SAURASHTRA UNIVERSITY

Re-Accredited Grade B by NAAC
Grade A

FACULTY OF SCIENCE

SYLLABUS FOR

Bachelor of Science

(Statistics)

(Semester- V&VI)

According to Choice Based Credit System
Effective from June – 2018

B.Sc. (Statistics)
Semester-V
Paper: 501(Theory)
COMPUTATIONAL TECHNIQUES &R-Language

Objective: The course aims to provide an understanding of application of statistics to business and industries while focusing to develop effective business communication skills among the students.

Key features: To make them aware about Statistical Methods application in the real life.

Course duration:Theory:60 hours, 6 hours a week.**Credit: 4**

Practical: 6 hours a week **Credit: 3**

Unit No.	Topic	Hours	Marks
I	**Finite differences** Difference Operators Definition and Relation between them. Gregory Newton's interpolation for equal intervals.	10	14
II	**Divided differences & Central differences** Newton's divided difference of unequal interval. Lagrange's interpolation and inverse interpolation. Gauss, Sterling and Bessel's formula	10	14
III	**Numerical Integration & solution of differential equations** General Quadreture formula, Trapezoidal rule, Simpson's one-third rule and 3/8 rule, Weddle's rule Picard's and Taylor'smethod of successive, Euler's Method, Euler-Mecluren's summation formula.	14	14
IV	**Solution of algebraic equations** Bisection method, Regula-Falsi (False position) method, Successive approximation (Fixed point Iteration) method Newton Raphson's method, Applications of Newton-Raphson formula.	12	14
V	**R-Language:** Introduction, Data: Descriptive Statistics and Tabulation, Distribution, Simple Hypothesis, Graphical Analysis, Formulation Notation and Complex Statistics Regression (Linear Modeling)	14	14

Paper: 501(Practical)

COMPUTATIONAL TECHNIQUES &R-Language

(27 Marks)

1. Gregory Newton's Interpolation formula.
2. Lagrange's Interpolation formula.
3. Newton's divided difference formula.
4. Central difference formula of Gauss, Sterling and Bessel.
5. Numerical evaluation of integral using Trapezoidal, Simpson 1/3, 3/8 rule, Weddle's rule.
6. Solution of Algebraic equation by graphical, false position iteration method.
7. Picard's and Taylor's method of successive.
8. Euler-Maclaurin's summation formula.
9. Newton-Raphson's method and its square root, inverse and inverse square-root formula.
10. Practical based on R-language.

Note: Viva-voce and Practical Journals **(8 Marks)**

REFERNCE

1. Gupta P. P. and Malik G. S. (94-96), Numberical Analysis.
2. Gupta-Malik (1998), Calculus of Finite differences & Numerical Analysis.
3. Hidebrand P. B. (1956): Introduction to Numerical Analysis, Mc Grow Hill
4. Kunz: Numerical Analysis
5. Raval and Patel: Numerical Analysis (Gujarati)
6. Dr. Mark Gardener: Beginning R (The Statistical Programming Language), Wiley India Pvt. Ltd.

B.Sc. (Statistics)
Semester-V
Paper (ELECTIVE): 501(Theory)
APPLIED DECISION MAKING

Objective: The course aims to provide an understanding of application of statistics to business and industries while focusing to develop effective business communication skills among the students.

Key features: To make them aware about Statistical Methods application in the real life.

Course duration:Theory:60 hours, 6 hours a week.**Credit:4**
Practical: 6 hours a week**Credit: 3**

Unit No.	Topic	Hours	Marks
I	**The Decision Problem** Introduction Element of decision theory Decision Making Under Uncertainty Laplace (equally likely decision) criterion, Maximin or Minimax criterion Maximax or Minimin criterion, Hurwicz criterion, Regret criterion	12	14
II	**Decision Making Under Risk** Expected Monetary Value (EMV), Expected Opprtunity Loss (EOL) Expected Value of Perfect Information (EVPI), Bayesian Analysis: Posterior Analysis, Decision Trees	12	14
III	**Decision under competition** Two person zero sum games, Pure and mixed strategies, Saddle points Dominance principle, Uniqueness of value, Solving 2×2 games, Solving $2 \times n$ games, Competitive and vindictive solutions of non-zero games, Equilibrium points.	12	14
IV	**Application of Decision Problem-I** The assignment problem economic order quantity model for inventory Inventory problems with random demand	12	14
V	**Application of Decision Problem-II** Critical path methods for production planning PERT and CPM Project crashing, Risk analysis	12	14

