PONDICHERRY UNIVERSITY
PONDICHERRY

Revised Syllabus for

B.Sc (STATISTICS)
(SEMESTER PATTERN)

Effective from 2009-2010 (Onwards)

PREAMBLE

PONDICHERRY UNIVERSITY
B.Sc DEGREE COURSE

REVISED REGULATION & SYLLABUS
(UG PROGRAMME IN STATISTICS)

The revised syllabus shall be effective from the academic year 2009-2010 onwards.

AIM OF THE COURSE:

The Degree of Bachelor of Science in Statistics aims to train the students both in the theoretical development and in the real life applications of modern statistical methodology. It will provide a platform for getting exposed to real life data and their statistical analysis using modern statistical softwares. It is also aimed to train the students to enable them to find an appropriate place in the modern Information Technology oriented society.

ELIGIBILITY FOR ADMISSION:

Candidates for admission to the first year of the B.Sc (Statistics) degree shall be required to have passed the Higher Secondary course examination (+2) conducted by the Government of Tamil Nadu with Mathematics or Statistics as one of the core subjects or similar examinations conducted by any other Board recognized as equivalent thereto by the Pondicherry University.

DURATION OF THE COURSE:

The duration of the B.Sc (Statistics) degree course shall be for three academic years of six semesters.

AGE LIMIT:

The rules as applicable to other under graduate courses as prevailing in Pondicherry University.

COURSE OF STUDY:
FOUNDATION COURSE

The course of study for the B.Sc (Statistics) degree shall comprise of the following.

Part I - Language – Tamil/French/Hindi
(Under B.Sc Pattern for four semesters – I year and II year only)

Any one of the Part I language under the option of the candidate for first year and second year only.

Part II - English
(Under B.Sc Pattern for four semesters – I year and II year only)

The syllabus and text books for the above said language papers shall be prescribed by the Pondicherry University from time to time.

Part III- Main subjects & Allied subjects (Theory and Practical)

EXAMINATION:

There shall be examinations at the end of each semester i.e. December/May. A candidate who does not pass the examination in any subject(s) shall be permitted to appear in such failed subject(s) in the subsequent semester examinations. No candidate shall be permitted to register for a subsequent examination without having registered at the first appearance. Rules and regulations prevailing in the University in respect of other courses will be followed.

The results of all the examinations will be communicated to the candidates through the Principals of the College.

SCHEME OF EXAMINATION:

All the theory and practical examinations will be of three hours duration. The maximum marks for each subject shall be 100. Passing minimum for theory and practical examination should be 40. Practical examinations with maximum marks 50 shall have the passing minimum 20.

EVALUATION:

Theory examinations will be evaluated by the Pondicherry University. Practical examination will be evaluated by a team of two examiners one – an external expert in the subject from another academic institution selected by the Pondicherry University and the other – an internal examiner from the college.

ATTENDANCE:

A candidate shall be permitted to appear for the examination in a subject of study only if

1. He/She secures not less than 80% of attendance in the subject concerned.
2. He/She may be allowed to appear for the examination under condonation category not below 60% of attendance.

CLASSIFICATION OF SUCCESSFUL CANDIDATE:

1. Candidates who pass all the examinations in all the 3 years and secure an aggregate of not less than 60% of the total marks in Part III of the University examinations shall be declared to have passed the examination for the degree in First Class.
2. Candidates who pass all the examinations in all the 3 years and secure an aggregate of not less than 50% but less than 60% of the total marks in the Part III of the University examinations shall be declared to have passed the examination for the degree in Second Class.
3. All other successful candidates who secure not less than 40% but less than 50% of the total marks in Part III of the University examinations shall be declared to have passed the examination for the degree in Third Class.

4. For purpose of declaring a candidate to have qualified for the degree of B.Sc(Statistics) in First Class/ Second Class / Third Class, marks obtained in Part III alone will be the criteria, provided he/she has secured the prescribed passing minimum in Part I and Part II.
5. There shall be no classification for Part I and Part II.

AWARD OF THE DEGREE:

The candidate should have undergone the prescribed course of study for a period of not less than 3 years and passed the prescribed examinations in all the papers / years.

REVISION OF REGULATIONS AND CURRICULUM:

The University may from time to time revise, amend and change the Regulations and Curriculum, if found necessary.

B.Sc (STATISTICS) – SCHEME OF EXAMINATION

	Subjects	Lecture Hrs./week	Exam Marks	Pass Min.
I Semester				
1.	**Part I** TAMIL/HINDI/FRENCH -I	6	100	40
2.	**Part II** ENGLISH – I	6	100	40
3.	**MAJOR PAPER I** BASIC STATISTICS	4	100	40
4.	**MAJOR PAPER II** PROBABILITY AND DISTRIBUTION -I	6	100	40
5.	**ALLIED PAPER I** MATHEMATICS FOR STATISTICS – I	6	100	40
6.	**MAJOR PRACTICAL – I** (MS-WORD & MS-EXCEL – BASIC STATISTICS)	2	50	20
II Semester				
7.	**Part I** TAMIL/HINDI/FRENCH- II	6	100	40
8.	**Part II** ENGLISH – II	6	100	40
9.	**MAJOR PAPER III** PROBABILITY AND DISTRIBUTION -II	4	100	40
10.	**MAJOR PAPER IV** NUMERICAL METHODS	6	100	40
11.	**ALLIED PAPER II** MATHEMATICS FOR STATISTICS – II	6	100	40
12.	**MAJOR PRACTICAL – II** (BASIC STATISTICS & PROBABILITY AND DISTRIBUTION)	2	50	20

Subjects	Lecture Hrs. /week	Exam Marks	Pass Min.
III Semester			
13. **Part I**			
TAMIL/HINDI/FRENCH –III	6	100	40
14. **Part II**			
ENGLISH – III	6	100	40
15. **MAJOR PAPER V**			
STATISTICAL ESTIMATION THEORY	6	100	40
16. **MAJOR PAPER VI**			
REAL ANALYSIS – I	6	100	40
17. **ALLIED PAPER III**			
COMPUTER PROGRAMMING – I (PROGRAMMING IN C)	4	100	40
18. **ALLIED PRACTICAL – I** (PROGRAMMING IN C)	2	50	20
IV Semester			
20. **Part I**			
TAMIL/HINDI/FRENCH -IV	6	100	40
21. **Part II**			
ENGLISH – IV	6	100	40
22. **MAJOR PAPER VII**			
TESTING OF HYPOTHESES	4	100	40
23. **MAJOR PAPER VIII**			
REAL ANALYSIS - II	6	100	40
24. **ALLIED PAPER IV**			
COMPUTER PROGRAMMING – II (OBJECT ORIENTED PROGRAMMING WITH C++)	4	100	40
25. **MAJOR PRACTICAL – III** (STATISTICAL ESTIMATION THEORY & TESTING OF HYPOTHESES)	2	100	40
26. **ALLIED PRACTICAL – II** (OOPS WITH C++)	2	50	20

Subjects	Lecture Hrs./week	Exam Marks	Pass Min.
V Semester			
27. **MAJOR PAPER IX** SAMPLING METHODS	6	100	40
28. **MAJOR PAPER X** DESIGN OF EXPERIMENTS	6	100	40
29. **MAJOR PAPER XI** REGRESSION ANALYSIS	4	100	40
30. **MAJOR PAPER XII** STOCHASTIC PROCESSES AND THEIR APPLICATIONS	6	100	40
31. **MAJOR PAPER XIII** VISUAL BASIC	4	100	40
32. **MAJOR PRACTICAL – IV** (VISUAL BASIC)	2	100	40
33. **MAJOR PRACTICAL – V** (DESIGN OF EXPERIMENTS, SAMPLING METHODS, REGRESSION ANALYSIS)	2	50	20
VI Semester			
34. **MAJOR PAPER XIV** STATISTICAL QUALITY MANAGEMENT	6	100	40
35. **MAJOR PAPER XV** APPLIED STATISTICS	4	100	40
36. **MAJOR PAPER XVI** OPERATIONS RESEARCH	6	100	40
37. **MAJOR PAPER XVII** HEALTH STATISTICS AND POPULATION DYNAMICS	6	100	40
38. **MAJOR PAPER XVIII** ELECTIVE I	6	100	40
39. **MAJOR PRACTICAL – VI** (APPLIED STATISTICS, S.Q.M. & HEALTH STATISTICS)	2	50	20
TOTAL		2700	

Total Aggregate Marks = 2700

LIST OF ELECTIVES

1. ACTUARIAL STATISTICS
2. INDUSTRIAL STATISTICS
3. APPLIED DECISION-MAKING
4. JAVA
5. DATA BASE MANAGEMENT SYSTEM
6. BIOINFORMATICS
7. STATISTICAL GENETICS
8. PROJECT WORK

SEMESTER I
MAJOR PAPER I: BASIC STATISTICS

(4 hours per week – 3 lecture-hours and 1 tutorial/seminar session per week)

UNIT 1

Introduction to Statistics – Primary and Secondary data – Nominal, Ordinal, Ratio, Interval scale (with examples) - Graphical Representation of data – Bar-charts, Pie-diagrams- classification of data,frequency histograms, polygon, Ogives

UNIT 2

Measures of central tendency –different averages and their properties – weighted means – graphical location of median, quartiles, deciles, percentiles, and mode – relation between arithmetic mean, geometric mean and harmonic mean.

