II-P	GE-II	GENERIC ELECTIVE-II: MATHEMATICS – II (OR) REAL ANALYSIS	3	3	40	60	100
12		FIRST ALLIED	III	GE-III	GENERIC ELECTIVE-III: MATHEMATICS – III (OR) ECONOMIC & OFFICIAL STATISTICS	4	4	25	75	100
13	P - IV	ES			PART - IV : ENVIRONMENTAL SCIENCE	2	2	25	75	100
14		NMSDC*	I	AECC -I	NMSDC-I:	2	2	25	75	100
TOTAL						30	26	230	570	800
III SEMESTER										
15	P - I	TAMIL	III		LT- III : TAMIL LANGUAGE	6	3	25	75	100
16	P - II	ENGLISH	III		LE - III : ENGLISH LANGUAGE	6	3	25	75	100
17	P - III	CORE	IV		C-IV : PROBABILITY DISTRIBUTIONS	4	4	25	75	100
		CORE	V*-P		C-V : COMPUTATIONAL STATISTICS –II (NS)	2	-	-	-	-
18		ME	I	C-VI	C-VI : OPERATIONS RESEARCH (OR) DEMOGRAPHY	4	4	25	75	100
19		SECOND ALLIED	I	GE-IV	GENERIC ELECTIVE-IV: C PROGRAMMING (OR) ECONOMETRICS - I	4	4	25	75	100
		SECOND ALLIED	II*-P	DSE-I	DISCIPLINE SPECIFIC ELECTIVE-I:C & R PROGRAMMING LAB (OR) ECONOMETRICS - II	2	-	-	-	-
20	P - IV	NME	I		NON MAJOR ELECTIVE-I : HTML (OR) E-COMMERCE	2	2	25	75	100
TOTAL						30	20	150	450	600
IV SEMESTER										
21	P - I	TAMIL	IV		LT- IV : TAMIL LANGUAGE	6	3	25	75	100
22	P - II	ENGLISH	IV		LE - IV : ENGLISH LANGUAGE	6	3	25	75	100
23	P - III	CORE	V-P		C - V : COMPUTATIONAL STATISTICS – II	4	4	40	60	100
24		CORE	VII		C-VII : ESTIMATION THEORY	5	5	25	75	100
25		SECOND ALLIED	II-P	DSE-I	DISCIPLINE SPECIFIC ELECTIVE - I: C AND R PROGRAMMING LAB (OR) ECONOMETRICS - II	3	3	40	60	100
26		SECOND ALLIED	III	DSE-II	DISCIPLINE SPECIFIC ELECTIVE - II: R PROGRAMMING (OR) ECONOMETRICS - III	4	3	25	75	100
27		P – IV	NMSDC*	II	AECC -II	NMSDC-II:	2	2	25	75
TOTAL						30	23	205	495	700

V SEMESTER										
28	P - III	CORE	VIII		C-VIII : TESTING OF HYPOTHESIS	5	5	25	75	100
29		CORE	IX		C-IX : STOCHASTIC PROCESS	5	5	25	75	100
30		CORE	X		C-X : STATISTICAL QUALITY CONTROL	6	5	25	75	100
31		CORE	X-P		C-XI : COMPUTATIONAL STATISTICS-III	5	5	40	60	100
32		ME	II	DSE-III	DISCIPLINE SPECIFIC ELECTIVE - III: APPLIED STATISTICS (OR) TIME SERIES & INDEX NUMBERS	5	3	25	75	100
33	P - IV	NME	II	NME	NON-MAJOR ELECTIVE - II: GIS (OR) BASICS OF REMOTE SENSING	2	2	25	75	100
34		SSD		AECC-III	SSD:	2	2	25	75	100
35	P - V	EA			EA:	-	1	25	75	100
TOTAL						30	28	215	585	800
VI SEMESTER										
36	P - III	CORE	XI		C-XII : SAMPLING TECHNIQUES	6	6	25	75	100
37		CORE	XII		C-XIII : REGRESSION ANALYSIS	6	5	25	75	100
38		CORE	XIII		C-XIV : DESIGN OF EXPERIMENTS	5	5	25	75	100
39		CORE	XIV-P		C-XV : COMPUTATIONAL STATISTICS-IV	6	5	40	60	100
40		ME	III	DSE-IV	DISCIPLINE SPECIFIC ELECTIVE - IV: NUMERICAL METHODS (OR) ACTUARIAL STATISTICS	5	3	25	75	100
41		NMSDC*	III	AECC-III	NMSDC-III:	2	2	25	75	100
TOTAL						30	26	165	435	600
GRAND TOTAL						180	142	1115	2985	4100
		*Optional			Extra / Additional:					

Program Specific Outcomes (PSOs)

On successful completion of B.Sc. Statistics program, the students will be expected to:

PSO1 Comprehend the theoretical aspects of statistics

PSO2 Recognize the application of statistics in diversified fields

PSO3 Develop computer programs and codes for statistical computation

PSO4 Understand the conditions and limitations of statistical methods in application

PSO5 Critically analyze statistical data and make interpretations

Program Outcomes (POs)

On successful completion of the B.Sc. Statistics program, the graduates will be able to:

PO1 Students are to be passionately engaged in initial learning with an aim to think differently as agents of new knowledge, understanding and applying new ideas in order to acquire employability/selfemployment.

PO2 Adopt conceptual ideas, principles and methods in diversified fields of study

PO3 Utilize analytical skills for basic mathematical computation

PO4 Utilize software skills for statistical computation

PO5 Students are to be imparted with a broad conceptual background in Statistics.

CORE-I

DESCRIPTIVE STATISTICS

SEMESTER – I

Credits : 5

Code:

Hour : 6

Course Objective

To enable students to gain knowledge about descriptive statistics such as functions of statistics, measures of location and dispersion, simple correlation and simple regression.

Course Outcomes

Student will be able to

- know the different methods of data collection .
- recognize different types of data and scales of measurement.
- familiar various techniques of presentation of data.
- understand measures of location and dispersion .
- understand correlation and simple regression.
- Study the consistency of the data.

Unit - I

Meaning and definition of Statistics, importance and scope of Statistics, functions of Statistics, uses and limitations of Statistics. Data Collection and Presentation: Collection of data– Census – Sample surveys –Types of Data –Nominal, Ordinal, Interval and Ratio – Classification and Tabulation. Diagrammatic representations of data - Bar diagrams, simple, component, multiple and percentage, Pie diagrams. Graphical representations - Histogram, Frequency curve, frequency polygon and Ogives (Construction and uses).

Unit –II

Measures of Central Tendency – Arithmetic Mean, Median, Mode, Geometric Mean and Harmonic Mean – Merits and Demerits, Inter Relationship between A.M, G.M and H. M - properties of a good average and problems.

Unit - III

Measures of Dispersion - Range, Quartile deviation, Mean Deviation, Standard Deviation and Coefficient of variation. Skewness - concept, Measures of Skewness – Karl Pearson's and Bowley's coefficient of skewness. Moments – Raw and Central. Kurtosis - Concept and measures of Kurtosis and problems.

Unit - IV

Correlation - Definitions, Types and Properties of Correlation coefficient (statement and proof). Scatter diagrams, Karl Pearsons's Co-efficient of Correlation and Spearman's Rank Correlation. Partial and Multiple Correlations - Regression- Linear Regression and its properties Uses and problems.- Principle of least squares for first degree, Second degree, Exponential and Power curves.

Unit-V

Theory of Attributes: Introduction – Definition-Classes and Class frequencies- Consistency of data-Independence of attributes-Association of attributes-Yule's coefficient and -Coefficient of Colligation.

Book for Study :

Gupta S.C, and Kapoor V.K (2013), Fundamental of Mathematical Statistics. - Sultan Chand & Sons, New Delhi.

Book for Reference:

Gupta S.P. (1995), Statistical Methods, Sultan Chand & Sons, New Delhi.

WEB RESOURCES:

1. <https://nptel.ac.in/courses/111/104/111104120/> .
2. https://www.iiserpune.ac.in/~bhasbapat/phy221_files/curvefitting.pdf .
3. [www.wikipedia.org / Correlation and regression.html](http://www.wikipedia.org/Correlation%20and%20regression.html) .

CORE II - COMPUTATIONAL STATISTICS – I

SEMESTER – I & II (NS)

Credits :4

Code:

Hour : 2+4

Course Objectives:

The main objectives of this course are to:

- Understand the various measures of central tendencies and measures of dispersion
- Understand correlation coefficient and regression coefficients

Course Outcome:

On the successful completion of the course, student will be able to:

- Calculate Arithmetic Mean, Median, Mode, Geometric Mean, Harmonic Mean
- Calculate quartile deviation, mean deviation and standard deviation.
- Calculate Karl Pearson's and Spearman's correlation coefficients.
- Form the regression equations.

Unit – I

Measures of Central Tendency - Calculation of Arithmetic Mean, Median, Mode, Geometric Mean, Harmonic Mean for Grouped Data and Ungrouped Data.

Unit – II

Measures of Dispersion – Calculation of Quartile Deviation, Mean Deviation, Standard Deviation and their co-efficients and Coefficient of variation. Measures of Skewness - Calculation of Karl Pearson's and Bowley's co-efficient of Skewness.

Unit – III

Calculation of Karl Person's co-efficient of correlation and Spearman's Rank Correlation co – efficient. Finding the two Regression Equations X on Y and Y on X and estimating unknown values of X and Y.

Unit – IV

Random variables – problems related to Discrete and continuous random variables - Mathematical expectation.

Unit –V

Bivariate distribution – problems related to Discrete and continuous random variables - Mathematical expectation – mean, variance, covariance and correlation co.efficient.

Book for Study:

Gupta.S.C. and Kapoor.V.K (2013), Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi.

Book for Reference:

Gupta.S.P (1995), Statistical Methods, Sultan Chand & Sons, New Delhi.

GENERIC ELECTIVE-I: MATRIX & LINEAR ALGEBRA

SEMESTER – I

Credits : 4

Code:

Hour : 4

Course Objectives:

The main objectives of this course are:

1. To study the basic operations of transpose and inverse of matrices
2. To know the structure of orthogonal and unitary matrices
3. To learn the invariance properties of ranks
4. To know and to apply the concepts of vector space and matrix polynomials.

Unit I

Matrices-Transpose-Conjugate transpose- Reversal law for the transpose and conjugate transpose. Adjoint of a matrix, Inverse of a matrix, Singular and Non -Singular matrices,

Unit II

Reversal law for the inverse of product of two matrices. Commutativity of inverse and transpose of matrix, Commutativity of inverse and conjugate transpose of matrix, Orthogonal and Unitary Matrices, Product of unitary matrices, Partitioning of matrices.

Unit III

Rank of a matrix, Echelon form, Rank of transpose, Elementary transformations, Elementary matrices, Invariance of rank through elementary transformations, Reduction to Normal form, Equivalent matrices.

Unit-IV

Vector space – Linear Dependence - Basis of a vector space –Sub-space - Properties of Linearly Independent and Dependent systems, Row and Column spaces, Equality of Row and Column ranks, Rank of Sum and Product of matrices.

Unit-V

Matrix polynomials, Characteristic roots and vectors, Relation between characteristic roots and characteristic vectors, Algebraic and Geometric multiplicity, Nature of characteristic roots in case of special matrices, Cayley- Hamilton theorem.

Book for Study:

Vasishtha.A.R (1972) : Matrices, KrishnaprakashanMandir, Meerut.

