HINDI MAHAVIDYALAYA

(AUTONOMOUS & NAAC RE-ACCRE DITED)

(Affiliated to Osmania Universi ty)

Nallakunta, Hyderabad-44

BOARD OF STUDIES

DEPARTMENT OF STATIST ICS

(M.Sc. APPLIED STATISTICS)

1ST YEAR

2019-2020

HINDI MAHAVIDYALAYA

(AUTONOMOUS & NAAC RE-ACCREDITED)

(Affiliated to Osmania University)

Nallakunta, Hyderabad-44

DEPARTMENT OF STATISTICS

M.Sc. APPLIED STATISTICS

(BOS – MEETING ON 03-09-2019 at 11 AM)

SYLLABUS, MODEL PAPER

PANEL OF EXAMINERS etc...

For the Academic Year

2019-2020

HINDI MAHAVIDYALAYA

(AUTONOMOUS & NAAC RE-ACCREDITED)

(Affiliated to Osmania University)

Nallakunta, Hyderabad-44

DEPARTMENT OF STATISTICS

M.Sc. APPLIED STATISTICS

SCHEME OF INSTRUCTION

AND

EXAMINATION

(THEORY AND PRACTICALS)

HINDI MAHAVIDYALAYA

(AUTONOMOUS & NAAC RE-ACCREDITED)

BOARD OF STUDIES

DEPARTMENT OF STATISTICS

(M.SC. APPLIED STATISTICS)

Chairperson

Miss Ranjitha Chul
Head-Department of Statistics
Hindi Mahavidyalaya
Nallakunta, Hyderabad

University Nominee

Dr. G. Jayasree
Head
Department of Statistics
Osmania University, Hyderabad

Members of BOS

1. Prof. A. Rajendra Prasad
   Department of Statistics
   Kakatiya University, Warangal.
2. Dr. K. Sampath Kumar
   Asst. Professor
   Department of Statistics
   Telangana University, Nizamabad.
3. Prof. C. Jayalakshmi
   Chairperson, BOS
   Department of Statistics
   Osmania University, Hyderabad.
4. Dr. Venu gopal Rao
   General Manager
   Juxt Smart Mandate, Hyderabad.

Chairperson **University Nominee** **Members** **Principal**

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HINDI MAHAVIDYALAYA

(AUTONOMOUS & NAAC RE-ACCREDITED)

DEPARTMENT OF STATISTICS

(M.SC. APPLIED STATISTICS)

COMPOSITION: DEPARTMENT OF STATISTICS

1. Head of the department concerned (Chairman)
   Miss Ranjitha Chul-Department of Statistics
   Dr. Mrs. B. SREEDEVI HEAD DEPT OF SCIENCE
2. One expert to be nominated by the vice-chancellor from a panel if six recommended by the College Principal.

   Dr. G. Jayasree-Chairperson, Chairman, BOS, Department of Statistics,
   Osmania University, Hyderabad.

3. Two experts in the subject from outside the college to be nominated by the Academic Council.

   1. Prof. A. Rajendra Prasad-Head, Department of Statistics, Kakatiya University, Warangal.

   2. Dr. K. Sampath Kumar-Asst.Professor, Department of Statistics, Telangana University, Nizamabad.

4. One industry expert in the subject from outside the college to be nominated by the Academic Council.

   a. Dr.M. Venu Gopal Rao-General Manager-Juxt Smart Mandate.

Chairperson	University Nominee	Members	Principal
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HINDI MAHAVIDYALAYA

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BOARD OF STUDIES

DEPARTMENT OF STATISTICS

(M.SC. APPLIED STATISTICS)

AGENDA OF THE MEETING

1.1. Welcome address by the chair.

1.2. Details of choice base credit system.

1.3. Discussion on Common Core Syllabus of Semester I & II.

1.4. Marks allotted for Internal and End Semester exams.

1.5. Discussion on Semester Exam Model Paper & Internal Exam Model Paper of Semester I & II.

1.6. Discussion on Practical Exam Model Paper of Semester I & II.

1.7. Panel of Examiners

1.8. Any other matter

1.9. Vote of Thanks

Chairperson **University Nominee** **Members** **Principal**

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HINDI MAHAVIDYALAYA

(AUTONOMOUS & NAAC RE-ACCREDITED)

BOARD OF STUDIES

DEPARTMENT OF APPLIED STATISTICS

ACADEMIC YEAR – 2019-20

MINUTES OF BOARD OF STUDIES MEETING

BOS meeting of the Department of APPLIED STATISTICS was held on 3rd September 2019 at 11:00 AM.

The following members were present

Miss Ranjitha Chul.	-	Chairperson
Dr. G. Jayasree	-	University Nominee
Prof. C Jayalakshmi	-	Member
Prof. A.Rajendra Prasad	-	Member
Dr. K. Sampath Kumar	-	Member
Dr. Venu Gopal Rao	-	Member

1.1 Welcome address by the chair

The chair welcomed the University Nominee, Ex-officio member BOS, O.U Department of APPLIED STATISTICS and Members of B.O.S.

1.2 Details of choice based credit system.

Members were informed that TSCHE has referred that from the academic year 2016-17 autonomous institutions have to follow CBCS i.e. From the Academic Year 2016-17 Osmania University has instructed all the Degree colleges including Autonomous Degree colleges to follow CBCS under which after passing the exam student will get the Grade in the Final Result. 4 Credits are given for theory paper and 4 credits is given for practical in each semester and 1 Credit for seminar in each subject.

