

**MANONMANIAM SUNDARANAR UNIVERSITY
TIRUNELVELI**

UG COURSES – AFFILIATED COLLEGES

B.Sc. Statistics

(Choice Based Credit System)

(with effect from the academic year 2016-2017 onwards)
(44th SCAA meeting held on 30.05.2016)

SEMESTER - V											
III	5.1	Statistical Inference – I	Core	4L + 4T	4	3	25	75	100	30	40
III	5.2	Statistical Quality Control	Core	4L+ 4T	4	3	25	75	100	30	40
III	5.3	Elective – III	EM	5	5	3	25	75	100	30	40
III	5.4	Elective – IV	EM	5	5	3	25	75	100	30	40
IV	5.5	Statistical Analysis using Software–II	SBS	4	4	3	25	75	100	30	40
		Total		30	22						
SEMESTER - VI											
III	6.1	Statistical Inference – II	Core	6	5	3	25	75	100	30	40
III	6.2	Design of Experiments	Core	6	5	3	25	75	100	30	40
III	6.3	Operations Research	Core	5	5	3	25	75	100	30	40
III	6.4	Elective - V	EM	4	5	3	25	75	100	30	40
III	6.5	Statistical Practical – III ***	Core (Practical)	4	4	3	50	50	100	20	40
III	6.6	Statistical Practical – IV ****	Core (Practical)	5	5	3	50	50	100	20	40
		Total		30	29						

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STATISTICAL INFERENCE - I

Unit - I

Statistical Inference: meaning and purpose, parameter and statistic. Sampling distribution and standard error. Estimator and estimate. Point Estimation : consistency, unbiasedness, efficiency and sufficient statistic - Neyman's factorization theorem (without proof) - simple problems.

Unit - II

Unbiased Estimation : Minimum variance unbiased estimator - Cramer-Rao Inequality and Rao-Blackwell theorem-applications and simple problems.

Unit - III

Methods of estimation: Methods of moments and maximum likelihood. Properties of estimators obtained by these methods – Simple Problems. Method of Least Squares for regression models. asymptotic properties of maximum likelihood estimations (without proof) - simple problems.

Unit - IV

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

Unit - V

Bayes estimation: concepts of prior, posterior and conjugate prior. Loss function: 0-1 loss function and quadratic error loss function. Bayes estimator. Simple problems involving quadratic error loss function.

BOOKS FOR STUDY:

1. Rohatgi, V. K. and A. K. md. Ehsanes Saleh (2009) An Introduction to Probability Theory and Mathematical Statistics, 2nd Edition, Wiley Eastern Limited, New Delhi.
2. Gupta, S.C., and V.K. Kapoor (1992) Fundamentals of Mathematical Statistics, A Modern Approach (Eighth Edition). Sultan Chand & sons, New Delhi.
3. Goon, A. M., M.K. Gupta, and B. Dasgupta (2005) Fundamentals of Statistics, Vol. I, (Eighth Edition), World Press, Kolkata.
4. Harold J. Larson (1982) Introduction to Probability Theory and Statistical Inference (Third Edition), John wiley & Sons. Inc., New York.
5. Robert V. Hogg, and Allen T.Craig (1978) Introduction to Mathematical Statistics (Fourth Edition), Macmillan Publishing Co., Inc., New York.
6. Alexander M. Mood, Franklin A. Graybill, and Duane C. Boes(1974) Introduction to the Theory of Statistics (Third Edition), Mc Graw Hill Co., Ltd., New York.
7. Rice, J.A. (2007) Mathematical Statistics & Data Analysis (Third Edition), Thomos Brooks/colt, Singapore.
8. Edward J. Dudewicz, and Satya N. Mishra (1988) Modern Mathematical Statistics, John Wiley & Sons. Inc., New York.
9. Parimal Mukopadhyay (2006) Mathematical Statistics (Third Edition), Books and Allied Private Limited, Kolkata.

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STATISTICAL QUALITY CONTROL

Unit - I

Control charts for variables: Quality control and need for statistical quality control techniques in industries - causes of variation - process control and product control. Process control: specifications and tolerance limits- 3σ limits, construction of Shewhart control charts - variable control charts - \bar{X} , R and σ charts- simple problems.