Book for Reference:

1. Shanthinarayan, (2012) : A Text Book of Matrices, S.Chand& Co, New Delhi
2. M.L.Khanna (2009), Matrices, Jai PrakashNath& Co

WEB RESOURCES:

1. <https://samples.jbpub.com/9781556229114/chapter7.pdf>
2. <https://www.vedantu.com/maths/matrix-rank>
3. <https://textbooks.math.gatech.edu/ila/characteristic-polynomial.html>
4. <https://www.aitude.com/explain-echelon-form-of-a-matrix/>

GENERIC ELECTIVE-II: REAL ANALYSIS

SEMESTER – I & II

Credits : 3

Code:

Hour : 2+3

Objectives of the Course

The main objectives of this course are:

- To study the basic operations of sets and functions
- To know the structure of the real sequence and its convergence
- To learn series and its convergence
- To learn the limits, continuity and derivative of real valued functions
- To know and to apply the Riemann integration

Unit I

Operations on sets, Functions, Real valued functions, Equivalence, Countability, Real Numbers, Cantor set, Least Upper Bounds, Greatest Lower Bound.

Unit II

Definition of Sequence, Subsequence, Limit of a sequence, Convergent and Divergent sequences, Oscillating sequence, Bounded and Monotone sequences, Operations on convergent sequences, Limit Infimum, Limit Supremum, Cauchy sequences, Summability of sequences.

Unit III

Definition of Series, Convergent and Divergent series, series with nonnegative terms, alternating series, conditional convergence, absolute convergences and test for absolute convergence.

Unit-IV

Limit of a function on the real line, Increasing and Decreasing functions, Continuous function, Operations on continuous functions, Composition of continuous functions, Derivatives, Derivative and continuity, Rolle's Theorem, Mean value theorem, Taylor's theorem.

Unit-V

Concept of Riemann Integral, Refinement of partition, Upper and Lower sums, Upper integral and Lower Integral Riemann integrability, Necessary and Sufficient condition for Riemann integrable, Properties of Riemann integrals, Fundamental theorem

Book for Study:

Goldberg .R R(1976) : Methods of Real Analysis, Oxford &IBH.

Book for Reference:

1. Shanthinarayan, (2012) : Real Analysis, S.Chand& Co, New Delhi
2. Walter Rudin (2017), Principles of Mathematical Analysis, 3rd Edition, McGraw-Hill

WEB RESOURCES:

1. <https://tutorial.math.lamar.edu/classes/calci/thelimit.aspx>
2. <https://www.mathsisfun.com/calculus/derivatives-introduction.html>
3. <https://www.math.ucdavis.edu/~hunter/m125b/ch1.pdf>
4. <https://math.hmc.edu/calculus/hmc-mathematics-calculus-online-tutorials/single-variable-calculus/taylors-theorem/>
5. <http://www.ms.uky.edu/~droyster/courses/fall06/PDFs/Chapter06.pdf>

PCSEC : OFFICIAL STATISTICS
SKILL BASED ELECTIVE – I

SEMESTER – I

Credits: 2

Code :

Hours : 2

Course Objective :

- To understand the statistical systems.
- To understand the official statistical system.
- Understand the functioning of government and policies.
- Promote human resource development in the official statistics and encourage research and development in theoretical and applied statistics.
- Execute the data handling tasks in various government records

Course Outcome:

An understanding of various Statistical Organisations and their functions.

Unit - I

Official Statistics: Definition – Growth of Indian Statistics – Statistical organizations of India: Central Statistical Organisation (CSO) – Divisions of Central Statistical Organisation – Functions – Publications.

Unit - II

National Sample Survey Organisation (NSSO) – Divisions of NSSO – Functions of NSSO – Procedure for collection of information – Agriculture Statistics, Yield Statistics – Official series: Traditional method, Random Sampling Method – NSS Series – Forest Statistics, Fisheries Statistics – Defects in agricultural Statistics.

Unit - III

National income: Definition – Methods of estimating national income: The Income method, the Output method and the Expenditure method – Uses of National income estimates – Difficulties of estimation.

Unit - IV

Social accounting – Population statistics – Sources – Different methods of collecting population census – Methods of enumeration – Merits and demerits of De Facto method, Merits and demerits of the De Jure system.

Unit -V

Price Statistics: Wholesale prices, Retail prices, Uses and limitations of price statistics, GDP.
Industrial Statistics: Main Sources of industrial Statistics – Limitations.

Book for Study:

R.S.N. Pillai and V. Bagavathi (1995), Statistics, Third Edition, S.Chand& Company, New Delhi – 110 055.

Books for Reference:

1. Central Statistical Organization (2011), Statistical Systems in India, Department of Statistics, Ministry of Planning, New Delhi.
2. Goon , A.M. Gupta, M.K and Das Gupta, B.(1986), Fundamentals of Statistics, Volume II, The World Press Private Limited, Calcutta.

WEB RESOURCES:

1. <https://www.classcentral.com/course/swayam-macro-economics-19942>
2. <https://www.classcentral.com/course/swayam-economics-of-health-and-health-care-14023>
3. www.mospi.nic.in and censusindia.gov.in

CORE - III

PROBABILITY THEORY

SEMESTER – II

Hours : 5

Code:

Credit : 5

Course Objective :

Enable the students to understand and study random phenomena mathematically.

Course Outcome:

Student will be able to

- utilize basic concepts of probability including independence and conditional probability.
- know Bayesian formula and its applications
- know random variables and its properties
- understand different probability functions with respect to univariate and bivariate continuous random variables.
- prove the properties and theorems on expectation and variance.
- know moment generating function and computation of moments.

Unit - I

Probability: Sample space – Events – algebraic operations on events. Definitions – Classical Probability, Empirical Probability, Axiomatic approach to probability – Independent events – Conditional probability – Addition and Multiplication theorems of probability – Bayes's Theorem.

Unit -II

Discrete and continuous random variables – Distribution function-properties – Probability mass function and Probability density function.

Unit -III

Multiple Random Variables: Joint, marginal and conditional distributions- independence of random variables – Transformation of random variables (one and two dimensional) and determination of their distributions.

Unit -IV

Mathematical Expectation: Expectation – Properties, Cauchy-Schwartz inequality, conditional expectation and conditional variance – theorems on expectation and conditional expectation. Moment generating function, characteristic function, probability generating function and their properties. Chebychev's inequality.

Unit - V

Limit Theorems: Convergence in probability, weak law of large numbers – Bernoulli's theorem, Khintchine's theorem (Statements only) – Central limit theorem for i.i.d random variables- simple applications.

Book for Study:

S. C. Gupta and V. K. Kapoor (2007). “ Fundamentals of Mathematical Statistics”, Sultan Chand and sons publications, New Delhi.

Books for Reference:

1. J. N. Kapur and H. C. Saxena (1989) “Mathematical Statistics”, S. Chand and company ltd., New Delhi.
2. Marek. Fisz, (1961). “Probability theory and mathematical statistics”, John Wiley and sons.

WEB RESOURCES:

1. <https://youtu.be/pCbFNf0NNhQ>
2. <https://youtu.be/82Ad1orN-NA>
3. <https://youtu.be/7MJ3b-J-ZCE>
4. www.wikipedia.org / probability.html
5. www.wikipedia.org/ Random variables.html
6. www.wikipedia.org / Mathematical expectation.html

GENERIC ELECTIVE-III: ECONOMIC & OFFICIAL STATISTICS

SEMESTER – II

Credits : 4

Code :

Hours : 4

Course Objectives

The main objectives of this course are:

1. To understand Indian official statistical system and data collection
2. To know Indian economic and agricultural surveys
3. To know index numbers and consumer price index
4. To know time series analysis
5. To learn demand analysis and its concepts

Unit I

Indian Statistical System: Data Collection for Governance – NSSO and its role in national data collection. NSSO reports and publications.

Unit II

Economic Statistics: Information collection for Socio-Economic Survey – Agricultural, Industrial, Crime Statistics and Statistical methods applied to analyse large volumes of data.

Unit III

Index numbers: Basic problems in construction of index numbers. Methods- Simple and Weighted aggregate-Average of price relatives-Chain base method. Criteria of goodness-Unit test , Time Reversal Factor Reversal and Circular tests. Base Shifting, Splicing and deflating index numbers. Wholesale and Consumer price index numbers. Index of industrial production.

Unit-IV

Time Series: Measurement of Trend : Graphic, Semi-averages, Moving averages. Least Squares – Straight line, Second degree parabola, Exponential curve, Modified Exponential curve, Gompertz curve and Logistic curve. Measurement of Seasonal variation by Ratio-to-Moving average method. Exponential smoothing , Holt Winter's method and Box-Jenkinson's method(only algorithm).

Unit-V

Demand Analysis: Introduction-Demand and Supply, Price elasticity of demand and supply, partial and cross elasticities of demand. Types of data required for estimating elasticity. Methods of estimating demand functions: Leontief 's and Pigou's methods. Engel's law and Engel's curves. Pareto's law of law of income distribution. Utility function.

Book for Study:

1. Gupta S.C. and Kapoor V.K. (2007) :Fundamentals of Applied Statistics , 4th edition ,Sultan Chand &Sons Publishers, New Delhi.
2. Gupta S.P. (2011) :Statistical Methods , Sultan Chand &Sons Publishers, New Delhi.
3. Spyros Makridakis, Steven C. Wheelwright and Rob J .Hyndman (2003):Forecasting Methods and Applications , 3rd Edition ,John Wiley and Sons Inc.
4. Websites of Government of India – Ministry of Statistics & Programme Implementation

Book for Reference:

1. Spyros Makridakis, Steven C. Wheelwright and Rob J .Hyndman (2003) :Forecasting Methods and Applications , 3rd Edition ,John Wiley and Sons Inc. .
2. Irving W. Burr (1974): Applied Statistical Methods, Academic Press.

CORE-IV: PROBABILITY DISTRIBUTIONS

SEMESTER – III

Credits : 4

Code :

Hours : 4

Course Objectives

To impart knowledge about discrete and continuous probability distributions to the students.

Course Outcomes

Students will able to

- Derive the MGF, Moments and recurrence relations of various distributions
- Understand the relationship among t , F and chi-square distributions.

Unit – I

Discrete Distributions: Bernoulli Distribution, Binomial distribution, Poisson distribution, Moments, Moment generating function, Characteristic function, Probability Generating Function. Recurrence relations for probabilities – Fitting of Binomial and Poisson Distributions- simple problems.

Unit – II

Negative binomial distribution- Geometric distribution - Hypergeometric distribution- Moments, Moment generating function, Characteristic function, Probability Generating Function- Lack of memory property- Fitting of Negative Binomial Distribution- simple problems.

Unit – III

Continuous Distributions: Uniform, Normal Distribution and its properties– Moments, Moment generating function and Characteristic function, Additive property. Fitting of Normal Distribution(Area and Ordinate methods) - simple problems.

Unit – IV

Exponentialdistribution - Gamma distribution, Beta distribution of First kind and second kind – Moments, Moment generating function and Characteristic function.

Unit – V

Sampling Distributions: *Student's t*, Chi-square and F-distributions - derivation of pdf, mean and variance only – relationships among *Student's t*, Chi-square and F-distributions.

Book for study:

Gupta, S.C and Kapoor, V. K. (2007) Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi.