UNIT 3

Measures of dispersion and their properties – Coefficient of dispersion – Coefficient of variation – Moments – Relation between moments about mean in terms of moments about any point – Pearson's β and γ coefficients.

UNIT 4

Skewness and Kurtosis – Pearson's coefficient of skewness – Bowley's coefficient of skewness – coeff. of skewness based upon moments – Curve fitting – Principle of least squares – Fitting of Straight line, Second degree and exponential models.

UNIT 5

Simple correlation – Karl Pearson's coefficient of correlation – Rank correlation – Regression – lines of regression – properties of regression coefficients – Multiple and Partial correlation coefficients in three variables and their properties.

Books for Study:

1. Bhat B.R, Srivenkataramana T and Rao Madhava K.S.(1996): Statistics: A Beginner's Text, Vol. I, New Age International (P) Ltd.
2. Goon A.M, Gupta M.K., Das Gupta B. (1991): Fundamentals of Statistics, Vol. I, World Press, Calcutta.
3. Spiegel M R (1989): Schaum's Outline of Theory and Problems in Statistics, Schaum's Outline Series.

Books for Reference:

1. Croxton F.E, Cowden D.J and Kelin S (1973): Applied General Statistics, Prentice Hall of India.
2. Snedecor G.W. and Cochran W.G. (1967): Statistical Methods, Iowa State University Press.

SEMESTER I
MAJOR PAPER II: PROBABILITY AND DISTRIBUTION - I

(6 hours per week – 5 lecture-hours and 1 tutorial/seminar session per week)

UNIT 1

Introduction to probability theory – Random experiments, Events, Sample space, Algebra of events, Operations on events – Classical approach to probability – Axiomatic approach to probability – Simple problems.

UNIT 2

Addition theorem - Conditional Probability – Independence of events – Multiplication theorem – Bayes theorem and its applications.

UNIT 3

Random variables – Discrete and Continuous Random Variables – Probability Mass function and Probability Density function – Distribution function - Properties – Mathematical Expectation of random variables and its properties.

UNIT 4

Moment generating function– Cumulant generating function – Characteristic function – Probability generating function – Definition, their properties and applications – Simple problems.

UNIT 5

Bivariate distributions – Discrete and Continuous type - Joint Density Function - Marginal and conditional distributions – Marginal and Conditional Expectation – Covariance, Correlation and Regression.

* Content and treatment should be as in the book by Hogg and Craig

Books for Study:

1. Hogg R. V. and Craig A. T. (1998); Introduction to Mathematical Statistics, 4/e, Academic press.
2. Bhat B.R, Srivenkataramana T and Rao Madhava K.S.(1996): Statistics: A Beginner's Text, Vol. II, New Age International(P) Ltd.
3. Mood A.M., Graybill F.A and Boes D.C. (1974): Introduction to the Theory of Statistics, McGraw Hill.

Books for Reference:

1. Meyer P.L. (1970): Introductory Probability and Statistical Applications, Addision Wesley.
2. Goon A.M, Gupta M.K., Das Gupta B. (1980): An Outline of Statistical Theory, Vol. I, 6^{th} revised edition, World Press, Calcutta.
3. Rohatgi V.K. and Md. Ehsanes Saleh A.K.(2001): An Introduction to Probability and Statistics, Second Edition, John Wiley

SEMESTER I
ALLIED PAPER I: MATHEMATICS FOR STATISTICS – I

(6 hours per week – 5 lecture-hours and 1 tutorial/seminar session per week)

UNIT 1

Logarithmic differentiation - Differentiation of one function with respect to another function - Differentiation involving parametric equations - Differentiation of implicit functions - Increasing and decreasing functions.

UNIT 2

Successive differentiation – Leibnitz theorem – Partial differentiation – Maxima and Minima of functions of two variables

UNIT 3

Integration - Properties of definite integrals - Reduction formula - Bernoulli's formula

UNIT 4

Double and Triple integrals - Evaluation in simple cases only - Use of Jacobian of transformation

UNIT 5

Beta and Gamma Integrals: Definitions - recurrence formula for Gamma integral - Properties of Beta integral - Relation between Beta and Gamma integrals.

Books for study

1. Narayanan S.V. and T. K. Manikavachagam Pillai(1996): Calculus (Vol. I & II), S. V. Publications.
2. Shanti Narayanan:Differential and Integral Calculus, Chand and Co.

SEMESTER I

MAJOR PRACTICAL – I

(MS-WORD & MS-EXCEL **–** BASIC STATISTICS**)**

(2 hours per week)

MS-WORD

1. Text Manipulations and Text Formatting
2. Usage of Header, Footer, Bulleting and Numbering
3. Usage of Spell Check, Find and replace
4. Picture insertion and alignment
5. Creation of documents using templates
6. Mail Merge

MS-EXCEL

7. Cell Editing and Formatting
8. Usage of Formulae and Built-in functions
9. Data Sorting
10. Data Filter, Validation, Subtotals
11. Graph
12. Usage of Auto Formatting
13. Classification, Tabulation and Frequency Tables
14. Bar Chart, Pie Diagram and Histogram
15. Box Plots
16. Summary Statistics

- Six questions to be set. Candidates may be required to answer four questions.
- Max. Marks: 50 **–** Practical Marks: 40 Record Marks: 10
- Duration of exam **–** 3 hours

SEMESTER II
MAJOR PAPER III: PROBABILITY AND DISTRIBUTION - II

(4 hours per week – 3 lecture-hours and 1 tutorial/seminar session per week)

Unit 1

Discrete Distributions – Bernoulli, Binomial, Poisson, Negative Binomial, Geometric, Hyper geometric, Discrete Uniform distributions – Properties - Moments – Moment Generating Function – Cumulants – Characteristic function - Recurrence relations- probability generating functions.

Unit 2

Continuous distribution - Uniform, Exponential, Gamma, Beta, Cauchy, Laplace Distributions - Properties of the distribution - Moment generating function - Characteristic function – Cumulants.

Unit 3

Normal, Lognormal distributions - Bivariate Normal distribution - Properties of the distribution - Moment generating function - Characteristic function – Cumulants Order statistics and their distributions - Distribution function of r^{th} order statistic, range, mid-range – Simple problems.

Unit 4

Sampling Distributions - Chi-square distribution – Properties - Distribution of sample mean and variance for normal distribution - Student's t distribution – Snedecor's F distribution - Derivation of t, F and chi-square distributions - Relation among t, F and χ^2 distributions.

Unit 5

Limit Laws – Chebyshev's inequality - Convergence in probability and in distribution – Weak law of Large Numbers - Convergence in distributions - Central limit theorem – DeMoivre - Laplace Theorem – Lindeberg-Levy theorem.

Books for Study:

1. Hogg R.V. and Craig A.T.(1998): Introduction to Mathematical Statistics, 4^{th} edition, Collier Macmillan Press.
2. Bhat B.R, Srivenkataramana T and Rao Madhava K.S.(1996): Statistics: A Beginner's Text, Vol. II, New Age International(P) Ltd.
3. Mood A.M., Graybill F.A and Boes D.C. (1974): Introduction to the Theory of Statistics, McGraw Hill.