Paper(ELECTIVE): 501(Practical)

APPLIED DECISION MAKING

(27 Marks)

1. Examples based on Decision Making Under Uncertainty
2. Examples based on Decision Making Under Risk
3. Examples based on Decision Trees
4. Examples based on Decision under competition
5. Examples based on Inventory Models
6. Examples based on PERT & CPM
7. Examples based on Project Crashing
8. Example based on Risk Analysis

Note: Viva-voce and Practical Journals **(8 Marks)**

REFERNCE

1. Bajpai Naval, Business Statistics, Indian Institute of Information Technology and Management, Gwalior
2. Sharma Anand, Statistics for Management, Indian Institute of Industrial Engineering, Delhi
3. Sharma J. K., Quantitative Techniques for Management.

B.Sc. (Statistics)
Semester-V
Paper: 502(Theory)
MATHEMATICAL STATISTICS

Objective: The course aims to provide an understanding of application of statistics to business and industries while focusing to develop effective business communication skills among the students.

Key features: To make them aware about Statistical Methods application in the real life.

Course duration:Theory:60 hours, 6 hours a week.**Credit:4**

Practical: 6 hours a week**Credit: 3**

Unit No.	Topic	Hours	Marks
I	**Limit Laws** Chebychev's inequality and its examples. Idea of convergence in probability and distribution. Law of large number. Weak law of large number and its examples. De-moivere-laplace theorem and its examples. Definition of characteristic function and its elementary properties, Statement of inversion theorem and its applications. Central limit theorem, Lindberge-Levy's central limit theorem.	**12**	**14**
II	**Normal Distribution** Definition, properties and derivation of p.d.f., moments, median, mode, proof of important properties	**12**	**14**
III	**Continuous Distribution (Univeriate)** Definition, Distribution function, properties and moments of Gamma and Beta Introduction of distributions :Uniform, Exponential, Parato, Weibull, Laplace, Cauchy and truncated binomial and poisson, Log-normal	**12**	**14**
IV	**Chi-square, t and F Distribution** Chi-square Distribution: Definition, derivation of its p.d.f., m.g.f., c.g.f. its moment and coefficient of skewness. Limitting term, mode, theoretical examples. t- Distribution: Definition, derivation of its p.d.f., its moment and coefficient of skewness, limiting term and mean deviation about mean. F- Distribution: Definition, derivation of its p.d.f., its moment, mode. Relations between t and F distribution and Relations between F and χ^2 distributions.	**12**	**14**

V	**Partial & Multiple Correlation and Regression** Partial Correlation and Multiple Correlation for 3 variables, its measures and related results. Test of significance of Partial Correlation Coefficient and Multiple Correlation Coefficients. **Bivariate Normal Distribution** Definition of Bivariate Normal Distributions, Probability density of BVN distributions, Moment Generating Function, Marginal, Conditional Distributions and its examples.	**12**	**14**

Paper: 502(Practical)
MATHEMATICAL STATISTICS

(27 Marks)

1 Examples based on t – distribution
2 Examples based on F – distribution
3 Examples based on χ^2- distribution
4 Examples based on Normal Distribution
5 Examples based on Bia-variate Normal Distribution
6 Multiple & Partial Correlation and Regression. Its test Of Significance

Note: Viva-voce and Practical Journals (8 Marks)

REFERNCE

1 Goon A. M., Gupta M. K. and Dasgupta B.(1980), Fundamentals of Statistics VOL-II, The World Press Publishers Pvt. Ltd. Calcutta.
2 Gupta S. C. and Kapoor V. K.(2012), Fundamentals of Mathematics and Statistics, Eleventh Edition, Sultan Chand & Sons, New Delhi.
3 Hogg R. V. and Craig A. T.(1978), Introduction to Mathematical Statistics Forth edition; Collier Macmilan Publishers.
4 Kenny J. S. &Keepine E. S.(1954), Mathematical Statistics VOL-I and VOL-II.
5 Rao C. R. (1973), Linear statistical Inference and its applications, Second Edition, Wiley Eastern Private Limited, New Delhi.
6 Rohatgi V. K. (1986), An Introduction to probability theory & Mathematical Statistics Willey Eastern.