Books for Reference:

1. Hogg, R.V. and Craig, A. G. (1978) Introduction to Mathematical Statistics, MacMillan, London.
2. Mood, A.M Graybill, F.A. and Boes,D.C(1974) Introduction to Theory of Statistics, Tata McGraw Hill, New Delhi
3. Goon, A.M.Gupta M.K. and Das Gupta, B. (1993) Fundamentals of Statistics Vol. I. World press, Kolkata.
4. Johnson, N. L., Kemp, A.W., and Kotz, S. (2005). Univariate Discrete Distributions, Third Edition, John Wiley and Sons, New York.
5. Rao, C. R. (2009). Linear Statistical Inference and Its Applications, Second Edition, John Wiley and Sons, New York.

WEB RESOURCES:

1. https://www.youtube.com/watch?v=M-Y_PAcJH5k
2. <https://www.youtube.com/watch?v=BFRwDG67UoA>
3. <https://www.youtube.com/watch?v=VKTMn5P7-7Q>
4. <https://www.youtube.com/watch?v=wO9n24mExjQ&list=PL9aVpS8B8Cg6Ui2dDQGh oWDtKFPxp-nI4>
5. <https://www.youtube.com/watch?v=HOebvVLpPIM&list=PL9aVpS8B8Cg5ZWTiWM WnpohJXbaEH0eq2>

CORE-V : COMPUTATIONAL STATISTICS –II

SEMESTER – III & IV (NS)

Credits :4

Code:

Hour : 2+4

Course Objective:

To equip the students in solving the problems in probability distributions and Estimation theory.

Course Outcome:

- Gain ability to solve problems applying statistical concepts.

Unit – I

Binomial Distribution: Determination of Moments, Skewness and Kurtosis based on moments-Fitting of Binomial distribution: when the nature of the coin is known and nature of the coin is unknown. Poisson distribution: Determination of Moments, Skewness and Kurtosis based on moments-Fitting of Poisson distribution.

Unit – II

Normal Distribution: Problems based on Normal distribution-Fitting of Normal distribution- Area Method and Ordinate Method.

Unit – III

Problems based on method of maximum likelihood.

Problems based on method of moments-raw moments and central moments.

Unit – IV

Construction of Confidence intervals for mean(s), variance(s) and proportion(s) based on Normal distribution

Unit – V

Construction of Confidence intervals for mean(s), and variance(s) based on t, Chi-square and F distributions.

Book for Study:

Gupta, S.C and Kapoor, V. K. (2007) Fundamentals of Mathematical Statistics, SultanChand & Sons, New Delhi.

Books for Reference:

1. Hogg, R.V. and Craig, A. G. (1978) Introduction to Mathematical Statistics, MacMillan, London.
2. Mood, A.M Graybill, F.A. and Boes,D.C(1974) Introduction to Theory of Statistics, Tata McGraw Hill, New Delhi

CORE-VI : OPERATIONS RESEARCH

MAJOR ELECTIVE - I

SEMESTER – III

Code:

Credits : 4

Hour : 4

Course objectives:

The main objectives of this course are to:

- Understand the Linear Programming Problem and methods to solve it.
- Understand the transportation and assignment problems.
- Explore the knowledge of theory of games and replacement problems.
- Understand network analysis.

Course Outcome:

On the successful completion of the course, student will be able to:

- Solve an LPP using simplex method and Charne's method
- Solve transportation problem using MODI's method and assignment problem using Hungarian algorithm
- Find the value of the game using dominance property and graphical method.
- Estimate the critical path and project duration of a network problem

Unit – I

Linear Programming Problem: Formulation of Linear programming problem – Graphical solution of LPP in two variables – LPP in standard form – Simplex method – Algorithm – Need for artificial variables – Charne's M-Technique – Concept of degeneracy.

Unit – II

Transportation problem: Transportation problem formulation- North-West Corner, Least cost, Vogel's Approximation method – UV-method – Assignment problem and algorithm.

Unit – III

Theory of Games: Basic definition – Maximin and Minimax criterion – Solution of Games with saddle points – Two-by-Two (2x2) Games without saddle point – principle of dominance – problems based on dominance rule – Graphical method for (2xn) and (mx2) games.

Unit – IV

Sequencing Problem – Meaning, Procedure for solving sequencing problems - Processing 'n' jobs through two machines, Processing 'n' jobs through three machines, Processing 'n' jobs through 'm' machines and Processing of two jobs through 'm' machines and Graphic Solutions.

Unit – V

Network analysis by CPM/PERT: Basic Concept – Constraints in Network – Construction of the Network – Time calculations – Concept of slack and float in Network Analysis – Network crashing – Finding optimum project duration and minimum project cost.

Books for Study:

1. Swarup, K., Mohan, M., and Gupta P.K. (2001). Operations Research, Sultan Chand and Sons, New Delhi.
2. Taha, H.A. (1996) Operations Research, 6/e, Prentice Hall, New Delhi

Books for Reference:

1. Goel, B.S. and Mittal, S.K. (1982) Operations Research, Pragati Prakashan, Meerut.
2. Gupta, R.K. (1985) Operations Research, Krishna Prakashan, Mandir, Meerut.
3. Hillier, F.S. and Lieberman, G. J. (1987) Operations Research, CBS Publishers and Distributors, New Delhi.
4. Gass, S. I. (1985). Linear Programming, Methods and Applications. Courier Dover Publications. (Reprint 2003)
5. Hadley, G (1963): Linear Programming. Addison Wesley Publishing Company.
6. Hillier, F.S., and Lieberman, G.J. (2005). Introduction to Operations Research, Ninth Edition, McGraw – Hill Publishing Company.
7. Sharma, J.K. (2013). Operations Research: Problems and Solutions, Fifth Edition, Macmillan India Limited.

WEB RESOURCES:

1. <https://www.ieor.columbia.edu>
2. <https://medium.com/.../an-introduction-to-operations-research-5a9e898b6c60>
3. <https://orc.mit.edu/academics/master's-operations-research>

CORE-VI : DEMOGRAPHY
MAJOR ELECTIVE - I

SEMESTER – III

Credits :4

Code :

Hours :4

Course Objectives:

- To provide knowledge and understanding in selected areas of Demography
- To develop competence in skill of learning and solve practical problems needed in Public and Private Sector.

Course Outcome

- Gain an understanding in various concepts in selected areas
- The ability and confidence to analyze and solve problems in real life situations

Unit – I

Demographic Data: Demography – definition-sources of demographic data - population census -demographic surveys - Registration method: vital registration - population register and other administrative records, registration of population in India.

Unit – II

Fertility:Fertility measurements – crude birth rates - general, specific and total fertility rates -gross and net reproduction rates and their interpretation.

Unit – III

Mortality:Mortality measurements: crude death rate- specific death rate-standardized death rate-infant mortality rate –maternal mortality rate –case fertility rate-comparative mortality index –force of mortality –graduation mortality rates-Makeham’s law.

Unit – IV

Life Table and Migration: Description and construction of various columns of a life table and their relationships-construction of an abridged life table –Reid and Pearl method-uses of life table –migration-factors effecting migration-gross and net migration rates.

Unit – V

Population Growth: Population projection –population estimates and projection – arithmetic, geometric and exponential growth rates- logistic curve and its suitability for graduating population data-Basic ideas of stationary and stable population.

Books for Study:

1. Gupta, S.C.andKapoor,V.K (2007) Fundamentals of Applied Statistics, Sultan Chand & Sons, New Delhi
2. Agarwala, S.N. (1991) Indian Population Problems, Tata McGrawHill,New Delhi.
3. Goon, A. M. Gupta. M. K.andDasGupta,B. (1993) Fundamentals of Statistics- Vol.II, World Press, Kolkata.

Books for Reference:

1. Mishra, D.E. (1982) An Introduction to the Study of Population, South India Publishers, Madras.
2. Hansraj, D.R. (1981) Fundamentals of Demography, Surjeet publications, New Delhi.
3. Cox, P.R. (1978).Demography (Fifth Edition).Cambridge University Press.
4. Bogue, D. J. (2007).Principles of Demography, Wiley, New York.
5. Gibbs, J.P. (2012). Urban Research Methods.Literary Licensing, LLC.

WEB RESOURCES:

1. <https://www.nationalgeographic.org/encyclopedia/demography>
2. <https://www.merriam-webster.com/dictionary/demography>
3. <https://www.thoughtco.com/what-is-demography-3026275>

GENERIC ELECTIVE-IV: C PROGRAMMING

SEMESTER –III
Code :

Credits : 4
Hours : 4

Course Objective

To equip the students with programming skill and apply the statistics tools in programming.

Course Outcome:

- Students will get the programming knowledge and will know how to write the c program for statistics tools.

Unit - I

Introduction to C - Character set - Key words and identifiers -Data types- Constants & Variables and their declarations – Operators: Arithmetic Operators, Relational Operators, Logical Operators, Assignment Operators, Increment and Decrement Operators, Conditional Operator, Bitwise Operators- Expressions: Arithmetic Expressions, Evaluation of Expressions, Precedence of Arithmetic Operators.

Unit - II

Input & output operations – Reading a Character, Writing a character – Formatted Input: Inputting Integer Numbers, Inputting Real Numbers, Inputting Character Strings-Formatted Output: Output of Integer Numbers, Output of Real Numbers – Printing of a Single Character and Printing of Strings.

Unit - III

Decision making and branching: Decision Making with IF Statement, Simple IF statement , IF-ELSE statement – Nesting of IF-ELSE statements, the ELSE-IF ladder, The Switch Statement, The ?: Operator, The GOTO Statement.

Unit – IV

Decision making and looping: The WHILE statement , the DO statement, the FOR statement – Arrays: One-dimensional Arrays, Declaration of One-dimensional Arrays, Initialization of One-dimensional Arrays, Two-dimensional Arrays, Initializing Two-dimensional Arrays. Character Arrays and Strings: Declaring and Initializing string Variables, Reading Strings from Terminal, Writing Strings to Screen, Arithmetic Operations on Characters, Putting Strings Together, Comparison of Two Strings.

Unit – V

User-defined Functions: Introduction, Elements of User-defined Functions, Definition of Functions, Return Values and their Types, Function Calls, Function Declaration, Category of Functions, Arguments with Return Values, Nesting of Functions, Recursion, Passing Arrays to Functions. Structures and Unions.

Book for study:

Balagurusamy, E, “Programming in ANSI-C”, (Fourth Edition), Tata Mc Graw Hill publishing Company. New Delhi

Book for Reference:

Byrons Gottfried , “Theory and Practice of Programming with C”, Schaum Outline Series, McGraw Hill publishing company.

WEB RESOURCES:

1. <https://www.programiz.com/c-programming>.
2. <https://www.tutorialspoint.com/cprogramming/index.htm>.
3. <https://www.w3schools.com/c/index.php>
4. <https://www.cprogramming.com/>

GENERIC ELECTIVE-IV: ECONOMETRICS – I

SEMESTER –III

Credits : 4

Code :

Hours : 4

Course objectives:

- Understand the concept of econometrics
- Understand two variable regression model.
- Explore the knowledge of transformation of variables.
- Understand the importance of assumptions of regression model.

Course Outcome:

- Solve a regression problem
- Find the problem of multi collinearity and other model assumptions
- Estimate the OLS estimators

Unit - I

Econometrics – definitions – scope – methodology – types.

Unit - II

Two variable regression model – assumptions – method of least squares – properties – BLUE – R-square – maximum likelihood method – testing of hypotheses using point and interval estimates – forecasting – solving problems using SPSS and STATA.

Unit - III

Nonlinear relationships – transformation of variables – functional forms – three variable regression model – applications using SPSS and STATA.