Books for Reference:

1. Meyer P.L. (1970): Introductory Probability and Statistical Applications, Addision Wesley.
2. Goon A.M, Gupta M.K., Das Gupta B. (1980): An Outline of Statistical Theory, Vol. I, 6^{th} revised edition, World Press, Calcutta.
3. Rohatgi V.K. and Md. Ehsanes Saleh A.K.(2001): An Introduction to Probability and Statistics, Second Edition, John Wiley.

SEMESTER II
MAJOR PAPER IV: NUMERICAL METHODS

(6 hours per week – 5 lecture-hours and 1 tutorial/seminar session per week)

UNIT 1

Solution of Algebraic and Transcendental Equations: Bisection method – Regula Falsi method – Iteration method - Newton Raphson method – Horner s Method Simultaneous equations: Direct methods: Gauss Elimination method – Gauss-Jordan method – Iterative methods: Gauss-Jacobi method - Gauss Siedal iterative method.

UNIT 2

Finite differences: Forward and backward differences – Differences of a polynomial – Relation between the Operators E, Δ, , and backward difference operator and their basic properties – Application to summation of series.

UNIT 3

Interpolation with equal intervals: Newton s forward and backward difference formulae. Central differences: Gauss s forward and backward difference formulae – Stirling s, Bessel s and Laplace- Everett s formula – Simple problems only.

UNIT 4

Interpolation with unequal intervals: Divided differences and their properties – Newton s divided difference formula – Lagrange s formula – simple problems- Inverse interpolation: Iteration or successive approximation method – Lagrange s method –– simple problems.

UNIT 5

Numerical Differentiation: Numerical Derivatives upto 2^{nd} order only – simple problems. Numerical Integration: Trapezoidal rule – Simpson s 1/3 and 3/8 rules – Weddle s rule – Euler s summation formula

Books for Study:

1. S.S.Sastry(1998) : Introductory Methods of Numerical Analysis, Prentice-Hall of India.
2. B. S. Grewal(1997): Numerical Methods in Engineering and Science, Khanna Publishers, India
3. M. K. Venkatraman: Numerical Methods in Engineering and Science, National Publishing company, India

Books for Reference:

1. Scarborough B: Numerical Mathematical Analysis, OUP.

SEMESTER II

ALLIED PAPER II: MATHEMATICS FOR STATISTICS - II

(6 hours per week – 5 lecture-hours and 1 tutorial/seminar session per week)

UNIT 1

Matrices: Elementary, scalar, Hermitian, skew-Hermitian, symmetric, skew-symmetric, unitary, triangular, equivalent and similar matrices – Transpose and conjugate of a matrix - Rank of a matrix – Determination of rank through elementary transformations.

UNIT 2

System of Linear Equations: Consistency – different types of solutions – Inverse of a matrix. Characteristics equation – Eigen Values and Eigen Vectors - Cayley-Hamilton theorem – Quadratic forms.

UNIT 3

Laplace Transform: Introduction - definition - properties - Laplace transforms of standard functions - derivatives and integrals of transforms - transform of derivatives and integrals.

UNIT 4

Fourier Series: Euler's formula - Dirichlet's conditions - convergence - (statement only) - change of interval - odd and even functions - half range series - Parseval's formula - complex form of Fourier series

UNIT 5

Fourier Transform: The infinite Fourier transform - sine and cosine transforms - properties - inversion theorem - finite Fourier transform - convolution theorem - Parseval's identity - Transform of derivatives.

Books For Study:

1. T.K. Manikavachagam Pillay(1996): Algebra, Vol. II, S.V. Publications.
2. M. K. Venkataraman: Engineering Mathematics III A & III B, National Publishing Company.

Books for Reference:

1. Ian Sneddon: Transform techniques, McGraw Hill Publications.
2. Widder: Integral Transforms

SEMESTER II
MAJOR PRACTICAL – II
(BASIC STATISTICS & PROBABILITY AND DISTRIBUTION**)**
(2 hours per week)

Working with Statistical Software Packages: SPSS or SYSTAT

1. Diagrammatic Representation – Bar Chart, Pie Diagram
2. Construction of Discrete and Continuous Frequency Tables from raw data
3. Graphical Representation - Histogram
4. Summary Statistics
5. Two way tables and plots
6. Simple correlation, Rank correlation
7. Partial and multiple correlation
8. Fitting of straight line, second degree and exponential curves
9. Simple Regression, multiple linear regression with two independent variables.
10. Fitting of Binomial, Poisson and Normal Distributions

- Six questions to be set. Candidates may be required to answer four questions.
- Max. Marks: 50 – Practical Marks: 40 Record Marks: 10
- Duration of exam – 3 hours

SEMESTER III
MAJOR PAPER V: STATISTICAL ESTIMATION THEORY

(6 hours per week – 5 lecture-hours and 1 tutorial/seminar session per week)

Unit 1

Point estimation – Properties of estimators – Unbiasedness – Asymptotically Unbiased Estimator –– Minimum Variance Unbiased Estimator (UMVUE) – Uniqueness of MVUE – Concept of efficiency- Cramer-Rao inequality and its uses – Simple problems.

Unit 2

Consistent estimators – Properties of consistent estimators – Sufficient condition for consistency - Concept of Sufficient statistics with illustration - Sufficient Statistic and optimal estimators –– Factorization theorem – Rao-Blackwell theorem - Simple problems.

Unit 3

Methods of estimation – Method of Maximum Likelihood – Properties of Maximum Likelihood Estimators (without proof) – Method of moments – Method of Minimum Variance – Method of Least Squares – Method of Minimum Chi-square - Simple problems.

Unit 4

Interval Estimation - Concepts of Confidence Interval and Confidence Coefficient - Confidence Intervals for the parameters of univariate and bivariate normal and exponential distribution – Large sample confidence intervals for proportions, means , variances and correlation coefficients.

Unit 5

Basic idea on decision theory – Loss function – Risk functions – Prior distributions – Bayes' Risk – Minimax principle and decision function - Simple problems. (treatment as in Rohatgi V.K.)

Books For Study:

1. Hogg R.V. and Craig A.T.(1998): Introduction to Mathematical Statistics, 4th edition, Collier Macmillan Press.
2. Mood A.M., Graybill F.A and Boes D.C. (1974): Introduction to the Theory of Statistics, McGraw Hill.
3. Goon A.M, Gupta M.K., Das Gupta B. (1980): An Outline of Statistical Theory, Vol. 2, 6th revised edition, World Press, Calcutta.
4. Hogg R.V. and Tanis E.A. (2001): Probability and Statistical Inference, Pearson Education Asia.

Books for Reference:

1. Rohatgi V.K. and Md. Ehsanes Saleh A.K.(2001): An Introduction to Probability and Statistics, Second Edition, John Wiley Publication.
2. Freund J.E. (2000): Mathematical Statistics, Prentice Hall of India.
3. Rao C.R. (1973): Linear Statistical Inference and Its Application, Revised Edition, Wiley Eastern.

SEMESTER III

MAJOR PAPER VI: REAL ANALYSIS – I

(6 hours per week – 5 lecture-hours and 1 tutorial/seminar session per week)

UNIT 1

Sets : Sets - elements - Operations on set. Functions : Real valued functions – equivalence - Countability - Real numbers - Upper and Lower bounds- Supremum and Infimum.

UNIT 2

Sequence of real numbers : Limit of a sequence - Convergent sequences, Divergent sequences - Bounded sequences - Monotone sequences – Cauchy's first and second theorem on limits – Cauchy's general principle of convergence

UNIT 3

Series of real numbers : Convergence and divergence - series with non-negative terms – comparison test –D'Alembert's ratio test, Cauchy's Root test - Alternating series - Conditional convergence and absolute convergence – Leibnitz test.

UNIT 4

Functions: Limit of real valued functions in one variable, continuity – types of discontinuities – algebra of continuous functions – Extreme value theorem – Intermediate value theorem – Uniformly Continuous functions

UNIT 5

Differentiability of Functions – Rolle's theorem – Mean value theorem for derivatives – Taylor's Series expansion – application to maxima and minima

Books for Study:

1. D. Somasundaram and B. Choudhary (2002) : A first course in Mathematical Analysis, Narosa Publishing house
2. R. R. Goldberg (1970) : Methods of Real Analysis, Oxford & IBH.
3. W. Rudin(1976): Principles of Mathematical Analysis, 3/e, McGraw Hill Company.