Unit - II

Control charts for attributes: control chart for fraction defectives (p chart), control chart for number of defectives (d chart) and control chart for number of defects per unit (c chart)-simple problems.

Unit - III

Acceptance Sampling: Product control - Sampling inspection, acceptance sampling by attributes- concepts of producer's risk and consumer's risk-acceptable quality level (AQL), lot tolerance percent defective (LTPD), average outgoing quality level (AOQL), ATI and ASN. Rectifying inspection plans.

Unit - IV

Acceptance sampling by attributes: Single sampling plan - OC, AOQ, ATI and ASN curves - Dodge and Romig sampling plans - Double sampling plan and its advantages over single sampling plan, Operating procedure.

Unit - V

Acceptance sampling for variables-sampling plan based on normal distribution- known and unknown standard deviation cases. Determination of n and k for one- sided specification limits - OC curve.

BOOKS FOR STUDY:

1. Montgomery, D.C. (1991) Statistical Quality Control (2nd Edition) John Wiley and Sons, New York.
2. Eugene L. Grant, and Richard S. Leavenworth (1988) Statistical Quality Control (Sixth Edition), McGrawhill Book co, New York.
3. Gupta, S. C. and V.K. Kapoor (1999) Fundamentals of Applied Statistics (Third Edition), Sultan Chand & sons, New Delhi.
4. Goon, A. M., M.K. Gupta and B. Dasgupta (1987) Fundamentals of Statistics, Vol. II. World Press, Kolkata.
5. Mahajan (1997) Statistical Quality Control, Dhanpat Rai & sons, New Delhi.
6. Juran, J.M.(1988) Quality Control Handbook, McGraw Hill, New York.

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ECONOMETRICS

Unit - I

Model with one explanatory variable: Definition, scope and objectives of Econometrics. Linear model with one independent variable - Least squares estimators of regression coefficients, properties of least squares estimators - analysis of variance to regression model.

Unit - II

Model with more variables: Linear model with more than one explanatory variables – assumptions – estimation of model parameter - Least squares estimators and their properties. Hypothesis testing – test the overall significance of the regression – Testing the individual regression coefficients.

Unit - III

Adequacy of Model: Model adequacy checking – residual analysis – residuals – standardized residuals – residual plot – normal probability plot – plot of residuals against estimated response. A formal test for lack of fit of the model.

Unit - IV

Autocorrelation: Meaning of serial independence – sources of autocorrelation – first order autoregressive scheme – consequences of autocorrelation – Durbin – Watson test – analysing the model in the presence of autocorrelation.

Unit - V

Multicollinearity : meaning and sources – consequences of multicollinearity. Test for detecting multicollinearity – Examining the correlation matrix – Variance Inflation factor – Eigen values of $X'X$.

BOOKS FOR STUDY:

1. Montgomery, D.C, Peck, E.C and Vining, G.G (2003) Introduction to Linear Regression Analysis (Third Edition). Wiley India, New Delhi.
2. Koutsoyiannis, A. (2006) Theory of Econometrics. (Second Edition) Palgrave, New York.
3. Singh, S. P., Parashar, K. and Singh, H. P. (1980) Econometrics. Sultan Chand & Co., New Delhi.
4. Klein, L. R. (1975) A Text Book of Econometrics (Second Edition). Prentice Hall of India, New Delhi.

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STOCHASTIC PROCESSES

Unit - I

Elements of Stochastic Processes: Basic terminologies. Classification of stochastic processes according to state space and domain-Elementary ideas on the Poisson process and Wiener process- Martingales-Markov processes- Stationary processes.

Unit - II

Markov Chain: definition-transition probability- discrete time Markov chain and transition probability matrix. spatially homogeneous Markov Chain-one -dimensional random walk.

Unit - III

Classification of states of Markov Chain. Reducible and irreducible Markov Chains- periodicity. Recurrent and transient states with examples. Concepts, results and problems concerning limiting probabilities (without Proof)- Simple problems.

Unit - IV

Classical examples of continuous time Markov Chain- infinitesimal generator -Poisson processes. General pure birth process and Yule's process. Birth and death processes - their differential and difference equations and solutions.

Unit - V

Social and behavioural processes - social mobility - industrial mobility of labour - educational advancement – recovery and data due to disease.