Unit - IV

General linear model (matrix approach) – specification – OLS estimators – testing significance of individual and overall regression coefficients – restricted least squares – structural regression models – dummy variables – problems and application using STATA.

Unit - V

Violation of classical assumptions – multicollinearity – autocorrelation – heteroscedasticity – problems – causes – consequences – remedial measures – model specification and diagnostic testing.

Book for study:

Damodar N. Gujarathi: Basic Econometrics, New Delhi: Tata McGraw Hill.

Books for Reference:

J.Johnston: Econometric Methods, McGraw Hill. 3. STATA Version 8.0: User's Guide, Texas: Stata Press.

DISCIPLINE SPECIFIC ELECTIVE-I: C & R PROGRAMMING LAB

SEMESTER – III & IV(NS)

Credits : 3

Code:

Hours : 2+3

Course Objectives:

The main objectives of this course are to:

- Understand the operations and functions of C and R Programming,
- Perform statistical analysis using built-in functions

Course Outcomes:

On the successful completion of the course, student will be able to:

- Understand the basics of C and R language
- Apply the logical skills for performing statistical analysis
- Use appropriate diagrams and charts for all kinds of data

Unit - I

Program for arranging a given set of n numbers and names in ascending order, descending order.

Unit - II

Program for finding the smallest value of given n-values, finding the largest value given n-values.

Unit - III

Program for finding n-factorial, finding ${}^N C_r$ value and solving Quadratic equations.

Unit - IV

Program for finding the value of Range and Co-efficient of Range of 'n' given values, Arithmetic Mean, Median, Mode, Geometric Mean and Harmonic Mean, Standard deviation, Co-efficient of Standard deviation, Variance and Co-efficient of Variation.

Unit - V

Program for finding correlation co-efficient, Regression co. efficient, Regression equations.

Books for study:

1. Balagurusamy, E, "Programming in ANSI-C", (Fourth Edition), Tata Mc Graw Hill publishing Company. New Delhi
2. An Introduction to R. Online manual at the R website at <http://cran.rproject.org/manuals.html>.

Books for Reference:

1. Byrons Gottfried , "Theory and Practice of programming with C", Schaum Outline Series, McGraw Hill publishing company.

2. Everin, B.S., and Hothorn T. (2010), A. Handbook of Statistical Analyses Using R, Second Edition, Chapman and Hall, CRC Press.
3. Peter Dalgaard. Introductory Statistics with R(Paperback) 1st Edition Springer-Verlag New York, Inc.
4. Purohit, S. G. Gore, S.D., and Deshmukh, S.R. (2009), Statistics Using R, Narosa Publishing House, New Delhi.

WEB RESOURCES:

1. <https://www.programiz.com/c-programming>.
2. <https://www.tutorialspoint.com/cprogramming/index.htm>.
3. <https://www.w3schools.com/c/index.php>.
4. <https://www.cprogramming.com/>
6. <https://www.coursera.org/learn/r-programming>.
7. <https://www.tutorialspoint.com/r/index.htm>

DISCIPLINE SPECIFIC ELECTIVE-I:ECONOMETRICS – II

SEMESTER – III & IV(NS)

Credits : 3

Code:

Hours : 2+4

Course Objective

To enable students to gain knowledge about Econometrics such as functions of auto regressive models, simultaneous equation model, logit, probit and tobit models.

Course Outcomes

Student will be able to

- know the different methods of dynamic econometrics .
- recognize different types of data and scales of measurement.
- understand censored regression model.
- Study the qualitative dependent variable.

Unit - I

Dynamic econometrics – autoregressive and distributed lag models – estimation methods – lagged variables – problem and applications using STATA.

Unit - II

Simultaneous equation model – specification – identification – rank and order conditions – problems.

Unit - III

Estimation methods – single equation and systems estimation methods – numerical problems – applications using STATA.

Unit - IV

Qualitative and limited dependant variable models – linear probability, logit, probit and tobit models – specification – estimation methods – applications.

Unit - V

Censored regression models – multinomial logit – hazard model – estimation - applications.

Books for study:

Gujarathi, D.N.: Basic Econometrics, New Delhi: Tata McGraw Hill.

Books for Reference:

1. Johnston, J.: Econometric Methods, McGraw Hill.
2. Greene, W.: Econometric Analysis, Pearson Education.
4. STATA Version 8.0: User's Guide, Texas: Stata Press

CORE -VII : ESTIMATION THEORY

SEMESTER – IV

Credits : 5

Code:

Hours : 5

Course Objective

- To develop knowledge and understanding the theoretical concepts and applications of estimation theory.
- To develop the ability and confidence to analyze and solve problems in selected areas of estimation theory.

Course Outcome

- Students gain analytical skills in selected areas of Estimation Theory.
- An understanding of Estimation principles, techniques and knowledge towards applications of statistical theory.

Unit – I

Point estimation: Estimator – Properties – Consistency, sufficient conditions for consistency. Efficiency – sufficient statistics – Neyman-Fisher Factorization theorem (statement only) – applications and simple problems.

Unit – II

Unbiased Estimation: Minimum variance unbiased estimators, Cramer – Rao Inequality, Rao-Blackwell theorem – Applications and simple problems.

Unit – III

Methods of estimation : Method of Maximum likelihood estimation – definition of likelihood function and MLE, properties of MLE (simple problems). Statement of Cramer Rao theorem and Hazoor Bazar's theorem.

Unit – IV

Methods of moments – Properties of estimators obtained by this method – Simple problems. Method of minimum Chi-square and modified minimum Chi-square. Method of Least Squares for regression models.

Unit – V

Interval Estimation: Interval estimator, confidence coefficient, confidence limits, pivotal quantity. Confidence Interval for proportion(s), mean(s), variance(s) based on normal, Chi-square, Student's t and F distributions – simple problems.

Books for Study:

1. Gupta, S.C, and Kapoor V K (1982): Fundamentals of Mathematical Statistics, Sultan Chand and Sons, New Delhi.
2. Mood, A.M. Graybill, F.A. and Boes, D.C. (1974) Introduction to the Theory of Statistics, McGraw Hill, New York.

Books for Reference:

1. Rohatgi, V.K. and Saleh, A. K. MD.E. (2001) An Introduction to Probability and Statistics, Wiley, India
2. Spiegel, M.R. and Ray,M(1980) Theory and Problems of Probability and Statistics, Schaum's Outline Series, McGraw Hill, New York.
3. Casella G and Berger R L, (2002). Statistical Inference, Second Edition, Thompson Learning, New York. (Reprint, 2007).
4. Goon, A M, Gupta M.K and Dasgupta B, (1989), An Outline of Statistical Theory, Vol. II, World Press, Kolkata.
5. Rohatgi, V.K and Saleh, A.K.Md.E, (2011), An Introduction to Probability and Statistics Second Edition, John Wiley & Sons, New York.

WEB RESOURCES:

1. <https://engineering.purdue.edu/ChanGroup/ECE645.html>
2. https://people.duke.edu/~hpgavin/SystemID/References/Estimation_Theory.pdf
3. <https://www.gaussianwaves.com/2012/05/an-introduction-to-estimation-theory>

DISCIPLINE SPECIFIC ELECTIVE - II: R PROGRAMMING

SEMESTER – IV

Code:

Credits : 3

Hour: 4

Course Objectives:

The main objectives of this course are to:

- To understand the operations and functions of R Programming.
- Perform statistical analysis using built-in functions .
- Learn and write customized program for mathematical and statistical problems.

Course Outcome:

On the successful completion of the course, student will be able to:

- Understand the principles of R Programming
- Understand the various operators and expressions
- Know the use of conditional control statements

Unit – I

Introduction to R – Using the help facility. R data types and objects, reading and writing data import and export. Data structures: vectors, matrices, lists and data frames

Unit – II

Built-in data-Reading data from other sources – Merging data across data sources. Control structures: functions, scoping rules, dates and times.

Unit – III

Grouping, loops and conditional execution – Ordered and unordered factors – Arrays and matrices – Classes and methods – Graphical procedures – Packages.

Unit – IV

Dealing with Missing values – Data Cleaning and Transforming - Exploring and Visualizing – Writing your own functions – Statistical models in R.

Unit – V

Vector matrix operations – matrix operations – addition, subtraction, multiplication, linear equations and eigenvalues, matrix decomposition – lu, qr, and svd and inverse, basis of matrix, rank of a matrix.

Books for study:

1. An Introduction to R. Online manual at the R website at <http://cran.r-project.org/manuals.html>.

2. Brian Everitt and Torsten Hothorn. A Handbook of Statistical Analysis Using R, 2nd Edition Chapman and Hall/CRC, 2009.

Books for Reference:

1. Everin, B.S., and Hothorn T. (2010), A. Handbook of Statistical Analyses Using R, Second Edition, Chapman and Hall, CRC Press.
2. Peter Dalgaard. Introductory Statistics with R(Paperback) 1st Edition Springer-Verlag New York, Inc.
3. Purohit, S. G. Gore, S.D., and Deshmukh, S.R. (2009), Statistics Using R, Narosa Publishing House, New Delhi.
4. Quick, J.M. (2010) Statistical Analysis with R, Packt Publishing Ltd., UK.
5. Robert Kabacoff, R in Action Data Analysis and Graphic with R, Manning Publications, 2011.

WEB RESOURCES:

1. <https://www.tutorialspoint.com/r/index.htm>
2. <https://www.w3schools.com/r/default.asp>
3. <https://www.udemy.com/r-programming>

DISCIPLINE SPECIFIC ELECTIVE - II: ECONOMETRICS – III

SEMESTER – IV

Code:

Credits : 3

Hour: 4

Course Objective

To enable students to gain knowledge about Econometrics such as consumption functions, production function, dynamic econometric models and qualitative response models.

Course Outcomes

Student will be able to

- know the different functions in Econometrics.
- recognize different types of Dynamic econometric models.
- familiar various techniques of Qualitative response models
- understand Simultaneous regression models.

Unit – I

Consumption functions – estimation of demand functions – Engel functions – functional forms viz. linear, double-log, semi-log, quadratic, log-inverse functions – computation of price and income elasticities.

Unit – II

Production function – estimation of production functions viz. Cob-Douglas, CES, Translog, frontier functions – estimation of cost, profit and supply response functions.

Unit – III

Dynamic econometric models – Koyck, adaptive expectation and partial adjustment, Almon distributed lag models – panel models.

Unit – IV

Qualitative response models – estimation of LPM, probit, logit and tobit models.

Unit – V

Simultaneous regression models – indirect least squares, two-stage least Squares – instrumental variable methods.

Books for study:

1. D.N. Gujarathi: Basic Econometrics, Tata – McGraw Hill.
2. A.Deaton and John Muellbauer: Economics and Consumer Behaviour, Cambridge University Press,

Books for Reference:

1. Julia Hebden: Applications of Econometrics, Heritage Publishers.
2. R.F.Wynn and K. Holden: An Introduction to Applied Analysis, Macmillan Press.
3. M.Upender: Applied Econometrics, Vrinda Publications

CORE-VIII : TESTING OF HYPOTHESIS

SEMESTER – V

Credits : 5

Code:

Hour: 5

Course Objectives:

The main objectives of this course are to:

- Understand the basic concepts of hypothesis testing.
- Familiar with the methods of framing and testing the hypothesis based on large samples and small samples.
- Understand the non-parametric methods for hypothesis testing.