Books for Reference :

1. T. M. Apostol(1985): Mathematical Analysis, Narosa Publishing House.

SEMESTER III

ALLIED PAPER III: COMPUTER PROGRAMMING – I

(PROGRAMMING IN C)

(4 hours per week – 3 lecture-hours and 1 tutorial/seminar session per week)

UNIT 1

Introduction – Variable names – Data types and sizes – Constants – Arithmetic operators – Relational and logical operators – Increment and Decrement operators – Assignment operators and expressions – Relational and logical expressions – conditional expressions – if and switch statements – Unconditional branching – goto statement – Input/Output operations: getchar( ), getc( ), putc( ), putchar( ), scanf( ), printf( )

UNIT 2

Control loops: for, while and do – while loops – continue and break statements. Concept of functions: function declaration and arguments – scope of variable – storage classes – external, static, automatic and register types.

UNIT 3

Arrays : declaration of one and two dimensional arrays – Subscripts – pointers – pointers and arrays – address arithmetic – structures – structures and functions – arrays of structures – pointers to structures – union – type def

UNIT 4

File access – Error handling – concept of data structure – list – linked list – stack and queues – operations on linked list

UNIT 5

Writing programs in C to the following statistical problems: Calculation of arithmetic mean, standard deviation, mean deviation, moments, skewness and kurtosis, correlation coefficient and regression coefficient – Fitting of a straight line - Numerical integration - Finding roots of algebraic & transcendental equations: Bisection method, Method of False position, Newton-Raphson method - Interpolation: Lagrange's interpolation formula, inverse interpolation - Matrix manipulation: Addition, subtraction, multiplication, inversion, transpose, determinant.

Books For Study :

1. B. S. Gottfried(1998): Programming in C, Schaum's Outline series.
2. Kernighan and D. Ritchie(1988): The C programming Language, Prentice Hall of India.
3. Yeshwant Singh Kanitkar(1993): Exploring C, BPB Publications.

Books for Reference:

1. E. Balagurusamy: Programming in ANSI C, Tata McGraw Hill.
2. Schildt Herbert: C Made Easy, McGraw Hill.

SEMESTER III
ALLIED PRACTICAL – I
(Programming in C**)**
(2 hours per week)

1. Program to calculate factorial.
2. Program to find sum of N natural numbers.
3. Program to reverse a number.
4. Program for string manipulations.
5. Program to find maximum and minimum in a given list.
6. Program to search for a given number in a list.
7. Program to sort a given list (Ascending and Descending order).
8. Program to read a line of text into a file and display the same.
9. Program to find roots of a quadratic equation.
10. Program to calculate arithmetic mean and standard deviation.
11. Program to calculate mean deviation about mean.
12. Program to calculate moments.
13. Program to calculate skewness and kurtosis.
14. Program to calculate correlation coefficient and regression coefficient.
15. Program for matrix addition, subtraction and multiplication.
16. Program to find transpose of a matrix.
17. Program to find determinant and inverse of a matrix.
18. Program to find roots of algebraic and transcendental equations using Bisection method, Regula Falsi method and Newton Raphson method.
19. Program for Lagrange's interpolation formula.
20. Program for Simpson's 1/3 and 3/8 rules and Weddle's rule.

- Two questions to be asked with internal choice.
- Max. Marks: 50 – Practical Marks: 40 Record Marks: 10
- Duration of exam – 3 hours

SEMESTER IV
MAJOR PAPER VII: TESTING OF HYPOTHESES

(4 hours per week – 3 lecture-hours and 1 tutorial/seminar session per week)

UNIT 1

Statistical Hypothesis – Simple and composite hypothesis, Null and Alternative Hypothesis – Two types of errors – Critical region – p-value – Power of a test – Most powerful test – Neyman Pearson Lemma – Simple problems.

UNIT 2

Uniformly most powerful tests – definition and simple applications – Likelihood Ratio tests – Definition and LR tests for means and variance (one and two sample problem only).

UNIT 3

Test of significance: Exact and Asymptotic tests based on Normal, Student's t, Chi-square and F-distribution for testing the means, proportions, variances and correlation coefficient – Chi-square test.

UNIT 4

Sequential tests – Need for sequential tests – Wald's SPRT with illustrations – Approximate OC and ASN functions for tests regarding parameters of binomial and normal distributions.

UNIT 5

Non-parametric methods: Sign test – Wilcoxon Signed rank test- Mann Whitney U test - Median test - Run test – Chi-square goodness of fit test - Kolmogrov-Smirnov test – Kruskal Wallis test.

Books For Study:

1. Mood A M, Graybill F A and Boes D C(1974): Introduction to Theory of Statistics, McGraw Hill Publishing Co., New York
2. Hogg R V and Craig A T(1998): Introduction to Mathematical Statistics, McGraw Hill Publishing Co., New York.
3. Goon A.M, Gupta M.K., Das Gupta B. (1980): An Outline of Statistical Theory, Vol. 2, 6^{th} revised edition, World Press, Calcutta.
4. Hogg R.V. and Tanis E.A.(2001) : Probability and Statistical Inference, Pearson Education Asia.

Books for Reference:

1. Rohatgi V.K. and Md. Ehsanes Saleh A.K.(2001): An Introduction to Probability and Statistics, Second Edition, John Wiley Publication.
2. Freund J.E. (2000): Mathematical Statistics, Prentice Hall of India.
3. Mukhopadhayay, P.(2006); Mathematical Statistics, Books and Allies(P) ltd, Kolkata

SEMESTER IV
MAJOR PAPER VIII: REAL ANALYSIS – II

(6 hours per week – 5 lecture-hours and 1 tutorial/seminar session per week)

UNIT 1

Riemann Integration : Definition of the Riemann Integral – Existence of the Riemann Integral – Properties of the Riemann Integral - Fundamental theorems of Calculus - Mean Value Theorems.

UNIT 2

Improper Integrals – their convergence and evaluation, convergence of Beta and Gamma integrals

UNIT 3

Sequences of Functions : Pointwise convergence of Sequences of functions – Uniform convergence of Sequences of functions – Consequences of Uniform Convergence – Properties without proof.

UNIT 4

Series of Functions: Convergence and uniform convergence of series of functions – Weisstrass test - Integration and differentiation of series of Functions – Abel Summability.(without proof) - Application

UNIT 5

Metric Space – definitions and examples, continuous functions on metric spaces– Open sets, closed sets and closure properties.

Books for Study:

1. D. Somasundaram and B. Choudhary (2002) : A first course in Mathematical Analysis, Narosa Publishing house
2. R. R. Goldberg (1970) : Methods of Real Analysis, Oxford & IBH.

Books for Reference :

1. T. M. Apostol(1985) : Mathematical Analysis, Narosa Publishing House

2. W. Rudin(1976): Principles of Mathematical Analysis, 3/e, McGraw Hill Company.

SEMESTER IV

ALLIED PAPER IV: COMPUTER PROGRAMMING – II

(OBJECT ORIENTED PROGRAMMING IN C++)

(4 hours per week – 3 lecture-hours and 1 tutorial/seminar session per week)

UNIT 1

Object oriented programming- basic concepts-application of OOPs - Tokens, Keywords and control statements: Identifiers- data types - basic, user-defined and derived data types- symbolic constants -variable declaration operators in C++, Scope resolution operator - manipulations - cost operators - operator over loading and precedence - control structures.

UNIT 2

Functions : Main - prototyping - call by reference - return - in line functions - default and constant arguments - over - loading functions - friend and virtual function.

UNIT 3

Classes and Objects: Class specification - member function - nesting and private member functions - array of objects - returning objects - constant member functions - Constructors and Destructors : Parameterised - multiple constructors - default arguments - copy and dynamic constructors – destructors - Operator overloading and type conversion : Overloading unary and binary operators - friends - rules for overloading operators - type conversion.

UNIT 4

Inheritance: Defining derived classes - single inheritance - multilevel and multiple inheritance - hierarchical and hybrid inheritance - abstract classes - constructors in derived classes - Pointers : Pointers to objects - this pointer - pointers to derived class es - virtual functions and polymorphism.

UNIT 5

Input/Output operators: console I/O -streams - stream classes - unformatted and formatted I/O - Files : Classes for files - opening and closing files - file modes - sequential I/O - updating files - random access - command-line arguments.

Object-Oriented system development : Procedure oriented paradigms - development tools - object oriented paradigm - steps in object oriented analysis and design.

Books for Study

1. E. Balaguruswamy (1998): Object Oriented Programming with C++, Tata McGraw- Hill, New Delhi.
2. Robert Lafore(1994): Object Oriented Programming in Turbo C++, Galgotia Publication Pvt. Ltd.