Some Markov models in business and sports - consumer behaviour - selecting a portfolio of credit risks - term structure - fencing.

BOOK FOR STUDY:

1. Medhi, J. (1994) Stochastic Processes (Second Edition). Wiley Eastern Limited, New Delhi.
2. Samuel Karlin and Taylor (1975) A First Course in Stochastic Processes. Academic Press, New York.
3. Bhat, U. N. (1972) Elements of Applied Stochastic Processes. John Wiley & Sons, New York.
4. Basu, A.K. (2005) Introduction to Stochastic Process, Narosa Publishing House Pvt. Ltd., New Delhi.

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ACTUARIAL STATISTICS

Unit - I

Accumulated value and present value of a sum under fixed and varying values of interest. Nominal and effective values of interest – Annuity – Classifications of annuities – Present and accumulated values of annuities – Immediate annuity due and deferred annuity.

Unit - II

Redemption of loans – Redemption of loans by installments payable times in a year Interest being p.a. effective. Role of probability distribution in general insurance (Weibull, Exponential).

Unit - III

Vital Statistics – meaning and uses of vital statistics – Measures of mortality – C.D. R, S.D.R., A.S.D.R. – Central mortality rate – Force of mortality – measures of fertility – C.B.R., G.F.R., A.S.F.R., T.F.R, G.R.R. and N.R.R.

Unit - IV

Mortality Table – Columns of a mortality table – Completing an incomplete mortality table and uses of mortality table – Expectation of life – Computing probabilities of survival and death using mortality tables – select mortality table – Ultimate mortality table – Aggregate mortality table.

Unit - V

Principle of insurance – Assurance benefits – Types of assurance – Endowment assurance, pure endowment assurance, whole life insurance and temporary assurance – Premiums – Natural premium – Level premium – Net premium – Office premium – Bonus loading with profit and without profit – Policy value – Retrospective policy value and prospective policy value.

BOOKS FOR STUDY:

1. Mathematical basis of Life Assurance (IC-81) Published by Insurance Institute of India, Bombay.
2. Gupta, S.C. and Kapoor, V.K. (1999) Fundamentals of Applied Statistics (3rd Edition), Sultan Chand & Co., New Delhi, (*for Unit III only*).

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JAVA PROGRAMMING

Unit - I

Principles of Object Oriented Programming- Software evolution- Basic concepts of OOP - features of OOP- applications of OOP-Java Programming structure- Constants- Variables-data types-type conversion and casting.

Unit - II

Operators: arithmetic operators, relational operators, logical operators, assignment operators, conditional operators, bitwise operators and special operators. Arithmetic expression- evaluation of expression-IF, SWITCH, WHILE, DO and FOR statements.

Unit - III

Class – Objects - methods– inheritance – arrays – strings – interfaces – packages - exception handling.

Unit - IV

Applet - introduction-building applet code-Designing a web page- Applet tag- Applet to HTML file-Graphics class-lines & rectangles-Drawing bar charts.

Unit - V

Java programming: using class and objects-sum of the series, mean and standard deviation, sum of the digits, sorting strings, Fibonacci series, correlation coefficient. Simple programs using exception handling, inheritance, packages, try-catch & multiple inheritance. Using Applet - displaying given messages, drawing given shapes.

BOOKS FOR STUDY:

1. Muthu, C. (2001) Programming with JAVA, Thomson Asia Pvt. Ltd, Singapore.
2. Balagurusamy, E. (2001) Programming with Java- A Primer, (2nd Edition). Tata McGraw Hill, New Delhi.
3. Patrick Naughton & Herbert Schildt (1999). The Complete Reference Java. Tata McGraw Hill, New Delhi.

STATISTICAL ANALYSIS USING SOFTWARE - II (SBS)

The following exercises should be carried out using statistical software.

Unit – I

- Formation of discrete and continuous frequency distributions.
- Construction of diagrams – simple bar, multiple bar, pie diagram, histogram and scatter diagram.
- Construction of plots – Box – Whisker plot, normal probability plot.

Unit – II

- Computation of measures of central tendency – mean, median, mode, quartile, percentile.
- Computation of measures of dispersion – range, standard deviation, quartile deviation, co-efficient of variation, co-efficient of skewness, co-efficient of kurtosis.