B.Sc. (Statistics)
Semester-V
Paper: 503(Theory)
STATISTICAL INFERENCE

Objective: The course aims to provide an understanding of application of statistics to business and industries while focusing to develop effective business communication skills among the students.

Key features: To make them aware about Statistical Methods application in the real life.

Course duration:Theory:60 hours, 6 hours a week.**Credit:4**

Practical: 6 hours a week**Credit: 3**

Unit No.	Topic	Hours	Marks
I	**Point Estimation-I** Unbiasedness, Consistency, Sufficiency, Factorization Theory(Without Proof), relative efficiency, illustrations of point estimation.	12	14
II	**Point Estimation-II** Definition of MVUE Cramer Rao Inequality, CR lower bound and its applications, Amount of information Rao-Black well theorem Concept of complete sufficient Statistic with illustration.	12	14
III	**Method of Estimation** Method of moments and its illustration Method of maximum likelihood and its illustration Properties of MLE (only statements) and example Method of minimum Chi-square. **Linear models & Linear Estimation** Linear model Assumption, Estimability and BLUE Method of least square Gauss-markov theorem Estimation of error variance	12	14
IV	**Testing of Hypothesis-I** Statistical Hypothesis simple and composite hypothesis Types of Error, Statistical tests, Critical region Power function and Power of a test with illustration Definition of MP N.P. Lemma its application in testing of hypothesis regarding Binomial, Poisson, Normal and Exponential distribution	12	14

V	**Testing of Hypothesis-II** Definition of UMP test and its comparison with MP test Likelihood Ratio test and its examples for Binomial, Poisson and Normal distribution Need for sequential tests Wald's SPRT with illustrations OC and ASN function for Binomial, Poisson and Normal distributions.	**12**	**14**

Paper: 503(Practical)
STATISTICAL INFERENCE

(27 Marks)

1. Method of estimation
2. Method of moments
3. Maximum likelihood estimator
4. MLE of truncated Binomial and Poisson distribution
5. Two types of error
6. Power of test
7. Drawing power curve of test
8. SPRT for Binomial, Poisson and Normal distribution
9. Drawing of OC and ASN

Note: Viva-voce and Practical Journals **(8 Marks)**

REFERNCE

1. Dharmadhikari and Patel: Statistical Inference, Gujarat Board.
2. Gupta S. C. and Kapoor V. K.(2012), Fundamentals of Mathematics and Statistics, Eleventh Edition, Sultan Chand & Sons, New Delhi.
3. Hogg R. V. and Craig A. T.(1978), Introduction to Mathematical Statistics, Fourth Edition, Collier Mc Milan Publishers.
4. Mood A. M. Graybill F. A. and Bosse D. C. (1974), Introduction to the Theory of Statistics, Third Edition, Mc Grow Hill.
5. Rao C. R. (1973), Linear statistical Inference and its applications ,Second Edition, Wiley Eastern Private Limited, New Delhi.
6. Rohatgi V. K.(1986), An Introduction to probability theory and Mathematical Statistics, Wiley Eastern.
7. Silvey S. D.(1970), Statistical Inference, Penguin Books.

B.Sc. (Statistics)
Semester-VI
Paper: 601(Theory)
DESIGN OF EXPERIMENTS AND SAMPLING TECHNIQUES

Objective: The course aims to provide an understanding of application of statistics to business and industries while focusing to develop effective business communication skills among the students.

Key features: To make them aware about Statistical Methods application in the real life.