Books for Reference

4. R. Venugopal( ): Mastering C++, Tata Mcgraw_Hill.
5. John Huddard (1996) Programming with C++, Schaum's Series, McGraw-Hill.

SEMESTER IV
MAJOR PRACTICAL – III
(STATISTICAL ESTIMATION THEORY & TESTING OF HYPOTHESES**)**
(2 hours per week)

Working with Statistical Software Packages: SPSS or SYSTAT and Scientific Calculators

1. Estimation of the parameters of the discrete and continuous distribution by the method of moments and method of maximum likelihood.

2. Confidence Intervals for the parameters of Normal distribution.

3. Computation of error probabilities – Power curves

4. Large Sample Tests: Means, Variances and Proportions

5. Test based on Chi-square statistic: Population variance, Homogeneity of correlation coefficient, Bartlett's test, and goodness of fit tests.

6. Test based on t statistic: Single men, Difference of means, Paired t test, Correlation coefficient, Regression coefficient.

7. Test based on F statistic: Equality of two population variances

8. Non-parametric tests – Sign test, Wilcoxon test, Mann-Whitney U test, Median test, Run test, Kolmogorov –Smirnov one sample test, Kruskal Wallis test.

- Six questions to be set. Candidates may be required to answer four questions.
- Max. Marks: 100 – Practical Marks: 80 Record Marks: 20
- Duration of exam – 3 hours

SEMESTER IV

ALLIED PRACTICAL – II

(OBJECT ORIENTED PROGRAMMING with C++**)**

(2 hours per week)

1. Program to find the total and average of given subject marks.
2. Program to display the electric bill of 'n' customers.
3. Program to reverse a number.
4. Program for string manipulations.
5. Program to search for a given number in a list.
6. Program to sort a given list (Ascending and Descending order).
7. Program to find the median.
8. Program to calculate arithmetic mean and standard deviation.
9. Program to calculate moments, skewness and kurtosis.
10. Program to calculate correlation coefficient and regression coefficient.
11. Program for matrix addition, subtraction and multiplication.
12. Program to display student detail using class.
13. Program to display bank account detail using class.
14. Program to display shopping detail using class.
15. Program to fit Binomial, Poisson and Normal distribution.
16. Program to show the virtual function using pointers.
17. Program to display employee detail using file.

- Two questions to be asked with internal choice.
- Max. Marks: 50 – Practical Marks: 40 Record Marks: 10
- Duration of exam – 3 hours

SEMESTER V
MAJOR PAPER IX: SAMPLING METHODS

(6 hours per week – 5 lecture-hours and 1 tutorial/seminar session per week)

Unit 1

Basic concept of Sample Surveys: Census and Sample Surveys- Advantages and Disadvantages - Principal steps in a sample survey – Probability and Non-probability sampling - Sampling and Non-sampling errors.

Unit 2

Simple random sampling – Properties of the estimates and their variances – Finite population correction – Estimation of the standard error from a sample – Confidence limits – Simple random sampling with replacement.

Unit 3

Sampling for proportions – Variances of the sample estimates - Estimation of sample size – Sample size with more than one item.

Unit 4

Stratified random sampling – Properties of the estimates and their variances - Optimum allocation – Proportional allocation – Advantages and disadvantages – Variance of the sample estimates – Relative precision of stratified random and simple random sampling.

Unit 5

Systematic sampling – Definition - Variances of the estimated mean – Populations with linear trend – Single stage Cluster sampling with clusters of equal sizes.

Books for study:

1. W.G.Cochran(1999), Sampling Techniques, 3rd Edition, Wiley Eastern Ltd.
2. Daroga Singh and F.S.Choudhary(1986), Theory and analysis of Sample Survey Designs, Wiley Eastern Ltd.
3. S.C. Gupta and V.K.Kapoor(2001), Fundamentals of Applied Statistics, Sultan Chand and Sons.

Books for Reference:

1. Pandurang.V.Sukhatme and Balkrishna.V.Sukhatme(1970): Sampling Theory of Survey with application, Asia Publication House.
2. Parimal Mukhopadhyay: Theory of Sample Surveys, Prentice Hall of India.

SEMESTER V
MAJOR PAPER X: DESIGN OF EXPERIMENTS

(6 hours per week – 5 lecture-hours and 1 tutorial/seminar session per week)

Unit 1

Analysis of variance – One way classification – Two way classification – Two way classification with m observations per cell – Statistical analysis of the models.

Unit 2

Terminology in experimental designs – principles of experimentation – completely randomized design – randomized block design – Latin square design – their models, least square estimates of the parameters and analysis – Statistical analysis of experiments – Missing plot technique in the case of one or two missing observations.

Unit 3

Factorial experiments – 2^2 , 2^3 and 3^2 experiments only **,** Split plot experiments.

Unit 4

Confounding in 2^3 factorial experiments - Total and partial confounding**-**multiple comparison tests-LSD and DMRT

Unit 5

Analysis of covariance – one-way layout with one concomitant variable – RBD with one concomitant variable

Books for study:

1. Das.M.N and Giri.N.C(1986): Design and Analysis of Experiments, Wiley Eastern Limited.
2. S.C.Gupta and V.K.Kapoor(2001): Fundamentals of Applied Statistics, Sultan Chand & Sons.
3. Goon A.M, Gupta M.K., Das Gupta B. (1991): Fundamentals of Statistics, Vol. II, World Press, Calcutta.

Books for Reference:

1. W.T.Federer(1967): Experimental Design, Oxford & IBH Publishing Co.
2. Oscar Kempthrone: Design and Analysis of Experiment, Wiley Eastern Private Limited.
3. Montgomery D.C.(1991): Design and Analysis of Experiments, John Wiley.

SEMESTER V
MAJOR PAPER XI: REGRESSION ANALYSIS

(4 hours per week – 3 lecture-hours and 1 tutorial/seminar session per week)

UNIT-1

Simple Regression model: Description of data model – Estimation and test of hypotheses – Index of fit – Predicted values and standard errors – Evaluation of fit – Analysis of residuals.

UNIT-2

Simple Regression model: Effect of outliers in simple linear regression – Model adequacy and residual plots – Deletion of data points – Transformation of variables – transformation to stabilize variance – Removal of hetroscedasticity – Principle of weighted least squares.

UNIT-3

Multiple regression model: Description of data model – Properties of least square estimators – Predicted values and standard errors – Multiple correlation coefficient - **S**election of variables – Forward selection procedure – Backward elimination procedure – Stepwise method (algorithms only).

UNIT 4

Test of hypothesis on the linear model – Assumption about the explanatory variable – Testing a subset of regression coefficients equal to zero – Testing of equality of regression coefficients.

Unit 5

Multicollinearity and its effects on inference and forecasting – Detection of multicollinearity – Searching of linear functions of regression coefficients – Method of overcoming multicolinearity problem, Ridge method.

Books for study:

1. S.Chatterjee and B.Price (1977): Regression Analysis by Example, John Wiley & Sons, New York. Chapter 1,2,3 and relevant portions in chapters 4,5,6,7,8,9
2. N.R.Draper & H.Smith (1981), Applied Regression Analysis, Second Edition.

Books for Reference:

1. Johnston J.(1984): Econometric Methods.

SEMESTER V
MAJOR PAPER XII: STOCHASTIC PROCESSES AND THEIR APPLICATIONS

(6 hours per week – 5 lecture-hours and 1 tutorial/seminar session per week)

Unit 1

Definition of Stochastic Processes – Classification of Stochastic processes according to time parameter and state space – examples of stochastic processes – definition of stationary process – stationary process with independent increments.

Unit 2

Markov Chain – definition – examples – transition probability matrix – Chapman-Kolmogrov equations – Random walk.

Unit 3

Classification of states of Markov chain – Stationary and limit distribution for a Markov Chain – Existence of the limiting distribution

Unit 4

Poisson Process – Simple properties – its connection to exponential distribution – – Birth death process (Concept only) – Simple problems

Unit 5

Simple queuing models M/M/1, M/M/S under stationary conditions– Simple problems

Books for study:

1. Medhi.J. (1982): Stochastic Processes, New Age International (P) Ltd.
2. Srinivasan.S.K. and Mehta.K.M. (1976): Stochastic Processes, Tata McGraw Hill Pub Comp Ltd.
3. Ross S.M. (1983): Stochastic Processes, John Wiley.