Course Outcome:

On the successful completion of the course, student will be able to:

- Understand basic concepts of testing of statistical hypothesis
- Understand Likelihood Ratio test, applications and properties
- Understand test of significance, tests based on normal, t, F and Chi-square distributions
- Understand the concept of distribution free test, non-parametric tests

Unit I

Statistical Hypothesis– Simple and Composite hypotheses – Null and Alternative Hypotheses — Critical region – Type-I and Type-II errors – level of significance, size and Power of test – Most powerful test – Neyman-Pearson fundamental Lemma – Simple problems.

Unit II

Likelihood ratio test – Tests for mean and variance of normal populations- Tests for equality of means of two normal populations – Test for equality of variances of two normal populations.

Unit III

Large Sample Tests – Sampling distribution, standard error. Large sample tests concerning mean, variance, proportion- difference between means, difference between proportions.

Unit IV

Small sample Tests: Tests based on t, F and χ^2 distributions for means, difference between means, variance, ratio of variances. Tests for co-efficient of correlation, regression coefficient. Chi-square Tests: Tests for association, independence and goodness of fit.

Unit V

Non-Parametric Tests: Sign, Wilcoxon's Signed rank test and Runs test for one sample problems. Median, Mann – Whitney tests for two sample problems – Kruskal – Wallis test- Simple problems.

Books for Study:

1. Gupta, S.C, and Kapoor, V. K. (1982) Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi.
2. Hogg, R.V. and Craig, A.T. (1972) Introduction to Mathematical Statistics, 3/e, Amerind, New Delhi

Books for Reference:

1. Mood, A.M. Graybill, F.A. and Boes, D.C. (1974) Introduction to the theory of Statistics, Tata McGraw Hill, New Delhi.
2. Spiegel, M.R., and Ray, M. (1980): Theory and Problems of Probability and Statistics, Schaum's Outline Series, McGraw Hill, New York.
3. Goon, A.M., Gupta, M. K., and Dasgupta, B. (1989). An Outline of Statistical Theory, Vol. II, World Press, Kolkata.
4. Lehmann, E. L. and Romano, J.P. (2005). Testing Statistical Hypotheses (Third Edition), Springer Verlag, New York. (Reprint, 2009).
5. Rao, C.R. (1973). Linear Statistical Inference and Its Applications (Second Edition), Wiley Eastern Ltd., New Delhi.
6. Rohatgi, V.K. and Saleh, A.K.Md.E. (2001). An Introduction to Probability and Statistics (Second Edition), John Wiley & Sons, New York. (Reprint, 2009).

WEB RESOURCES:

1. <https://online.stat.psu.edu/.../hypothesis-testing>
2. <https://www.formpl.us/blog/hypothesis-testing>
3. <https://www.analyticsvidhya.com/blog/2021/01/>

CORE-IX : STOCHASTIC PROCESS

SEMESTER : V

Credits : 5

Code :

Hours : 5

Course Objectives:

The main objectives of this course are to:

- Understand the fundamental concept of random processes and its classification.
- Understand the concepts of Markov chain and its applications.
- Compute transition probability matrix .
- Inculcate various models of stochastic processes and its applications.
- Impart knowledge on various classification of states and its applications.

Course Outcome:

On the successful completion of the course student will be able to

- Compute transition probability matrix
- Classify the states of Markov chain
- Know the concept of Poisson process and Birth and death process.
- Know the concept of application of Markov chain and its applications
- Know the concept of various consumer behavior of Markov chain

Unit –I

Notion and specification of Stochastic Processes – Stationary Process – Markov Chains – Definition and examples – Higher transition probabilities: Chapman – Kolmogorov equations. Classification of States and Chains

Unit II

Markov Chains – Determination of Stability of a Markov System – Limiting Behaviour – Ergodic theorem. One dimensional random walk

Unit III

Markov Processes with discrete state space: Poisson Process – Postulates of Poisson process Properties of Poisson Process – Poisson process and related distributions. Pure Birth process – Yule-Furry process. Pure Death Process – Simple Birth and Death Process.

Unit-IV

Renewal Process – Definition, related concepts and examples – Renewal equation – Elementary Renewal Theorem – Basic Renewal Theorem.

Unit-V

Applications in Stochastic Models: Queuing Systems and Models: Simple queuing models M/M/1, M/M/s queuing systems (finite and infinite) steady state solution-simple problems with finite and infinite capacities.

Books for Study:

1. Medhi.J(2002), Stochastic Processes, New Age International, New Delhi.
2. KantiSwarup, Gupta.P.K. Man Mohan.,(2010): Operations Research, Sultan Chand & Sons

Books for Reference:

1. Karlin.S.and Taylor(1975) A first course in Stochastic processes, Academic Press, New York.
2. Ross, S.M.(1983),Stochasti Processes, Holden-Day, San Francisco.
3. Hoel,P.G.Port,S.C. and Stone,C.J.(1991), Introduction to Stochastic Processes, Universal Book Stall, New Delhi.
4. Parzen,E.(1962) , Stochastic Processes, Holden-Day, San Francisco.
5. Taylor, H.M. and Karlin.S(1999), Stochastic Modelling , Academic press, New York.
6. Bhat.U.N.(1972) Elements of Applied Stochastic Processes, Wiley, New York.
7. Prabhu,N.U.(2007) Stochastic Processes: Basic Theory and Applications, World Scientific , Singapore.

WEB RESOURCES:

1. <https://web.ma.utexas.edu/users/gordanz/notes/>
2. <https://pi.math.cornell.edu/~jerison/math4740.html>
3. <https://online.stanford.edu/courses/stats217-introduction-stochastic-processes>
4. <http://www.randomservices.org/random/>
5. <https://www.britannica.com/science/stochastic-process>

CORE-X : STATISTICAL QUALITY CONTROL

SEMESTER : V

Credits : 5

Code :

Hours : 6

Unit- I

Control charts for variables: Need for Statistical Quality Control techniques in Industry .Causes of quality variation-Uses of Shewart Control charts – specifications, tolerance limits- 3σ limits – warning limits — Application of Theory of runs in quality control. Variable Control \bar{X} , R and σ - charts – Basis of sub grouping – Interpretation of \bar{X} and R charts.

Unit- II

Control Chart for Attributes – Control Chart for Fraction Defective (p-Chart) – Control Chart for Number of Defectives (d-chart, for fixed and variable sample size) – Control Chart for Number of Defects per unit (c- Chart) – Natural Tolerance Limit and Specification Limits.

Unit –III

Acceptance sampling: Acceptance Quality Level (A.Q.L) – Lot Tolerance Proportion or Percent Defective (LTPD) – Process Average Fraction Defective (p) – Consumer's Risk(β) – Producer's Risk(α) – Rectifying Inspection Plan – Average Outgoing Quality Level (AOQL)

Unit – IV

Acceptance sampling for attributes: Operating Characteristic Curve (OC-curve) – Average Sample Number (ASN) – Average Amount of Total Inspection (ATI) – Single Sampling Plan – Determination of 'n' and 'c', AOQL, OC-curve – Double Sampling Plan – ASN and ATI of Double Sampling Plan – Single sampling Vs Double Sampling plan.

Unit –V

Acceptance sampling for variables: Known- σ and unknown- σ sampling plans (one sided specification only). Determination of n and k for one sided specification of OC curve.

Book for Study:

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

Books for Reference:

1. Mahajan, M., Statistical Quality Control, Dhanpat Rai & Co.
2. Gupta, R.C.(1974) Statistical Quality Control,KhannaPublishing Co, New Delhi
3. Montgomery, D.C. (2009). Introduction to Statistical Quality Control, Sixth Edition, Wiley India, New Delhi.

WEB RESOURCES:

1. <https://www.analyticssteps.com/blogs/what-statistical-quality-control>
2. <https://www.brighthubengineering.com/.../66226-statistical-quality-control>
3. <https://www.ispatguru.com/statistical-quality-control>

CORE-XI P : COMPUTATIONAL STATISTICS-III

SEMESTER - V

Code :

Credits : 5

Hours : 5

Course Objectives:

The main objectives of this course are to:

- Be acquainted with the knowledge of time series analysis.
- Understand the significance of index numbers and its types.
- Verify optimality and evaluation of cost of living index numbers.
- Understand the application of Statistics in industrial environment
- Acquire knowledge on manufacturing process changes and process variability
- Understand the methods of framing and testing the hypothesis based on large samples and small samples.

Course Outcome:

On the successful completion of the course, student will be able to:

- Understand test of significance, tests based on normal, t, F and Chi-square distributions
- Compute the trend values and seasonal indices for a time series
- Compute various types of Index numbers
- Construct control charts for variables and attributes
- Effectively interpret the results from the control charts
- Understand basic concepts of testing of statistical hypothesis

Unit - I

Time series - Fitting of linear, Quadratic and Exponential trend by the method of least squares. Finding trend values by the method of moving averages.

Unit – II

Calculation of Laspeyre's, Paasche's, Fisher's, Dorbish - Bowley's and Marshall- Edgeworth Index Numbers. Calculation of weighted average of price relatives using Arithmetic Mean and Geometric Mean.

Unit – III

Control chart for Variables – X-Bar and R- Chart – Control Chart for Attributes – Control Chart for Fraction Defective (p-Chart) – Control Chart for Number of Defectives (d-chart, for fixed and variable sample size) – Control Chart for Number of Defects per unit (c - Chart).

Unit IV

Large Sample Tests – Sampling distribution, standard error. Large sample tests concerning mean, variance, proportion- difference between means, difference between proportions.

Unit V

Small sample Tests- Tests based on t, F and χ^2 distributions for means, difference between means, variance, ratio of variances. Tests for co-efficient of correlation, regression coefficient. Chi-square Tests: Tests for association, independence and goodness of fit.

Book for Study:

1. Gupta S,C and Kapoor V.K (1993): Fundamental of Applied Statistics. - Sultan Chand & Sons, New Delhi.
2. Mahajan, M., Statistical Quality Control, Dhanpat Rai & Co.

Books for Reference:

1. Gupta S.P (1995) , Statistical Methods, Sultan Chand & Sons, New Delhi.
2. Goon A.M, Gupta M.A and Das Gupta (1987) , Fundamentals of Statistics, SultanChand & Sons, New Delhi.

DISCIPLINE SPECIFIC ELECTIVE - III: APPLIED STATISTICS

MAJOR ELECTIVE – II

SEMESTER – V

Credits : 3

Code:

Hour: 5

Course Objectives:

The main objectives of this course are to:

- Understand the Educational & Psychological Statistics
- Be acquainted with the knowledge of time series analysis.
- Understand the significance of index numbers and its types.
- To know the knowledge about vital statistics

Course Outcome:

On the successful completion of the course, student will be able to:

- Compute the trend values and seasonal indices for a time series.
- Compute various types of Index numbers.
- Effectively interpret the results from Educational & Psychological Statistics Scaling procedures
- Understand basic concepts of vital statistics
- Compute time series analysis tools.

Unit - I

Index Numbers :Basic problems in construction of index numbers. Methods – Simple and Weighted Aggregate methods, Average of Price Relatives, Chain Base method .Criteria of goodness – Unit test, Time Reversal, Factor Reversal & Circular tests. Base shifting, Splicing & Deflating index numbers. Wholesale Price index& Consumer price index numbers. Index of industrial production.

Unit –II

Educational & Psychological Statistics Scaling procedures – Scaling of individual test items, of scores, of rankings & of ratings. Reliability of test scores – Index of reliability, Parallel tests, Methods for determining test reliability, Effect of test length & ranges on reliability.