Course duration:Theory:60 hours, 6 hours a week.**Credit:4**

Practical: 6 hours a week**Credit: 3**

Unit No.	Topic	Hours	Marks
I	**Basic concepts of Design of Experiment** Need for Design of Experiments Fundamental principles of Design of Experiment **Analysis of variance** Model and assumptions Derivation of analysis of variance for one-way classification (with fixed effect models). Derivation of analysis of variance for two-way classification (with fixed effect models).	12	14
II	**Basic Design** C.R.D., R.B.D., L.S.D. with their analysis Missing plot technique (Up to two missing values) for R.B.D. and L.S.D.	12	14
III	**Efficiency** Efficiency of designs Efficiency of R.B.D. over C.R.D. Efficiency of L.S.D. over C.R.D. and R. B.D. **Factorial Designs** Concept of Factorial designs and its comparison with basic design. 2^2, 2^3, 3^2 factorial design and their analysis of variance table. Concept of Confounding Experiments with example. Concept of total and partial confounding with illustrations	12	14
IV	**Concept of Sampling** Concept of population and sample Need for sampling, census and sample survey Basic concepts in sampling, sample selection, sample size, sampling frame, sampling error and non-sampling error. **Simple random sampling** Simple random sampling with and without replacement. Estimation of population mean, population and variance. Example.	12	14

V	**Stratified random sampling** Estimation of population mean and its variance. Different types of allocation: Neyman, Proportional and Optimum, their comparison with simple random sampling, Example. **Systematic sampling** Estimation of population mean and its variance. Comparison with simple random and stratified samplings, elements of non sampling errors, Example.	**12**	**14**

Paper: 601(Practical)

DESIGN OF EXPERIMENTS AND SAMPLING TECHNIQUES

(27 Marks)

1. ANOVA for one-way and two-way classification(with fixed effect models)
2. Analysis of C.R.D., R.B.D. and L.S.D.
3. Efficiency of R.B.D. over C.R.D., Efficiency of L.S.D. over C.R.D. and L.S.D. over R.B.D.
4. Missing plot techniques(Up to Two) for R.B.D. and L.S.D.
5. 2^2, 2^3, 3^2 Factorial experiments
6. Concept of total confounding
7. Only selection of sample and determination of sample size
8. Simple random sampling, Stratified random sampling and Systematic random sampling
9. Gain due to stratification from the simple random sampling

Note: Viva-voce and Practical Journals (8 Marks)

REFERNCE

1. ChaudhuriArijit and Strenger H. (2005), Theory and Methods of Survey Sampling, Chapman & Hall/CRC, Taylor & Francis Group, New Yourk.
2. Cochran W. G. and Cox G. M. (1957) Experimental design, John Wiley.
3. Cochran W. G. (2007), Sampling Technique, Third Edition, Wiley-India, New Delhi.
4. Das, M.N. and Giri, N. (1975). Design and analysis of experiments. New age international publication.
5. Ghosh D. K. (2013), Factorial Designs, Saurashtra University, Rajkot.
6. Goon A. M., Gupta M. K. and Dasgupta B. (1986), Fundamental of Statistics, VOL-2, World Press, Calcutta.
7. Gupta S. C. and Kapoor V. K.(2011), Fundamentals of Applied Statistics, Fourth Edition, Sultan chand& Sons, New Delhi.
8. Murthy, M. N. (1977). Sampling theory and methods. Statistical publishing society. Kolkatta.
9. MukhopadhyayParimal(2008), Theory and Methods of Survey Sampling, Second Edition, Prentice Hall India.
10. Shah S. M., Experimental design and sampling techniques(Gujarat Board)
11. Sukhatme et al. (1984), Sampling Survey methods and its applications, Indian Society of Agricultural Statistics.
12. W. G. Cochran (1984), Sampling techniques, third edition, Wiley Eastern.

B.Sc. (Statistics)
Semester-VI
Paper: 602(Theory)
STATICAL QUALITY CONTROL & OPERATION RESEARCH

Objective: The course aims to provide an understanding of application of statistics to business and industries while focusing to develop effective business communication skills among the students.