Books for Reference:

1. Karlin S. and Taylor H.M. (1975): A first course in Stochastic Processes, Academic Press.
2. Cinlar E. (1975): Introduction to Stochastic Processes, Prentice Hall.

SEMESTER V

MAJOR PAPER XIII: VISUAL BASIC

(4 hours per week – 3 lecture-hours and 1 tutorial/seminar session per week)

UNIT 1

Introduction to object oriented programming - GUI - Client-Server computing - Form, ToolBox, Project and Property windows - Forms and Controls - Creating forms and using controls - setting properties of controls - List and combo boxes - Additem, RemoveItem and Clear methods - ListIndex and ListCount properties - Columns and Multiselect properties - TabOrder, TabIndex and TabStop properties - Predefined Dialog boxes - InputBox, MsgBox statement and MsgBox function .

UNIT 2

Programming - Structure of Visual Basic application - Events and event-driven procedures - Event-driven versus Traditional programming - Coding procedures in events - data types - Constants, variables and their scope - expressions and assignment - If and Select case structures - Do and For loops - Exit statement - DateTime, Empty and Null values - Passing arguments by value and reference - Arrays - dynamic arrays - user defined data types - Symbolic constants

UNIT 3

Objects and instances - object variables and their declaration - Scope and lifetime - Generic and specific types - control object types - New and Me keywords - objects assignment - Determining TypeOf objects - multiple instances of objects. Mouse events - MouseUp, MouseDown and MouseMove methods – Drag and Drop - DragOver, DragIcon and DragMode - concepts of Grid control

UNIT 4

Displaying and Printing - Font properties and settings - TAB and FORMAT$ - Print method - TextHeight and TextWidth methods - CurrentX and CurrentY properties - PrintForm method - Key board events - KeyDown, KeyPress and KeyUp events and the associated methods - File systems - Drive ListBox, Directory ListBox - ChDir statement - Path - Multiselect property - Random, Sequential and Binary access and associated functions and statements

UNIT 5

Data control and database - Table definition and Fields - Database related properties to be set Connect property - Bound controls - Record Source - DynaSet and SnapShot - record manipulation with code - Adding, deleting and editing records - Updating - UpdateRecord and UpdateControls - controlling transactions - Database objects and properties - accessing Recordset objects - MoveFirst, MoveLast, MovePrevious and MoveNext methods - Begin, Commit and Rollback transactions - accessing FoxBase files - MDI applications - creating MDI forms and Child forms - Menu and Tollbar

Books for Study:

1. Warner, Teach yourself Visual Basic 6, Tata McGraw hill
2. Bradley, Programming in Visual Basic 6.0, Tata McGraw Hill.
3. Jerke, Visual Basic 6: The complete Reference, Tata McGraw Hill.

SEMESTER V
MAJOR PRACTICAL- IV
(VISUAL BASIC)
(2 hours per week)

1. Create an application that does the following when a text is entered
   (a) Choose an option from each combo box for Font, Style and Size
   (b) Select Effect as Underline or Strikethrough
   (c) While performing (a) and (b) the user should be able to see the preview as a label.
   (d) Add two command buttons OK and EXIT
2. Design the form like a small calculator that accepts two numbers and does the following
   (a) Addition (b) Subtraction (c) Multiplication (d) Division
   The result of operation should be displayed as label. ADD and EXIT button to terminate the execution.
3. Design an application that will allow you to draw on the screen when the left mouse button is pressed.
4. Create a form with following student details
   (i) Register Number (ii) Name (iii) Sex (iv) Department (v) Class (vi) Date of birth (vii) Create a listbox to add the items entered in the list (viii) Create a text box to show no. of students entered in the list box. Do the following operations in the form
   (a) Add data to the list.
   (b) Remove data from the list
   (c) Clear form
   (d) Clear list
   (e) EXIT
5. Create a form with an image control and two command buttons, one to enlarge the image and other to shrink. Add another command button to EXIT.
6. Create a form that enables to scroll a line of text. Add command buttons to START, STOP and EXIT.
7. Create a form that includes shapes and add command buttons
   3 Circle (b) Ellipse (c) Rectangle (d) Square (e) Colour
   (to fill the chosen shape)
8. Create a form that uses animation to bounce a ball. Add command buttons START, STOP and EXIT.
9. Create a menu Edit with the commands cut, copy and paste. Add a text box that allows you to enter text and do the above mentioned operations.
10. Create a table in Access with the following fields
    a. Employee ID (b) Employee Name (c) Designation
    (d) Salary
    Retrieve this table using datacontrol and do the following operations
    (a) Add (b) Delete (c) Update (d) Close

- Two questions to be asked with internal choice.
- Max. Marks: 100 – Practical Marks: 80 Record Marks: 20
- Duration of exam – 3 hours

SEMESTER VI
MAJOR PRACTICAL V
(DESIGN OF EXPERIMENTS, REGRESSION ANALYSIS & SAMPLING METHODS)
(2 hours per week)

Working with Statistical Software Packages: SPSS or SYSTAT and Scientific Calculators

1. One way classification and Two way classification
2. Two way classification with m observations per cell
3. Completely Randomised Design
4. Randomised Block Design and R.B.D. with one or two missing values
5. Latin Square Design and L.S.D. with one or two missing values
6. 2^2 Design, 2^3 Design and 3^2 Design
7. Total and Partial Confounding in 2^3 experiments
8. Split Plot design
9. Simple Linear Regression
10. Multiple Regression
11. Simple random sampling
12. Stratified random sampling – Proportional allocation
13. Stratified random sampling – Optimum allocation
14. Systematic sampling
15. Single stage cluster sampling

- Six questions to be set. Candidates may be required to answer four questions.
- Max. Marks: 50 – Practical Marks: 40 Record Marks: 10
- Duration of exam – 3 hours

SEMESTER VI
MAJOR PAPER XIV: STATISTICAL QUALITY MANAGEMENT

(6 hours per week – 5 lecture-hours and 1 tutorial/seminar session per week)

Unit 1

Concept of Quality – Quality movement in India – Standardization for Quality – Quality management – Quality circles – Total Quality Management – ISO 9001.

Unit 2

Need for SQC in industries – process control – chance and assignable causes of variations – concepts of specification and tolerance limits – process capability – statistical basis for control charts – control chart for variables – X bar and R chart - their construction and analysis.

Unit 3

Control charts for attributes – p, np, c and U charts – their construction and analysis.

Unit 4

Product control – fundamental concepts of acceptance sampling by attributes – producer's and consumer's risk – concepts of AQL, LTPD, AQL and AOQL – Single sampling plan OC, AOQ, ASN, ATI curves.

Unit 5

Double sampling plan for attributes – OC, AOQ, ASN, ATI curves – Dodge and Romig tables – Sequential sampling plan for attributes.

Books for Study:

1. Montgomery.D.C. (1991), Introduction to Statistical Quality Control, 2nd Edition, John Wiley and Sons.
2. S.C.Gupta and V.K.Kapoor(1999), Fundamentals of Applied Statistics, Sultan Chand and Sons.

Books for Reference:

1. Grant.E.L. and Leavenworth.R.S. (1980), Statistical Quality Control, McGraw Hill.
2. Duncan A.J.(1974): Quality Control and Industrial Statistics, 4th Ed., Taraporewala & Sons.

SEMESTER VI
MAJOR PAPER XV: APPLIED STATISTICS

(4 hours per week – 3 lecture-hours and 1 tutorial/seminar session per week)

UNIT 1

Concept of time series, components of a time series – Additive and Multiplicative models – Resolving the components of a time series – Evaluation of trend by least square method – Methods of moving averages.