Unit – III

Vital Statistics Uses and Methods of obtaining vital statistics. Rates & Ratios. Measurement of Mortality – Crude, Specific & Standardized death rates. Life Table – Stationary & Stable population, Construction of life tables. Fertility – Crude, General, Specific & total fertility rates

Unit – IV

Time Series – Trend Component :- Components of Time Series, Mathematical models of time series. Measurement of Trend Component : Graphic, Semi-Averages, Moving Averages. Least-squares – Straight Line, Second Degree Parabola, Exponential Curve, Modified Exponential Curve, Gompertz Curve, Logistic Curve.

Unit – V

Time Series – Other Components: Measurement of Seasonal Variations – Simple averages, Ratio-to-trend, Ratio-to Moving average, Link Relative. Deseasonalisation of data. Measurement of Cyclic variations.

Book for Study:

Gupta S,C and Kapoor V.K (1993): Fundamental of Applied Statistics. - Sultan Chand & Sons, New Delhi.

Books for Reference:

1. Gupta S.P (1995) , Statistical Methods, Sultan Chand & Sons, New Delhi.
2. Goon A.M, Gupta M.A and Das Gupta (1987) , Fundamentals of Statistics, Sultan Chand & Sons, New Delhi.

WEB RESOURCES:

1. <https://online.stanford.edu/courses/stats191-introduction-applied-statistics>
2. <https://umdearborn.edu/.../applied-statistics>
3. <https://researchleap.com/applied-statistics-basic-principles-and-application>

DISCIPLINE SPECIFIC ELECTIVE - III: TIME SERIES & INDEX NUMBERS

MAJOR ELECTIVE – II

SEMESTER – V

Credits : 3

Code:

Hour: 5

Course Objectives:

The main objectives of this course are to:

- Be acquainted with the knowledge of time series analysis.
- Understand the significance of index numbers and its types.
- Verify optimality and evaluation of cost of living index numbers.

Course Outcome:

On the successful completion of the course, student will be able to:

- Compute the trend values and seasonal indices for a time series.
- Compute various types of Index numbers.
- Compute demand analysis tools.

Unit – I

Analysis of Time Series – Its definition and uses, Additive and Multiplicative Models in Time Series, Components of Time Series - Secular Trend, Seasonal variation, Cyclic Variations and Irregular fluctuations- Definition and Concepts. Measurement of Trend – Graphic method, Method of Semi-Averages, Method of Moving Averages and Method of Least Squares. Fitting of Straight line trend.

Unit – II

Measurement of Seasonal Variations – Method of Simple Averages, Ratio to Moving Average method by additive and multiplicative model , Ratio to Trend Method and Link Relative Method - Simple Problems.

Unit – III

Index Numbers – Definition and Uses, Types of Index Numbers, Problems involved in the construction of Index Numbers. Construction of Simple Index Numbers. – Simple aggregate method and Simple average of Price Relatives using A.M & G.M. Construction of Weighted Index Numbers – Laspeyre's, Paasche's, Dorbish Bowley, Marshall Edge worth and Fisher's Ideal Index Numbers - Simple Problems.

Unit – IV

Definition of Deflation, Splicing, Inflation, and Real wages. Construction of Weighted Average of Price relatives Index Numbers using A.M & G.M. Fixed Base Index Numbers and Chain Base Index Numbers. Tests of adequacy of a good Index Number – Time Reversal Test, Factor Reversal Test, Unit test and Cyclic test - Simple Problems.

Unit – V

Demand Analysis: Introduction-Definition of Demand and Supply- Laws of Demand and Supply- Equilibrium Price-Giffen's Paradox. Price Elasticity of Demand and Price Elasticity of Supply: Definition, Interpretation and Simple problems.

Book for Study:

Gupta S,C and Kapoor V.K (1993): Fundamental of Applied Statistics. - Sultan Chand & Sons, New Delhi.

Books for Reference:

3. Gupta S.P (1995) , Statistical Methods, Sultan Chand & Sons, New Delhi.
4. Goon A.M, Gupta M.A and Das Gupta (1987) , Fundamentals of Statistics, Sultan Chand & Sons, New Delhi.

WEB RESOURCES:

4. <https://online.stanford.edu/courses/stats191-introduction-applied-statistics>
5. <https://umdearborn.edu/.../applied-statistics>
6. <https://researchleap.com/applied-statistics-basic-principles-and-application>

CORE-XII :SAMPLING TECHNIQUES

SEMESTER : VI

Credits : 6

Code:

Hours : 6

Course Objectives:

- To develop the knowledge about the sampling theory and its application.
- Impart the understanding of the basic concepts of sampling theory.
- Understand the meaning of different sampling method.

Course Outcome:

On the successful completion of the course student will be able to

- Understand the basic concepts of sampling survey
- Identify the sample size for different sampling method.
- Determine the estimation of population parameters

Unit –I

Sample Survey: Basic concepts of sample surveys-Principles of sample survey(Validity, Statistical regularity and optimization)-Sampling unit-Sampling frame-Census-Merits and Demerits . Preparation of schedules and questionnaires. Sampling distribution and standard error-Sample mean(s),variances(s) and proportion(s).

Unit-II

Sampling and Non-sampling errors: sampling errors-Relationship of sampling errors with sample size. Non-sampling errors-Sources and types-Bias and variable errors-Incomplete frame and missing units-Non-response and response errors.

Unit-III

Simple random sampling : Simple random sampling with and without replacement – Procedures of selecting a random sample.(Lottery method, use of random number tables)- Estimation of population parameters-mean, variance and proportion-Simple random sampling for attributes confidence limits-Determination of sample size.

Unit-IV

Stratified random sampling :Principles of stratification-Estimation of population mean and its variance- Allocation techniques(equal allocation , Proportional allocation, Neyman's optimum allocation)- Estimation of gain due to stratification.

Unit-V

Systematic sampling: Estimation of population mean and its standard errors-
Comparison of systematic, simple random and stratified random sampling.

Books for Study:

Daroga Singh and F.S.Chaudhary(2014), Theory and Analysis of Sample survey Designs, The new Age International Publishers, New Delhi.

Books for Reference:

1. Cochran W.G.(2007) Sampling Techniques, Third Edition, John Wiley & sons, New Delhi.
2. Kapoor V.K. and Gupta S.P.(1978): Fundamentals of Applied Statistics, Sultan Chand & sons, New Delhi.
3. Desraj(1976), Sampling Theory , Tata McGraw Hill, New York(Reprint 1979).
4. Murthy, M.N.(1977) , Sampling Theory and Statistical Methods, Statistical Publishing Society, Kolkata.
5. Thompson.S.K.(2012) Sampling , John Wiley and Sons, New York.
6. Des Raj and Promod Chandhok(1998) Sample survey Theory, Narosa, New Delhi.
7. Ardilly P and Yves T.(2006), Sampling methods: Exercise and Solution, Springer.

WEB RESOURCES:

1. <https://youtu.be/vTyrthS7t5g>
2. <https://youtu.be/9PaR1svnJs>
3. <https://youtu.be/be9e-Q-jC-0>
4. <http://www.statpac.com/surveys/sampling.htm>
www.apparison.com

C-XIII :REGRESSION ANALYSIS

SEMESTER - VI

Credits : 5

Code:

Hours : 6

Course Objectives:

To familiar the regression models and its applications in real life situation.

Course Outcome:

Students will understand the concept of regression models and how to apply the models in different situations.

Unit I

Simple regression models with one independent variable, assumptions, estimation of parameters, Properties of Least Square estimation of the regression co.efficient ,standard error of estimator, testing the significance of regression coefficients.

Unit II

Multiple regression analysis: Estimation of the model parameters. Properties of Least Square estimation of the regression co.efficient. Estimation of σ^2 – Maximum-Likelihood Estimation.

Unit III

Multiple regression analysis: Hypothesis testing about individual regression coefficients, testing the overall significance of the sample regression, testing the equality of two regression coefficients – Confidence intervals in multiple regression co.oefficients.

Unit IV

General Linear Model-Link Functions and Linear Predictors- Parameter estimation and inference in the general linear model. Prediction and Estimation with the general linear model.

Unit V

Robust Regression: The need for Robust regression-M estimators, Properties of Robust estimators, Breakdown point and Efficiency- Survey of other Robust Regression Estimators.

Books for Study :

1. Douglas C. Montgomery, Elizabeth A. Peck, G.Geoffrey Vining(2001): Introduction to Linear Regression Analysis, John Wiley & Sons.
2. Draper N.R. and Smith. H (1981), Applied Regression Analysis, John Wiley & Sons.
3. D.N. Gujarati and Sangeetha (2008) Basic Econometrics, (4th Edition). Tata Mc Graw Hill publishing Company, New Delhi.

Books for Reference:-

1. Brook R.J. and Arnold. G.C. (1985), Applied Regression Analysis and Experimental Design, Marcel Dekker, Inc.
2. Plackeff. R.L. (1960), Principles of Regression Analysis, Oxford at the Clarendon press.
3. Huang. D.S. (1970), Regression and Econometric Methods, John Wiley and Sons.
4. Norman R. Draper and Harry Smith (1998) Applied Regression Analysis (Wiley Series in Probability and Statistics).
5. John O. Rawlings, Sastry G. Pantula and David A. Dickey (2001) Applied Regression Analysis: A Research Tool (Springer Texts in Statistics).

WEB RESOURCES:

1. <https://youtu.be/wscb2XfW11Q>
2. <https://youtu.be/owl7zxCqNY0>
3. [www.wikipedia.org/least square method.html](http://www.wikipedia.org/least%20square%20method.html)
4. [www.wikipedia.org/ regression analysis.html](http://www.wikipedia.org/regression%20analysis.html)
5. www.econpapers

C-XIV: DESIGN OF EXPERIMENTS

SEMESTER: VI

Credits :5

Code :

Hours : 5

Course Objectives:

The main objectives of this course are to:

- Teach the students to understand the theoretical concepts of analysis of variance
- Make the students familiar with various experimental designs
- Make the students understand some advanced concepts of design of experiments

Course Outcomes:

On the successful completion of the course, Student will be able to:

- Remember and understand the theoretical underpinning of analysis of variance and design of experiments
- Understand the type of any given experiment and the type of design apt for its analysis
- Apply various design of experiments in several practical situations and evaluate its results

Unit - I

Analysis of Variance: Definition and assumptions. Cochran's theorems (statement only) ANOVA - One way and Two way classifications (with one observation per cell). Experimental error.

Unit - II

Design of Experiment: Need, terminology. Randomization, Replication and Local control; Completely Randomized Design (CRD), Randomized Block Design (RBD), Latin Square Design (LSD) - Estimation of missing values in RBD and LSD (one and two missing values).

Unit - III

Factorial experiments – Definitions - main effects and interactions; definitions of contrast and orthogonal contrast; Yate's method of Computation - Analysis of 2^2 , 2^3 and 2^n factorial experiments.

Unit - IV

Confounding in factorial design – Total Confounding and Partial confounding in 2^3 experiments.

Unit - V

Analysis of co-variance for a one way layout with one concomitant variable and RBD with one concomitant variable.

Book for Study:

S.C. Gupta and V.K. Kapoor (2013), Fundamentals of Applied Statistics, Sultan Chand & Sons, New Delhi.