Key features: To make them aware about Statistical Methods application in the real life.

Course duration:Theory:60 hours, 6 hours a week.**Credit:4**

Practical: 6 hours a week**Credit: 3**

Unit No.	Topic	Hours	Marks
I	**STATISTICAL QUALITY CONTROL-I** **(INTRODUCTION AND THEORY OF CONTROL CHARTS)** Introduction Quality and Quality Control, Variations in Quality, Theory of Control Charts. Theory of Runs. Specification Limits, Process Limits and Revised Limits, Use of Statistical Quality Control. Charts for Variables: $\bar{X}$ chart,R chart, $\sigma -$ chart Charts for Attributes: np-chart, p-chart, c-chart	12	14
II	**STATISTICAL QUALITY CONTROL-II** **(ACCEPTANCE SAMPLING PLANS):** Principles of acceptance sampling problem of lot acceptance Simulation of good and bad lots Producer's risks and consumer's risks, AQL and LTPD Single Acceptance Sampling Plan and Double Acceptance Sampling plans and their functions like OC, ASN, AOQ and ATI.	12	14
III	**LINEAR PROGRAMMING PROBLEM-I** Elementary theory of convex sets, Definition of general linear programming problems, Problems occurring in various fields, Graphical method of solving LPP.	12	14
IV	**LINEAR PROGRAMMING PROBLEM-II** Method of solving LPP: Simplex, Two Phase and Big-M Duality of LPP and its examples.	12	14
V	**Transportation problem** **(non-degenerate and balances case only)** Definition and Concept. Method of initial feasible solution: N-W corner, Minimum Row, Minimum Column, Least cost, Vogel's **Assignment problem** Definition and Concept,Method of solution: Hungarian	12	14

Paper: 602(Practical)

STATICAL QUALITY CONTROL & OPERATION RESEARCH

(27 Marks)

1. Control Charts:$\bar{X}$ chart,R chart, $\sigma -$ chart, np-chart, p-chart, c-chart
2. Single acceptance sampling plan and Double acceptance sampling plan..
3. Graphical method of solving LPP
4. Method of solving LPP: Simplex, Two Phase and Big-M
5. Transportation problem: Method of initial feasible solution by N-W corner, Minimum Row, Minimum Column, Least cost and Vogel's.
6. Assignment problem:Method of solution by Hungarian.

Note: Viva-voce and Practical Journals (8 Marks)

REFERNCE

1. Cowden D. J. (1960), Statistical method in Quality Control, Prentice Hall.
2. Ducan A. J.(1974), Quality Control and Industrial Statistics, Fourth Edition, Taraoprewal and Sons.
3. E. L. Grant (1964), Statistical Quality Control, Third edition, Mc Grow Hill.
4. Gupta S. C. and Kapoor V. K.(2011), Fundamentals of Applied Statistics, Fourth Edition, Sultan chand& Sons, New Delhi.
5. Sharma J. K.(2009), Operations Research Theory and Application, Fourth Edition, MACMILLAN PUBLICHSERS INDIA LIMITED, New Delhi.
6. TahaHamdy A.(2008), Operations Research: An Introduction, Eight Edition, Pearson Prentice Hall, New Delhi.

B.Sc. (Statistics)
Semester-VI
Paper: 603(Theory)
PROGRAMMING WITH C++,VITAL STATISTICS
& NON-PARAMETRIC METHODS

Objective: The course aims to provide an understanding of application of statistics to business and industries while focusing to develop effective business communication skills among the students.

Key features: To make them aware about Statistical Methods application in the real life.