UNIT 2

Seasonal indices – Simple average, Ratio to moving average – Ratio to trend, link relative method – Cyclical fluctuations – residual method only – Variate difference method

UNIT 3

Basic index numbers and their definitions – Main steps in the construction of index numbers and its uses – Fixed and Chain base index numbers - Laspeyre's, Paasche's, Fisher's, Marshall – Edgeworth index numbers - Optimum tests for index numbers - Cost of living index number – Construction and uses of wholesale price index

UNIT 4

Demand Analysis – Theory and analysis of consumer's demand – Law of demand, Price elasticity of demand – estimation of demand curves –forms of demand functions - Demand and Supply – utility and indifference maps – determination of price and supply and demand

UNIT 5

Present official statistical system in India – Methods of collection of official statistics – their reliability and limitations – Principal publications containing data on topics such as population, agriculture, industry, trade, prices, labour and employment, transport and communications, banking and finance – Various official agencies responsible for data collection and their main functions

Books for Study:

2. Goon A.M, Gupta M.K., Das Gupta B. (1991): Fundamentals of Statistics, Vol. II, World Press, Calcutta.
3. Kapoor V.K. and Gupta S.C. (1978): Fundamentals of Applied Statistics, Sultan Chand ans Sons.
4. Saluja M.R. (1972): Indian official Statistical Systems, Statistical Publishing Society, Calcutta and The Indian Econometric Society, Hyderabad.

Books for Reference :

1. Croxton F.E, Cowden D.J and Kelin S (1973): Applied General Statistics, Prentice Hall of India.
2. Guide to current Indian Official Statistics. Central Statistical Organization, Govt. of India
3. Mukhopadhyay P. (1999): Applied Statistics, New Central Book Agency Pvt. Ltd., Calcutta.

SEMESTER VI
MAJOR PAPER XVI: OPERATIONS RESEARCH

(6 hours per week – 5 lecture-hours and 1 tutorial/seminar session per week)

Unit 1

Introduction to Operations Research – Principal Components of a Decision problem – Phases of Operations Research study.

Unit 2

Linear Programming – Graphical Solution – Simplex method including artificial variable technique – Duality problems.

Unit 3

Transportation and Assignment models – Sequencing models

Unit 4

Game Theory – Optimal Solution of two person zero sum games – Mixed strategies – Graphical solution of (2 x n) games – Solution of (m x n) games by linear programming – Dominance property.

Unit 5

PERT and CPM - network diagrams - determination of the floats and critical path - probability considerations in project scheduling.

Books for study:

1. Hamdy.A.Taha(1999): Operations Research, 6th Edition, Macmillan Publishing Co. Inc.
2. Kanti Swarup et al.: Opertaions Research, Sultan Chand and Sons, New Delhi.
3. Goel and Mittal (1982): Operations Research, Pragati Prakashan, Meerut.

Books for Reference:

1. Hillier F.S. and Libermann G.J.: Introduction to Operations Research, McGraw Hill.
2. Sharma J.K.(2001): Operations Research: Theory and Applications, Macmillan India Ltd.

SEMESTER VI
MAJOR PAPER XVII: HEALTH STATISTICS AND POPULATION DYNAMICS

(6 hours per week – 5 lecture-hours and 1 tutorial/seminar session per week)

Unit 1

Health statistics: Introduction, utilization of basic data, sources of health statistics, problems in the collection of sickness data, measurement of sickness, hospital statistics and the international classification of diseases – sources of demographic data in India: census, vital events, registration, survey, extent of under registration

Unit 2

Measures of mortality – crude and specific rates – infant mortality rate – direct and indirect standardization of death rates – complete life table – structure – interrelationship among life functions – uses of life table

Unit 3

Measures of fertility – CBR – ASBR – GFR – TFR – cohort fertility analysis – measures of migration – crude, specific and standardized rates – survival ratio and national growth rate method

Unit 4

Force of mortality – Gompertz and Makeham law – Abridged life table – need and uses – construction by Reed – Merril – King and Graville methods

Unit 5

Population growth and change – arithmetic, geometric and exponential growth rates – population estimation and projection – GRR – NRR – component method of projection – logistic curve and its graduation

Books for study

1. P.S.S.Sundar Rao and J.Richard: An introduction to Biostatistics (A manual for students in health sciences), Prentice Hall of India, Pvt. Ltd.
2. Bhaskar.D.Misra: An introduction to the study of population, South Asian Publishers Pvt. Ltd.

Books for Reference

1. Barclay.G.W, Techniques of population Analysis, John Wily, New York
2. Keyfitz.N., Applied Mathematical Demography, John Wiley, New York

SEMESTER VI
MAJOR PRACTICAL VII
(S.Q.M, APPLIED STATISTICS &HEALTH STATISTICS**)**
(2 hours per week)

Working with Statistical Software Packages: SPSS or SYSTAT and Scientific Calculators

1. $\bar{X}$ and R chart
2. p chart, np chart
3. c chart
4. Single Sampling Plan
5. Double Sampling Plan
6. Time series: Curve fitting by principle of least squares – straight line, Exponential and Logistic curves.
7. Seasonal fluctuations: Ratio to trend method, Ratio to moving average method and Link relative method.
8. Index numbers: Calculation of indices using Laspeyre's, Paasche's, Marshall-Edgeworth, Bowley's and Fisher's formula.
9. Cost of Living indices.
10. Crude specific and Standardised death rates

16. Construction of life tables

17. Crude specific and general fertility rates

- Six questions to be set. Candidates may be required to answer four questions.
- Max. Marks: 50 – Practical Marks: 40 Record Marks: 10
- Duration of exam – 3 hours

SEMESTER VI
ELECTIVE 1: ACTUARIAL STATISTICS

(6 hours per week – 5 lecture-hours and 1 tutorial/seminar session per week)

Unit 1

Elements of compound interest (nominal and effective rates of interest, annuities certain, present values, accumulated amounts, deferred annuities) – the functions included in compound interest – tables and their uses

Unit 2

Redemption of loans – sinking funds – the average yield on the life fund of an assurance office

Unit 3

The mortality table – select rate – general natures – construction – characteristics and uses of mortality tables

Unit 4

Premiums – general principles – natural premiums – level premiums – office premiums – loading for expenses – with profit and without profit premiums – adequacy of premiums relative consistency

Unit 5

Life office valuations – general principles – policy values – retrospective and prospective methods of valuation of liabilities

Books for Study:

1. Federation of Insurance Institutes Study Courses – Mathematical Basis of Life Assurances F1, 2
2. Donald.D.W. (1970) – Compound Interest and Annuities, Heinemann, London

Books for reference:

1. Elandt-Johnson.R.C, Johnson.N.L (1980), Survival Models and Data Analysis, John Wiley.

SEMESTER VI
ELECTIVE 2: INDUSTRIAL STATISTICS

(6 hours per week – 5 lecture-hours and 1 tutorial/seminar session per week)

Unit 1

Inventory planning: Concept of planned inventory policies – Deterministic models – Policy when inventory levels are reviewed continuously and demands occur uniformly with and without shortage costs – Economic order quantity.

Unit 2

Policy for production planning when inventory levels are reviewed periodically – Stochastic models – Single period model with no set up cost having zero or non-zero initial stock {(s,S) policy} – Solving special cases using computer packages.

Unit 3

Forecasting: Concept of forecasting and its applications in manufacturing and non-manufacturing industrial situations – Different methods of forecasting including average, last value, weighted average(exponential smoothing) – Forecasting in presence of linear trends using least square methods – Forecasting in presence of seasonal effects – Solving special cases using computer package.

Unit 4

Reliability: Definitions and relationships between survival function, hazard function, hazard rate of a non-negative random variable – Parametric distributions: Weibull, Gamma, Lognormal and Exponential as life time distributions - Concept of aging, IFR, IFRA classes of distributions and their dual.

Unit 5

Coherent system as binary function: Minimal cut and path sets(vectors) – Representation of structure function of series, parallel and k out of n : G systems of independent components – Minimal cut and path structure functions – Dual of a coherent structure – Derivation of reliabilities of above structures.

Books for study:

3. Taha H A (1999): Operations Research, Macmillan Publishing Co.
4. Hiller F S and Libermann G J(1995): Introduction to Operations Research, 6th Edition, McGraw Hill.
5. Bain L J and Enghardt(1991): Statistical Analysis of Reliability and Life Testing Models, Marckel Dekker.

Books for Reference:

1. Zacks S (1992): Introduction to Reliability Analysis, Probability models and Statistical methods, Springer Verlag.
2. Barlow R E and Proschan F(1975): Statistical theory of Reliability and Life testing :Probability models, Holt, Rinehart and Winston.

SEMESTER VI
ELECTIVE 3: APPLIED DECISION MAKING

(6 hours per week – 5 lecture-hours and 1 tutorial/seminar session per week)

Unit 1

Decision Problem: Goals and objectives – Conflict between goals – Possible solutions – Constraints – Feasible solutions – Objective function – Costs and benefits, notions and criteria for optimality.