Unit – III

- Calculation of co-efficients of correlation – simple linear (Karl Pearson) and Spearman's rank.
- Calculation of co-efficients of partial and multiple correlations.
- Fitting of linear regression models – two regressors, three regressors.

Unit – IV

- Testing equality of means (two sample problems) – two – sample t test, paired t test.
- Cross tabulations.
- Testing the independence of two attributes.
- Carryingout ANOVA – one- way classified data, two-way classified data.

Unit – V

- Nonparametric tests for one -sample problems – runs test, sign test, Kolmogorov – Smirnov test, χ^2 – test.
- Nonparametric tests for two -sample problems – median test, Mann-Whitney U test.
- Nonparametric tests for k-sample problems- Kruskal-Wallis H test, Friedman's test.

STATISTICAL INFERENCE - II

Unit - I

Statistical hypotheses- simple and composite hypotheses-null and alternative hypotheses-critical region- two kinds of errors. Randomized and non-randomized tests -most powerful test-Neyman-Pearson lemma- simple problems.

Unit - II

Likelihood ratio test- tests for mean, equality of two means (independent samples), variance and equality of variances of normal populations.

Unit - III

Tests of significance: sampling distribution, standard error. Large sample tests concerning mean(s), variance(s), proportion(s) and correlation coefficient – simple problems.

Unit - IV

Tests of significance: Exact tests based on t, F and chi-square distributions concerning mean(s), variance(s), correlation coefficient(s)- Partial and multiple correlation coefficients. contingency table-test for goodness of fit and test for independence of attributes – simple problems.

Chi-square Tests: Tests for association, independence and goodness of fit.

Unit - V

Non-parametric tests – advantages and disadvantages of nonparametric tests- runs test, Kolmogorov -Smirnov test, sign test, median test, Mann-Whitney U test, and Wilcoxon's signed -rank test –simple problems and applications.

BOOKS FOR STUDY:

1. Alexander M. Mood, Franklin A. Graybill, and Duane C. Boes (1974) Introduction to the Theory of Statistics (Third Edition), Mc Graw Hill Co., Ltd., New York.
2. Robert V. Hogg, Allen T. Craig (2012) Introduction to Mathematical Statistics (Fourth Edition), Macmillan Publishing Co., Inc., New York.
3. Goon, A. M., M.K. Gupta, and B. Dasgupta (2002) Fundamentals of Statistics, Vol. I, (Third Edition), World press Ltd, Kolkata.
4. Harold J. Larson (1982) Introduction to Probability Theory and Statistical Inference (Third Edition), John wiley & sons.Inc., New York.
5. Gupta, S.C., and V. K. Kapoor (1992) Fundamentals of Mathematical Statistics, A Modern Approach (Eighth Edition). Sultan Chand & sons, New Delhi.
6. Rice, J.A. (2007) Mathematical Statistics & Data Analysis (Third Edition), Thomas Brooks/colt, Singapore.
7. Edward J. Dudewicz, and Satya N. Mishra (1988) Modern Mathematical Statistics, John Wiley & Sons. Inc., New York.
8. Rohatgi, V. K. and A. K. md. Ehsanes Saleh (2009) An Introduction to Probability Theory and Mathematical Statistics, 2nd Edition, Wiley Eastern Limited, New Delhi.
9. Parimal Mukopadhyay (2006) Mathematical Statistics (Third Edition), Books and Allied Private Limited, Kolkata.

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DESIGN OF EXPERIMENTS

Unit - I

Fundamental principles of experiments – randomization, replication and local control. Size of experimental units. Analysis of variance- one-way and two-way classifications.

Unit - II

Analysis of Variance and Basic Designs: Concept of Cochran's Theorem. One-way and Two-way analysis of variance. Completely randomized design(CRD)- Randomized block design(RBD) - Latin square design(LSD) and their analysis - Missing plot techniques in RBD and LSD.

Unit - III

Post ANOVA Tests: Multiple range test; Newman-Keul's test-Duncan's multiple range test-Tukey's test. Analysis of Covariance technique for RBD with one concomitant variable.