Course duration:Theory:60 hours, 6 hours a week.**Credit:4**

Practical: 6 hours a week**Credit: 3**

Unit No.	Topic	Hours	Marks
I	**Introduction** History & Features of C Language, Components of C Language Structure of C Program, C Editor Command **Variable, Identifier, Constants, Operators and expressions** Variable declaration, Local, Global, Parametric variables , Assignment of variables.Basic Data Types, Enumerated data types, Derived data types.Constants.Arithmetic, Relation and logical operators, Assignment operators, Increment and Decrement operators, Conditional operators, Bitwise operators.	12	14
II	**Control Statement** Control statements, Conditional statements, If……else Statement and Nesting of if……else.Switch statement, Break Statement.For loop statement.While loop statement.Do while loop statement. **Functions and Arrays Statement** Standard header file, Library function, String functions, Mathematical functions, One dimensional Array, Two dimensional Array, Multi dimensional Array	12	14
III	**Introduction:**Uses of Vital Statistics.Methods of Obtaining Vital Statistics. **Measurement of Mortality**: Crude Death Rate (C.D.R.), Specify Death Rate (S.D.R.), Standardized Death Rates. **Mortality Table or Life Table** Stationary Population, Stable Population, Central Mortality Rate, Force of Mortality, Assumptions, Description and Construction of Life Table. Uses of Life tables.	12	14
IV	**Fertility** General Fertility Rate (G.F.R.), Specific Fertility Rate (S.F.R.), Total Fertility Rate (T.F.R.).	12	14

	Measurement of Population Growth Crude Rate of Natural Increase and Pearle's Vital Index, Gross Reproduct Rate, Net Reproduction Rate		
V	**NON-PRAMETRIC METHODS** Introduction, Advantages and drawbacks of Non-Parametric Methods over Parametric Methods. Wald-Wolfowitz Run test, Median test, Sign Test, Mann-Whitney-Wilcoxon U-test.	**12**	**14**

Paper: 603(Practical)

PROGRAMMING WITH C++,VITAL STATISTICS & NON-PARAMETRIC METHODS

(27 Marks)

1. Mathematical Series Print Problems.
2. Finding nPr and nCr.
3. Finding Maximum and Minimum value of a given set of Observations.
4. Mean, Variance for ungrouped data.
5. Mean, Variance for grouped data.
6. Simple and compound interest.
7. Arrange ascending/descending number and alphabet.
8. Matrix addition, subtraction and multiplication of matrix.
9. Fining correlation coefficient of ungrouped data
10. Finding the Binomial and Poisson probability.
11. Vital Statistics
12. Non Parametric methods

Note: Viva-voce and Practical Journals (8 Marks)

REFERNCE

1. Balaguruswamy E: Programming in ANSI C, Tata McGraw Hill.
2. Gottfried Byrons: Theory and problems of programming with C , TMH.
3. Gupta S. C. and Kapoor V. K.(2012), Fundamentals of Mathematical Statistics, Eleventh Edition, Sultan Chand & Sons, New Delhi.
4. Gupta S. C. and Kapoor V. K.(2012), Fundamentals of Applied Statistics, Eleventh Edition, Sultan Chand & Sons, New Delhi.
5. Kanitkar Y.P. Working with C, BPB publication.
6. Kernighan Brian W. and Ritchie Dennis M. (1991), The C programming Language, Second Edition, Prentice-Hall of India Prv. Ltd., New Delhi.
7. Schildt Herbert C: Made Easy, Mac Graw Hill.
8. Schildt Herbert C: The Complete reference IIIEd .TMM

B.Sc. (Statistics)
Semester-VI
Paper (ELECTIVE): 603(Theory)
APPLIED STATISTICS

Objective: The course aims to provide an understanding of application of statistics to business and industries while focusing to develop effective business communication skills among the students.

Key features: To make them aware about Statistical Methods application in the real life.

Course duration:Theory:60 hours, 6 hours a week.**Credit:4**
Practical: 6 hours a week**Credit: 3**