Unit 2

Steps in decision-making: Determining objective(s), identifying alternative feasible solutions, determining (expected) costs and benefits associated with a feasible solution, developing a measure of effectiveness, finding the optimal solution – Sensitivity analysis and post-optimality problems – controlling a solution.

Unit 3

Structure of decisions – Development of the pay-off measure – Bernoullian utility – Expected value – Pay-off without a natural measure – Standard gamble – Strategies and states of nature – Analysis of decisions – Pay-off matrix – Decisions under certainty, uncertainty, risk and competition – Optimality criteria of pessimism, optimism and regret – A decision among decision criteria – Laplace criterion.

Unit 4

Sequential decisions – Decision trees – Informal analysis of decision trees – Cutting decision trees – Decision –making using expected money value and utility – Expected profit with perfect information – Value of sample information – Expected net gain due to sampling

Unit 5

Decision problems in marketing – Brand-loyalty model – Brand-share model – Pricing problem – Competitive bidding – Allocation of advertising funds
Decision problems in finance – Investment decision trees – Risk analysis – Portfolio selection – Dividend policy

Books for study:

1. Raiffa H and Schlaifer R (1968): Applied Statistical Decision Theory, MIT Press.
2. Johnson R D and Siskin B R (1976): Quantitative Techniques for Business Decisions, Prentice-Hall, India.

Books for Reference:

1. Kemeny J G, Schleifer Jr. A., Snell J L and Thompson G L (1968): Finite Mathematics with Business Applications, Prentice-Hall, India.

SEMESTER VI

ELECTIVE 4: JAVA PROGRAMMING

(6 hours per week – 5 lecture-hours and 1 tutorial/seminar session per week)

UNIT I

Introduction to JAVA : JAVA features, Java program structure – Java tokens –Java Literals –Java Datatypes-Type Casting Operators –Arrays, Multi Dimensional array – Control statements.

UNIT II

Classes-Objects-Methods-method Overloading –Array of Objects .
Inheritance: Types-Method Overriding, Abstract classes-Interfaces, packages

UNIT III

Overviews of Applets: Applet basics – Applets life cycle-creating an executable Applet in Html file AWT: working with graphics – working with frame window-Using Awt Controls : label – Buttons – Checkbox- Check Box Groups- Choice control.-text field-Multi Threading - Creating Thread – Extending Threads .

UNIT IV

Event handling : Event classes – Event Listener Interfaces-handling Mouse Events-Exception handling : Fundamental –using try and catch –throw-finally statements. I/O basics: Input Stream – Output stream-file input stream – file output stream –data input stream –data output stream.

UNIT V

Java Swing – Introduction – Advantages – Swing controls. Introduction to servlets – Overview of Java Beans

Books for study:

Herbert Schildt (2002): JAVA 2 (The Complete Reference), 4/e, BPB Publications.

REFERENCE

1. E.Balagurusamy: Programming with Java, 2/e , Tata Mc.Graw-Hill Publishing Company Ltd .

2. C.Xavier: Programming with Java2 , Scitech Publications Ltd.

SEMESTER VI

ELECTIVE 5: DATA BASE MANAGEMENT SYSTEM

(6 hours per week – 5 lecture-hours and 1 tutorial/seminar session per week)

UNIT- I

Introduction - DBMS Basic Concepts - Purpose of Database Systems – Database System / File System - Overall System architecture – Database Languages – Classifications – Data Models

UNIT – II

Entity relationship model: Mapping constraints – Primary Keys – Foreign Keys – Structural Constraints. – ER notations - ER model examples – Enhanced Entity Relationship Model: EER Concepts like Generalization, Specialization, Union, Category, Disjoint, Overlapping etc. EER model examples

UNIT- III

Relational DataBase Design – ER/EER to Relational Mapping algorithm - Relational Model: Structure – Formal Query Languages – Relational Algebra – Informal Design Guidelines – Functional Dependencies – Normalization upto Third Normal Form

UNIT- IV

SQL – Basics of SQL –DDL – DML – DCL – TCL Commands in detail with examples

UNIT- V

PL/SQL: Stored Procedure Concepts – Procedure – Functions – Cursors - Triggers.

Books for study:

1. H.F. Korth and A.Silberschatz (1988): Database System Concepts, McGraw Hill Publication.
2. Albert Lulushi (1997): Developing ORACLE FORMS Applications, Prentice Hall

Reference Books:

1. Ramez Elmasri and B. Navathe, Fundamentals of Database Systems (Chapters 1, 2, 3, 4.1, 7, 8, 9, 14), 3/e, Addison Wesley.

SEMESTER VI

ELECTIVE 6: BIOINFORMATICS

(6 hours per week – 5 lecture-hours and 1 tutorial/seminar session per week)

Unit 1

Introduction – Development of Bioinformatics - Biological concepts of Bioinfomatics - DNA- The Blue print of life – Chromosomes and its organization - Genetic Code – Genes Expression – RNA- Rice- Human – Genome.

Unit 2

Data representation – Data file formats – Data Retrieval Syatems - Biological data base – Structural data bases – Genome databases – Primary and Secondary data bases.

Unit 3

Sequence manipulations – Sequence files – Sequence editing – Sequence symbols.

Unit 4

Pairwise alignment – Local and global alignment - Multiple sequence Alignment- Phylogenetic Analysis – Gene Finding.

Unit 5

Data base searches – BLAST, FASTA –Elementary concepts of data mixing.

Books for study:

1. K. Mani and N. Vijayaraj (2002): Bioinformatics for Beginners, Kalaikathir Achchagam.
6. Arthur M. Lesh: Introduction to Bioinformatics

SEMESTER VI
ELECTIVE 7: STATISTICAL GENETICS

(6 hours per week – 5 lecture-hours and 1 tutorial/seminar session per week)

Unit 1

Statistics Genetics: Cells, Chromosomes, Gametes, Genes and Gene frequency, Mendel's laws- Single locus with two alleles – Hardy-Weinberg equilibrium – A-B-O bloodgroup system, Calculation of probabilities of offspring bloodgroup for given parental blood group – Chance of incompatibility.

Unit 2

Definition of ED50, ED90 etc.- Simple method of estimation of the above. Data: Dose levels (Z,I), number of individuals exposed (n,I), number responding (r,I). Simple regression of probit on log dose to estimate parameters of tolerance distribution.

Unit 3

Introduction to logistic regression with binary response and one independent variables (continuous) - Exponential and logistic models of population growth, solving the following differential equations :

$DNt/dt = kNt$, $dNt/dt = aNt(k-Nt)$.

Fitting the above growth models to data by linearization and regression.

Unit 4

Capture-recapture method of abundance estimation. One and two recapture occasions. Use of likelihood under binomial distribution – Concept of biodiversity. Simpson's and Shannon-Wiener indices.

Unit 5

Study of exponential and Weibull distributions as models for survivorship data. Corresponding hazard functions and interpretation of their shapes. Applications to environmental data.

Books for Study :

1. D.J.Finney (1978): Statistical Methods in Biological Assays, Charles Griffics & Co.
2. A.P.Gore and S.A. Paranjpe (2000): A course in Mathematical & Statistical Ecology, Kluwer.

Books for References:

1. R.C.Elandt Johnson (1975): Probability Models and Statistical Methods in Genetics Wiley.
2. C.C.Li (1976): First course in Population Genetics, Boxwood Press.

SEMESTER VI
ELECTIVE 8: PROJECT WORK
(6 hours per week)

Guidelines for the Project work:

1. A project work shall be normally offered in the third year (sixth semester).
2. A project work shall be assessed for a maximum of 100 marks. The assessment will be based on the project report, presentation and viva-voce – ONLY INTERNAL EVALUATION.
3. A project may be undertaken by a group of students and the maximum number of students in a team shall not exceed five.
4. A project work shall be supervised by a faculty member assigned by the Head of the Department.
5. There shall be an internal examiner for the evaluation of the project work.
6. A project work should encourage a student to interact with the end user.
7. A project work should be chosen such that there is enough scope to apply and demonstrate the statistical techniques learnt in the course.
8. The students should submit a report above their project work before the last working day of the concerned semester. Even if a team of students undertake the same project, the project report submitted by each member of the team should be separate.
9. A project work report shall clearly state the problem addressed, the methodology adopted, the assumptions and the hypotheses formulated, any previous references to the study undertaken, statistical analyses performed and the broad conclusion drawn.