Book for Reference:

1. Douglas C.Montgomery (2010), Design and Analysis of experiment, Wiley International Edition, India.
2. Cochran.W.G. &G.M.Cox (1957), Experimental designs, Wiley International edition, India.
3. Das M.N. and Giri, N.C. (1986) Design and Analysis of Experiments, Wiley Eastern,New Delhi.
4. Joshi, D.D (1987). Linear Estimation and Design of Experiments, New Age International (P) Ltd. New Delhi.

WEB RESOURCES:

1. www.booksc.org
2. www.khanacademy.org

CORE-XV : COMPUTATIONAL STATISTICS - IV

SEMESTER - VI

Credits : 5

Code :

Hours : 6

Course Objectives:

The main objectives of this course are to:

1. To develop the knowledge about the sampling theory and its application
2. Impart the understanding of the basic concepts of sampling theory
3. Understand the meaning of different sampling method.

Course Outcome:

On the successful completion of the course, student will be able to:

- understand the basic concepts of sampling survey
- Identify the sample size for different sampling method.
- Determine the estimation of population parameters

Unit - I

Simple Random Sampling - Estimation of Mean and Variance of the population, variance of the estimator of the mean. Stratified random sampling with Proportional Allocation and Optimum Allocation - Estimation of Mean and Variance of the population, variance of the estimator of the mean.

Unit - II

Estimation of mean and variance of population using Systematic Random sampling, Ratio estimator and Regression estimators.

Unit - III

Design of Experiment: Completely Randomized Design (CRD), Randomized Block Design (RBD), Latin Square Design (LSD) - Estimation of missing values in RBD and LSD (one and two).

Unit - IV

Factorial experiment - Analysis of 2^2 and 2^3 experiments – Total Confounding and Partial confounding in 2^3 experiments.

Unit - V

Problem of interpolation – with equal and unequal intervals. forward and backward interpolation - Newton-Gregory, Gauss, Stirling, Everitt, Lagrange's methods of interpolation.

Book for Study:

1. S.C. Gupta and V.K. Kapoor (2013), Fundamentals of Applied Statistics, Sultan Chand & Sons, New Delhi.
2. Sastry, S. S. (1993) Introductory Methods of Numerical Analysis, PHI learning, New Delhi.

**DISCIPLINE SPECIFIC ELECTIVE - IV:
NUMERICAL METHODS
MAJOR ELECTIVE – III**

SEMESTER – VI

Credits : 3

Code:

Hour : 5

Course Objectives:

The main objectives of this course are to:

- Understand the algebraic and transcendental equations.
- Understand the methods of solving problems using numerical methods

Course Outcome:

On the successful completion of the course, student will be able to:

- Interpolate the value using techniques of numerical methods
- Solve equations using numerical methods
- Perform numerical differentiation.
- Perform numerical integration using Trapezoidal and Simpson's rule etc.

Unit I

Operator and Differences: Symbolic operators- E , Δ , δ and ∇ , and their relationships and their role in difference tables. Central, forward, backward and divided differences –differences of polynomials.

Unit II

Interpolation: Problem of interpolation – with equal and unequal intervals. Formulae for forward and backward interpolation - Newton-Gregory, Gauss, Stirling, Everitt, Lagrange's methods of interpolation.

Unit III

Solutions of equations: Bi-section, false position, Horner's and Newton – Raphson methods. Solving of simultaneous linear equations by Gauss elimination method.

Unit IV

Numerical differentiation: The operator D -Relation between A and D – Formulae for Numerical differentiation. Expression for D in terms of maxima and minima of a function - numerical problems.

Unit V

Numerical integration: Quadrature formulae. Trapezoidal rule. Simpson's one-third rule – Simpson's three-eight rule. Weddle's rule. Gregory's formulae. Newton – Cote's formula.

Book for Study:

1. Sastry, S. S. (1993) Introductory Methods of Numerical Analysis, PHI learning, New Delhi.

Books for Reference:

1. Balasubramaniam, Pand Venkatraman, M.K. (1972) Numerical Mathematics, Part I and II, Rochoose and Sons, New Delhi.
2. Saxena, H.C. (1972) Finite differences, S. Chand & Co, New Delhi.
3. Rajaraman, V.(1993) Computer Oriented Numerical Methods, PHI learning, New Delhi.
4. Hutchison, I. H. (2015) A student guide to Numerical Methods, Cambridge University Press, Cambridge.

WEB RESOURCES:

1. www.numerical analysis.com
2. www.programsforstatistics.com

**DISCIPLINE SPECIFIC ELECTIVE - IV:
ACTUARIAL STATISTICS
MAJOR ELECTIVE – III**

SEMESTER – VI

Credits : 3

Code:

Hour : 5

Course Objectives

The main objectives of this course are:

1. It develops a greater understanding of statistical principles and their application in actuarial statistics.
2. Describe the core areas of actuarial practice and relate to those areas actuarial principles, theories and models.
3. It gives the understanding of the application knowledge of the life insurance environment.

Unit - I

Simple and compound interest, present value and accumulated values of fixed rate, varying rate of interest.

Unit –II

Mortality : Gompertz - Makeham laws of mortality - life tables. Annuities: Endowments, Annuities, Accumulations, Assurances, Family income benefits.

Unit - III

Policy Values : Surrender values and paid up policies, industrial assurances, Joint life and last survivorship, premiums.

Unit-IV

Contingent Functions: Contingent probabilities, assurances. Decrement tables. Pension funds: Capital sums on retirement and death, widow's pensions, benefits dependent on marriage.

Unit-V

Principles of insurance, pure endowment, whole life assurance, Net premium for assurance and annuity plans-level annual premium under temporary assurance .

Book for Study:

- 1, Hooker,P.F., Longley, L.H.-Cook (1957) : Life and other contingencies, Cambridge.
2. Alistair Neill(1977) : Life contingencies, Heinemann professional publishing.
3. Gupta and Kapoor (2001) Fundamentals of Applied Statistics

Books for Reference:

1. Study material of IAI/IFoA of Actuarial Societies
2. Hosack, I.B., Pollard, J.H. and Zehnirth, B. (1999) : Introductory statistics with applications in general insurance, Cambridge University.

ALLIED – I
MATHEMATICAL STATISTICS - I
(For B.Sc Mathematics)

SEMESTER – I

Hours : 4

Code :

Credit : 4

Course Objectives:

To enable students to gain knowledge about descriptive statistics such as functions of statistics, measures of location and dispersion, correlation and regression.

Course Outcomes :

Student will be able to

- know methods of data collection .
- recognize different types of data and scales of measurement.
- know various techniques of presentation of data .
- represent the data using graphs and diagrams.
- know measures of location and dispersion .
- know correlation and regression .

Unit - I

Measures of central tendency- Mean, Median, Mode, Geometric Mean Harmonic Mean and Quartiles - Inter Relationship between A.M, G.M and H. M - properties of a good Average.

Unit - II

Measures of Dispersion- Range, Quartile deviation, Mean Deviation, Standard Deviation and Coefficient of variation, Measures of Skewness and Kurtosis.

Unit - III

Correlation –Definition, Types of Correlation, Scatter diagram, Karl Pearson’s Co-efficient of correlation, Rank Correlation Co-efficient – Linear Regression Equation.

Unit - IV

Probability- Axiomatic and Classical Probability – Simple problems. Addition and Multiplication Theorem of Probability – Baye’s Theorem- Simple problems .

Unit – V

Concept of Random Variable –Discrete and Continuous , Distribution Functions, Probability Mass Function, Probability Density Function and Mathematical Expectations, Moment Generating Function.

Book for Study:

Gupta S.C and V.K. Kapoor, Fundamental of Mathematical Statistics, Sultan & Sons, New Delhi.

Books for Reference:

1. Gross, A.J. and Clark, V.A. (1975). Survival distribution: Reliability applications in the Biomedical Sciences, Wiley, New Delhi.
2. Kalbfleisch, J D. and Prentice, R.L.(1980). The Statistical Analysis of Failure Time Data, wiley, New York.
3. Lawless, J.F. (1982). Statistical Models and Methods of Life Time Data, Wiley, New York.
4. Sinha, S.K. (1979), Reliability and Life Testing, Wiley Eastern, New Delhi.

WEB RESOURCES:

1. <https://www.youtube.com/watch?v=5k6RFJw1t8s&t=36s>
2. <https://www.youtube.com/watch?v=BGvxNHFRLCM&t=4s>
3. https://www.youtube.com/watch?v=mrCxwEZ_22o
4. <https://www.youtube.com/watch?v=uqlO5y6CJc8>
5. https://www.youtube.com/watch?v=08aaJU_UhJY

ALLIED - II
MATHEMATICAL STATISTICS – II
(For B.Sc Mathematics)

SEMESTER – I & II (NS)

Hours : 2+2

Code :

Credit : 2

Course Objectives:

The main objectives of this course are to:

- Understand the various measures of central tendencies and measures of dispersion
- Understand correlation coefficient and regression coefficients

Course Outcome:

On the successful completion of the course, student will be able to:

- Calculate Arithmetic Mean, Median, Mode, Geometric Mean, Harmonic Mean.
- Calculate quartile deviation, mean deviation and standard deviation.
- Calculate Karl Pearson's and Spearman's correlation coefficients.
- Form the regression equations.

Unit - I

Calculation of Arithmetic Mean, Median, Mode, Geometric Mean and Harmonic Mean (Numerical problems only) and Quartiles.

Unit - II

Computation of M.D , S.D., and Co-efficient of Variation - Karl Pearson's and Bowley's Co-efficient of Skewness (Numerical Problem only).

Unit- III

Karl Pearson's co-efficient of Correlation, Spearman's rank correlation, Regression line. (Numerical Problems only)

Unit - IV

Fitting of Binomial and Poisson distributions. Fitting of Normal distribution (Area method only)

Unit - V

Test of significance based on Normal distribution and Student's t-distribution for mean. Proportions and simple correlation. Chi-square test for independence of attributes.

Book for Study:

Gupta, S.C. and V.K. Kapoor, Fundamental of Mathematical Statistics, Sultan & Sons. New Delhi

Book for Reference:

Kapoor and Saxena, Mathematical Statistics, Chand & Co, New Delhi

WEB RESOURCES:

1. <https://www.youtube.com/watch?v=5k6RFJw1t8s&t=36s>
2. <https://www.youtube.com/watch?v=BGvxNHFRLCM&t=4s>
3. https://www.youtube.com/watch?v=mrCxwEZ_22o
4. <https://www.youtube.com/watch?v=uqI05y6CJc8>
5. https://www.youtube.com/watch?v=08aaJU_UhJY

ALLIED – III

MATHEMATICAL STATISTICS - III
(For B.Sc Mathematics)

SEMESTER – II

Hours : 4

Code :

Credits : 4

Course Objectives :

To impart knowledge about discrete and continuous probability distributions to the students.

Course Outcomes :

Students will able to

- Find the constant, MGF, Moments and recurrence relations of various distribution
- Understand the relationship between t , F and chi-square distributions.

Unit - I

Introduction to Binomial distribution – moments- recurrence relation for the moments- M.G.F-Additive property – simple problems.

Unit - II

Introduction to Poisson distribution – moments- recurrence relation for the moments- M.G.F-Additive property – simple problems.

Unit - III

Normal distribution – Definition and derivation of MGF. 't' , F and chi-square distributions- Definition, Derivations of the distributions and M.G.F – Inter relationship between t, F and χ^2 distributions.

Unit - IV

Test of Significance for large Samples- Single Mean, difference between mean, Single proportion and difference between proportion.