Unit No.	Topic	Hours	Marks
I	**INVENTORY CONTROL** Costs associated with inventory-classification of inventory systems Lot-size models with and without shortage(back order policy only) Inventory models under price breaks and quantity discount Deterministic inventory models under given rest icons-ABC and VED analysis. Elasticity of demand and supply with short exercise.	**12**	**14**
II	**QUEUING THEORY AND SEQUENCING PROBLEMS** Basic concepts for a quieueins system Study of M/M/1:(00/FIFO) and M/M/m:(00/FIFO) queues with simple properties. Apply of queuing theory without any mathematical derivations. Problem of sequencing-sequencing of n jobs on two and three machines.	**12**	**14**
III	**SIMULATION** Introduction, Simulation defined, Types of Simulation, Steps of simulation process. Stochastic Simulation and Random number: Monte Carlo Simulation, Random Number Generation. Simulation Problems: Inventory, Queuing and Investment.	**12**	**14**
IV	**INFORMATION THEORY** Introduction, Communication Process, A measure of Information, Measure of Other Information Quantities, Channel Capacity, Efficiency and Redundancy, Encoding, Shannon-Fano Encoding Procedure, Necessary and Sufficient Condition for Noiseles Encoding.	**12**	**14**
V	**DYNAMIC PROGRAMMING** Introduction, Dynamic Programming Terminology, Developing Optimal Decision Policy, Dynamic Programming under Certainty, Dynamic Programming Approach for Solving Linear Programming Problem.	**12**	**14**

Paper (ELECTIVE): 603(Practical)

APPLIED STATISTICS

(27 Marks)

1. Examples based on Inventory
2. Examples based on Queuing theory and Sequencing Problems
3. Examples based on Simulation
4. Examples based on Information Theory
5. Examples based on Dynamic Programing

Note: Viva-voce and Practical Journals (8 Marks)

REFERNCE

1. Sharma J. K.(2009), Operations Research Theory and Application, Fourth Edition, MACMILLAN PUBLICHSERS INDIA LIMITED, New Delhi.
2. TahaHamdy A.(2008), Operations Research: An Introduction, Eight Edition, Pearson Prentice Hall, New Delhi.

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THEORY **100 MARKS**	
Marks for External Examination:	(Short Questions) →20 Marks (Descriptive type) → 50 Marks Total Marks →**70 Marks**
Marks for Internal Examination:	Assignmentsand Test→**30 Marks**

Format of External Question Paper		
• There shall be paper of **70** marks and timing **2** hours and **30** minutes		
• There shall be **FIVE** questions from each unit of **14** marks each.		
• Each Question will be of the following form.		
Question	(A) Answer any four out of four (Short answer type question)	4 Marks
	(B) Answer any one out of two	2 Marks
	(C) Answer any one out of two	3 Marks
	(D) Answer any one out of two	5 Marks
TOTAL		**14 Marks**

PRACTICAL **MARKS: 50**	
Marks for External Examination: **TIME: 3 HOURS**	(Examples) →27 Marks (Via-voce→ 08 Marks and Practical Journals) Total Marks →**35 Marks**
Marks for Internal Examination:	**15 Marks**

-: Project Work:-

• There will be a project on any topic in Statistics preferably not covered in the syllabus.

• There will be one lecture per week to guide and motivate for each group of Students (5^{th} and 6^{th} semester).

• There will be credit of Project work is 3 at 5^{th} and 6^{th} semester each.

• **During the fifth semester:**

1. Introduced and assigned title of the project,
2. Teams will be formed for the same.
3. Each group will study, search reference, collect data and work-out details for their topic of project-work.

• **During the sixth semester:**

1. Students will finalize, document, submit and get the project work certified in their names.
2. The project work must be submitted by the student in the fourteenth week of the sixth semester.
3. Only on the submission of project dissertation the student will be issued hall ticket for the end semester theory and practical examination.
4. The dissertation may be typed at least 50 pages of A4 size.
5. Project work shall be evaluated by an external and one internal examiner which will be followed by presentation of the work and viva-voce.
6. Students will be required to undergo verification, evaluation and viva of the project-work they have done.
7. Certified documentation of the project-work done by each group is mandatory. The certified documentation should be produced while appearing for viva and evaluation of project during final examination of sixth semester.

• The project work will be evaluated for 100 marks of which **80% marks** will be allotted for the **dissertation** and **20% for the presentation** and **viva-voce**

• **The Evaluation of the project work will be done at the end of the sixth semester. For the Evaluation of the project work there shall be three hours duration at the end of the sixth semester.**