Unit - IV

Factorial experiments: 2^2 , 2^3 and 2^n factorial experiments. Definitions and their analyses.

Unit - V

Principles of confounding –partial and complete confounding in 2^3 – balanced incomplete block design(BIBD)– parametric relationship of BIBD.

BOOKS FOR STUDY:

1. Das, M.N. and Giri,N.C. (1988) Design and Analysis of Experiments(2^{nd} Edition). New Age International, New Delhi.
2. Douglas,C. Montgomery(2012) Design and Analysis of Experiments. John Wiley & sons, New York.
3. Goon A. M., Gupta, S.C. and Dasgupta, (2002)B. Fundamentals of Statistics, Vol.II, World Press, Kolkata.
4. Gupta, S. C. and V. K. Kapoor (1999) Fundamentals of Applied Statistics (Third Edition), Sultan Chand & Sons, New Delhi.
5. Dean, A and Voss (2006) Design and Analysis of Experiments. Springer India Private Limited, New Delhi.

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OPERATIONS RESEARCH

Unit - I

Concepts of Operations Research – Limitations - Linear Programming Problem(LPP) - mathematical formulation of normal form - graphical solution.

Unit – II

Simplex method – Big M method –Two-phase method – dual formulation.

Unit - III

Transportation problem-mathematical formulation- North-West corner rule and Vogel's rule-MODI method - Assignment problem - Hungarian method.

Unit - IV

Game theory: Maximin and Minimax criterion - saddle points-2 × 2 Games without saddle point-Dominance rule based on graphical method for (2×n) and (m×2) games.

Unit - V

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

BOOKS FOR STUDY:

1. Goel, B.S. and Mittal, S.K. (2000) Operations Research, Pragati Prakashan, Meerut.
2. Gupta, R.K. (1985) Operations Research, Krishna Prakashan, Mandir, Meerut.
3. Hillier, F.S and Lieberman, G. J. (1998) Operations Research, CBS Publishers and Distributors, New Delhi.
4. Kanti Swarup, Gupta, P.K. and Man Mohan (2008) Operations Research (3rd Edition). Sultan Chand & Co, New Delhi.
5. Kapoor, V.K. (2001), Operations Research, Sultan Chandan & Sons, New Delhi.
6. Sharma, J.K. (2001) Operations Research. Theory and applications, Macmillan, New Delhi.
7. Sharma J.K. (2002) Operations Research. Problems and solutions, Macmillan, New Delhi.
8. Taha, H.A. (2007) Operations Research – An Introduction (8th Edition) Prentice Hall of India, New Delhi.
9. Taha, H.A. (1996) Operations Research, 6/e, Prentice Hall, New Delhi

DISCRETE MATHEMATICS

Unit - I

Sets and Relations: Introduction - Sets – Ordered pairs – Operations on Sets - Introduction to Relations – Binary relation – Classification of Relations – Composition of Relations –Inverse of Relation.

Unit - II

Functions: Introduction to Functions – Addition and Multiplication of Functions - Classifications of Functions – Composition of Function – Inverse Function.

Unit - III

Mathematical Logic: Introduction – Statement (Propositions)- Laws of Formal Logic-Basic Set of Logical operators/operations - Propositions and Truth Tables – Tautologies and Contradictions – Logical Equivalence – Logical Implication.

Unit - IV

Matrix Algebra: Introduction – Operations on Matrices – Symmetric and Skew-symmetric Matrices – Conjugate of a Matrix – Determinant of a Matrix – Adjoint and Inverse of a Matrix – Singular and Non-singular Matrices - Inverse of Matrices.

Unit - V

Graph: Introduction – Graph and Basic Terminologies – Types of Graphs – Sub Graph – Representation of Graph – Tree.

BOOKS FOR STUDY:

1. Swapan Kumar Chakraborty and Bikash Kanti Sarkar (2014), Discrete Mathematics, oxford university press, UK.
2. Glory Ratna Mary and Y. S. Irine Viola, Mathematical foundations for computer science – part 1, Shekina publications.
3. Seymour Lipschutz and Marc Lars Lipson (2010), Discrete mathematics, third edition, Tata Mcgraw Hill education private limited, New Delhi.