Unit - V

Test of significance for Small Sample- 't' test for single mean, Difference between means, Paired 't' test. Chi-square test for independence of attributes.

Book for Study:

Gupta S.C. and V.K. Kapoor, Fundamental of Mathematical Statistics, Sultan & Sons. New Delhi

Book for Reference:

Kapoor and Saxena, Mathematical Statistics, Chand & Co, New Delhi

WEB RESOURCES:

1. <https://www.youtube.com/watch?v=5k6RFJw1t8s&t=36s>
2. <https://www.youtube.com/watch?v=BGvxNHFRLCM&t=4s>
3. https://www.youtube.com/watch?v=mrCxwEZ_22o
4. <https://www.youtube.com/watch?v=uq1O5y6CJc8>
5. https://www.youtube.com/watch?v=08aaJU_UhJY

NON-MAJOR ELECTIVE - I
SPATIAL STATISTICS

SEMESTER – VI
Code :

Credits : 2
Hours : 2

Course Objectives:

The main objectives of this course are to:

- Understand the origin, significance and scope of Statistics.
- Know the significance of presenting data in the form of tables and diagrams.
- Learn computational aspects of basic statistical measures.

Course Outcomes

Student will be able to

- Know the different methods of data collection .
- Recognize different types of data and scales of measurement.
- Familiar various techniques of presentation of data.
- Represent the data using graphs and diagrams.
- Understand measures of location and dispersion .

Unit - I

Spatial Statistics - meaning, definitions, origin, importance, scope, functions and limitations. Collection of data - primary and secondary-sources.

Unit – II

Classification – objectives –Types of classification. Tabulation - objectives, parts of the table and types of tables.

Unit –III

Presentations of data: Diagrams- Bar diagrams, simple, component, multiple, percentage and Pie diagrams. Graphical representations - Histogram, Frequency curve and frequency polygon.

Unit – IV

Measures of Central Tendency – Arithmetic Mean, Median, Mode and quartiles – Merits ,Demerits and problems (based on Geo Statistics).

Unit – V

Measures of Dispersion - Range, Quartile deviation, Standard Deviation and Coefficient of variation- Merits, Demerits and problems (based on Geo Statistics).

Book for study:

R.S.N.Pillai and V.Bgagavathi, Statistics, S.Chand & company, New Delhi

Books for reference:

1. Gupta. S.P, Statistical Methods , Sultan Chand & Sons, New Delhi.
2. Alan E. Gelfand, Peter Diggle, Peter Guttorp: Handbook of Spatial Statistics
3. Yongwoan Chun and Daniel A Griffith :Spatial Statistics and Geo Statistics

WEB RESOURCES:

1. <https://www.hsph.harvard.edu/gis/spatial-statistics>
2. <https://ocw.mit.edu/.../spatial-statistics>

NON-MAJOR ELECTIVE – I

BASICS OF REMOTE SENSING

SEMESTER – VI

Code :

Credits : 2

Hours : 2

Course Objectives:

The main objectives of this course are to:

- To have basic knowledge on History of Remote sensing
- To elaborate on the Remote Sensing Process
- To have the deep knowledge on the types of Aerial and Satellite Remote Sensing
- To explore the Resolution in Remote Sensing
- To have wide understanding on Applications of Remote Sensing

Course Outcomes

Student will be able to

- Define Remote Sensing and Its History
- Acquires knowledge about the Remote Sensing Process
- Differentiate between the Aerial and Satellite Remote Sensing
- Distinguish the Resolution of Remote Sensing
- Summarise the application of Remote Sensing in Land Cover and Land use, Agriculture and Environmental mapping,

Unit – I

Remote Sensing: – Definition; History of Remote Sensing in India.

Unit – II

Remote Sensing Processes; – Electromagnetic Spectrum; Plat Forms and its types.

Unit – III

Overview of Aerial and Satellite Remote Sensing

Unit – IV

Resolution:- Spectral-Spatial-Radiometric and Temporal

Unit – V

Application of Remote Sensing; Land use/ Land cover; Agriculture and Environment.

Book for study:

1. Siddique M.A.(2006): Introduction to Geographic Information Systems, Sharda Pustak Bhawan, Allahabad.
2. Chandra A.M &S.M.Ghosh, (2006) Remote sensing and Geographical Information System, Alpha Science Int'l limited, New Delhi.

Books for reference:

1. Panda B.C(2005): Remote sensing principles and applications, Viva books private limited.
2. Anji Reddy. M. (2001): Remote sensing and Geographical information system, BS publication, Hyderabad

WEB SOURCE:

1. www.gdmc.nl/oosterom/PoGISHyperlinked.pdf
2. RSgeography.com › RS Analysis

NON-MAJOR ELECTIVE-II :
EXPLORATORY DATA ANALYSIS

SEMESTER – VI

Credits : 2

Code :

Hours : 2

Course Objectives:

The main objectives of this course are to:

- To understand the method of Averages, dispersion and skewness.
- Be acquainted with the knowledge of time series analysis.
- Understand the significance of index numbers and its types.
- To verify optimality and evaluation of cost of living index numbers.

Course Outcomes

Student will be able to

- Recognize different types of data and scales of measurement.
- Understand measures of location and dispersion .
- Compute various types of Index numbers and Time series.

Unit – I

Computation of Measures of Central Tendency – Mean, Median, Mode, Geometric Mean and Harmonic mean.

Unit – II

Measures of Dispersion: Range, Quartile deviation, Mean deviation, Standard deviation and their co-efficients, Co-efficients of variation.

Unit – III

Skewness - concept, Measures of Skewness – Karl Pearson's and Bowley's coefficient of skewness - problems (based on Geographical data). Kurtosis - measures of Kurtosis. (concept only).

Unit – IV

Time series-definitions and uses. Components of time series-measurement of trend - semi average method, moving average method and least square method.

Unit – V

Index numbers-definitions-uses –types. Unweighted Index numbers-simple aggregate method-weighted index numbers -Laspere's, Paasche's and Fisher's index number.

Book for Study:

R.S.N.Pillai and V.Bgavathi, Statistics, S.Chand& company, New Delhi

Book for Reference:

Gupta. S.P, Statistical Methods , Sultan Chand & Sons, New Delhi.

WEB RESOURCES:

1. <https://nptel.ac.in/courses/111/104/111104120/>
2. https://www.iiserpune.ac.in/~bhasapat/phy221_files/curvefitting.pdf

Additional Credit Course-I

STATISTICS FOR COMPETITIVE EXAMINATION –I

SEMESTER:

Credits :

Code :

Hours :

Course Objective:

To give basic idea for competitive Examination using the Statistics tools.

Course Outcome:

It gives confident that the objective type of questions of Statistics can be completed in stipulated time.

Unit- I

Uses, Scope and limitation of Statistics, Collection, Classification and Tabulation of data, Diagrammatic and Graphical representation, Measures of location-Arithmetic Mean, Median, Mode, Geometric Mean and Harmonic Mean.

Unit -II

Measures of dispersion- Range, Quartile deviation, Mean deviation, Standard deviation and Co-efficient of Variation. Measure of Skewness:

Karl-Pearson's Method, Bowley's Method, Kelly's Method and based on moments. Measure of Kurtosis : Based on moments.

Unit- III

Correlation Analysis: Scatter diagram, Karl-Pearson's Co-efficient of Correlation, Spearman's Rank Correlation co-efficient - Regression Analysis – Curve Fitting – Linear and Quadratic equation by the method of least squares.

Unit- IV

Concept of Random experiment – Trial – Sample point – Sample space Event, Algebra of Events, Mutually Exclusive – Exhaustive events. Definition of probability, classical, statistical and Axiomatic approach – Properties of Probability, Theorems on Probability – Addition theorem of probability – Conditional probability – Multiplication theorem – Baye's theorem-simple problems.

Unit- V

Mathematical expectation – discrete and continuous random variables – Properties – Moments and cumulants generating functions – variance – properties – covariance-simple problems.

Book for Study:

Gupta S.C. and V.K. Kapoor, Fundamental of Mathematical Statistics, Sultan & Sons.
New Delhi

Additional Credit Course-II

STATISTICS FOR COMPETITIVE EXAMINATION –II

SEMESTER:

Credits :

Code :

Hours :

Course Objective:

To give idea about Distribution Theory and Estimation Theory concepts for competitive Examination.

Course Outcome:

It gives confident that the objective type of questions of distributions and estimation theory concepts can be easily solved in competitive examinations.

Unit-I

Probability distributions – Binomial, Poisson, Geometric and Hypergeometric.
Continuous distributions – Uniform, exponential and normal distribution-simple problems.

Unit- II

Sampling distributions and standard error, student's 't', Chi-square and F statistic – distributions and their relationships- Simple problems.

Unit- III

Point estimation: Estimator – Properties – Consistency, sufficient conditions for consistency. Efficiency – sufficient statistics – Neyman-Fisher Factorization theorem (statement only) – Unbiased Estimation: Minimum variance unbiased estimators, Cramer – Rao Inequality, Rao- Blackwell theorem - applications.

Unit- IV

Methods of Estimation – Methods of Maximum likelihood and moments – Properties of estimators obtained by these methods – Simple problems. Method of minimum Chi-square and modified minimum Chi-square-simple problems.

Unit- V

Interval Estimation: Interval estimator, confidence coefficient, confidence limits, pivotal quantity. Confidence Interval for proportion(s), mean(s), variance(s) based on normal, Chi-square, Student's t and F distributions – simple problems.

Book for Study:

Gupta S.C. and V.K. Kapoor, Fundamental of Mathematical Statistics, Sultan & Sons. New Delhi

Additional Credit Course-III

STATISTICS FOR COMPETITIVE EXAMINATION –III

SEMESTER:

Credits :

Code :

Hours :

Course Objective:

To give idea about Statistical Hypothesis, Sampling Theory, Design of Experiment and Statistical Quality Control concepts for competitive Examination.

Course Outcome:

It gives confident that the objective type of questions of Statistical Hypothesis, Sampling Theory, Design of Experiment and Statistical Quality Control concepts can be completed in stipulated time.

Unit- I

Tests of Hypothesis – Null and Alternative – Types of errors – Power of test, Neyman – Pearson lemma, UMP and Likelihood ratio tests, Test procedures for large and small samples – Independence of attributes, Chi-square test – Goodness of fit

Unit -II

Simple random sample – stratified, systematic, Cluster (Single stage) Estimation of mean and variance in SRS – Sample Survey – Organisation – CSO and NSSO – Sampling and Non-Sampling errors.

Unit -III

Analysis of Variance – Principles of design CRD, RBD and LSD – Factorial experiments 22 , 23 and 32 (Without confounding) Missing plot techniques.

Unit-IV

Concept of SQC – Control Charts – X, R, p and charts Acceptance sampling plan – single and double – OC curves Attributes and Variables plan. OR Models – Linear Programming problems – Simplex method Dual – Primal, Assignment problems, Net work – CPM and PERT

Unit-V

Time series – Different components – Trend and Seasonal Variations – Determination and elimination Index Numbers – Construction and uses – Different kinds of simple and weighted index numbers – Reversal tests – construction and use of cost of living index numbers – Birth and death rates – Crude and standard death rates, Fertility rates – Life table construction and uses.

Book for Study:

Gupta S.C. and V.K. Kapoor, Fundamental of Mathematical Statistics, Sultan & Sons. New Delhi

Book for Reference:

S.C. Gupta and V.K. Kapoor (2013), Fundamentals of Applied Statistics, Sultan Chand & Sons New Delhi.