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. RDBMS with ORACLE

Unit - I

Data Base Systems - Data models- Data Base Languages - Transaction - Storage Management – Data Base Administrator-Data Base Users - System Structure – Entity - Relationship Model.

Unit - II

Relational Model-Relational Algebra- Tuple and Domain Relational Calculus –extended Relational Algebra Operation-Relational Data Base Design- Decomposition –Normalization.

Unit - III

Oracle Architecture - Hardware Configuration - Logical and physical database layouts-SQL; DML, DCL, DDL Commands.

Unit - IV

Single-Group-Data-Character- Numeric-Conversion-Miscellaneous Functions-Set Operators and Joins-Sub queries-Data Base Objects: Views-Object views –synonyms-sequence and Index.

Unit - V

Introduction to PL/ SQL-Architecture of PL/ SQL Data types -Control Structures - Error handling - Procedures and Functions - Database Triggers.

BOOKS FOR STUDY:

1. Abraham Silberschartz, Henry F. Korth and S. Sudharshan (1997) Database System Concepts (III Edition). McGraw-Hill, New York.
2. George Koch & Kevin Loney (1997) The Complete Reference (Third Edition), Tata McGraw Hill, New Delhi.
3. David McClanahan (1997) Oracle Developers Guide, Tata McGraw Hill Publishing House, New Delhi.
4. Desai, B. C. (1995) An introduction to Database Systems, Galgotia Publications Private Ltd., New Delhi.
5. Steve Bobrowski (1994) Mastering Oracle 7 and Client Server Computing (First Indian Edition) BPB Publications, New Delhi.

MSU/2016-17/B. Sc Statistics/ Semester -VI/ Core Practical – III

STATISTICAL PRACTICAL – III

(The following exercises should be carried out using non-programmable scientific calculator)

Statistical Inference-I

1. Computation of estimates applying method of moments.
2. Computation of estimates applying maximum likelihood method.
3. Construction of confidence interval for mean of normal population when standard deviation is (i) known (ii) unknown.
4. Construction of confidence interval for difference between means of two normal populations i) when variances are known ii) with common unknown variance.
5. Construction of confidence interval for variance of normal populations.
6. Construction of confidence interval for ratio of variances of two normal populations.

Statistical Quality Control

7. Construction of control charts for mean and range (\bar{X} and R charts)
8. Construction of control charts for standard deviation (σ chart)
9. Construction of control charts for fraction defectives (p chart)
10. Construction of control charts for number of defectives (d chart)
11. Construction of control charts for number of defects per unit (c chart)
12. Draw OC, AOQ and ATI curves for single and double sampling plans by attributes.

Statistical Inference-II

13. Calculation of size and power of most powerful tests.
14. Testing the population proportion based on large sample.
15. Testing the equality of two population proportions based on large samples.
16. Testing the mean of normal populations when standard deviation is (i) known (ii) unknown.
17. Testing the equality of means of two normal populations i) when variances are known and ii) with common but unknown variance.
18. Testing the variance of normal population.
19. Testing the homogeneity of variances of two normal populations.
20. Testing the independence of two attributes.
21. Non parametric test for one sample problems – runs test, sign test, Kolmogorov – Smirnov test.
22. Non parametric test for two sample problems – median test, Mann-Whitney U test and Wilcoxon's signed – rank test.

Design of Experiments

23. Carrying out ANOVA for one way classified data.
24. Carrying our ANOVA for two way classified data.
25. Analyzing completely randomized design.
26. Analyzing randomized block design.
27. Analyzing Latin square design.
28. Analyzing 2^2 factorial design.
29. Analyzing 2^3 factorial design.

Operations Research

30. Solving linear programming problem applying graphical method, simplex method.
31. Finding initial basic feasible solution to transportation problem applying methods of North- West corner, row minima, column maxima, matrix minima method, Vogel's Approximation methods.
32. Solving 2 x 2 game with saddle point.
33. Solving 2 x 2 game applying dominance rules.

MSU/2016-17/B. Sc Statistics/ Semester –VI / Core Practical - IV

STATISTICAL PRACTICAL – IV

The exercises in all core subjects from Semester-I to Semester-VI should be carried out using statistical software.

(Objective: Providing knowledge on collection and analysis of the data applying appropriate statistical tools using Statistical Software)