Chairperson **University Nominee** **Members** **Principal**

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Discussion and Distribution of Common Core Syllabus.

i. Members were informed by the chair that Department of APPLIED STATISTICS, Hindi Mahavidyalaya is following common core syllabus prescribed by Osmania University.

ii. We are adopting same syllabus as Osmania University for each semester as it is without any changes.

Syllabus copy for Ist Year both the semesters is enclosed.
Syllabus was approved by the Members of BOS.

1.4 Marks allotted for Internal and End Semester exams (I & II).

1. Internal assessment is of 15 marks. In each semester two internal assessments of 15 Marks will be conducted and an average of both the internal assessments will be added in the marks of theory exam and one assignment is of 5 Marks, total of 20 Marks.
2. Theory Question paper is of 80 marks.
3. Total allotted marks are 100.

The distribution of marks was approved by the Members of BOS.

1.5 Discussion on Pattern and Model Paper of Semester exam and Model Paper of Internal Exam

1. Each Semester Two Internal exams will be conducted for 15 marks. The internal assessment will have three sections.

Section – A 10 Multiple choice questions each carries ½ marks
(10x ½ = 5M),
Section – B 10 Fill in the blanks each carries ½ marks
(10x ½ = 5M) and
Section – C 5 short notes each 1mark (5x1=5)

Average of mark one words answer questions of these two internal exams will be taken.

2. Semester exam will be conducted as per the Almanac which will be provided by the exam branch. Internal exam duration will be 30Mnts and Semester exam duration will be of 3 hrs.
3. Model Question paper for Semester I and Semester II was discussed. Theory paper for each Semester will have 2 sections.

(i) Section A contains 8 short Questions (2 questions from each unit) . Each Question carries 4 Marks (8X4=32 Marks)

(ii) Section B contains 4 Essay type Questions with internal choice. Each Question carries 12 Marks (4X12=48 Marks)

- Pattern of Model Theory Question Papers for Semester I & II are approved.

Chairperson **University Nominee** **Members** **Principal**

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Discussion on Practical Exam Model paper.

- It is decided that the practical examinations held for M.Sc. I years (Semester I & II) will be of 100 marks with 4 credits. The duration of the exam will be 3hrs.
- The practical model papers of Semester I and II (Paper V & VI) were approved by the members of BOS.

1.7 Panel of Examiners

The panel of examiners was approved by the members.

- List is enclosed

1.8 Any other matter.

The syllabus for the batch (2019-20) is also approved by the members. w.e.f. 2019-20.

1.9 Vote of Thanks

Meeting concluded with the Vote of Thanks by Miss Ranjitha Chul

Chairperson	University Nominee	Members	Principal
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HINDI MAHAVIDYALAYA

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(Affiliated to Osmania University)

Nallakunta, Hyderabad-44

DEPARTMENT OF STATISTICS

M.Sc. APPLIED STATISTICS

First Year

With effect from batch of students admitted from the Academic Year

2019-2020

under CBCS semester system

HINDI MAHAVIDYALAYA

(AUTONOMOUS & NAAC RE-ACCREDITED)
(Affiliated to Osmania University)
Nallakunta, Hyderabad-44

DEPARTMENT OF STATISTICS

M.Sc. APPLIED STATISTICS

Semester I

SYLLABUS

HINDI MAHAVIDYALAYA

(AUTONOMOUS & NAAC RE-ACCREDITED), (Affiliated to Osmania University)

Nallakunta, Hyderabad-44

M.SC. APPLIED STATISTICS

Choice Based Credit System(CBCS)

Semester – I

PAPER	SUB. CODE	PAPER TITLE	INSTRUCTION HRS/ WEEK	DURATION OF EXAM (IN HRS)	SEMESTER END EXAMINATION MARKS	CONTINOUS EVALUATION	TOTAL MARKS	CREDITS
						IA AND ASSIGN.		
THEORY								
I	MS101	LINEAR ALGEBRA AND LINEAR MODELS (LA AND LM)	4	3	80	20	100	4
II	MS102	PROBABILITY THEORY (PT)	4	3	80	20	100	4
III	MS103	DISTRIBUTION THEORY AND ESTIMATION THEORY (DT AND ET)	4	3	80	20	100	4
IV	MS104	SAMPLING THEORY AND SURVEYS (ST)	4	3	80	20	100	4
PRACTICALS								
V	MS105	Statistical methods using Python Programming	9	3	100	***	100	4
VI	MS106	Linear Algebra,Linear Models, Distribution Theory,Estimation Theory and Sampling Theory and surveys (LA, LM, DT, ET, ST)	9	3	100	***	100	4
VII	SEMINAR		2		20	5	25	1
Total			36	***	540	85	625	25
Semester Total					625			

Chairperson

University Nominee

Members

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Principal

HINDI MAHAVIDYALAYA

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Nallakunta, Hyderabad-44

M.SC. APPLIED STATISTICS

Choice Based Credit System(CBCS)

Semester – II

PAPER	SUB. CODE	PAPER TITLE	INSTRUCTION HRS/ WEEK	DURATION OF EXAM (IN HRS)	SEMESTER END EXAMINATION MARKS	CONTINOUS EVALUATION	TOTAL MARKS	CREDITS
						IA AND ASSIGN.		
THEORY								
I	MS201	Statistical Inference (SI)	4	3	80	20	100	4
II	MS202	Applied Regression Analysis (ARA)	4	3	80	20	100	4
III	MS203	Multivariate Data Analysis (MDA)	4	3	80	20	100	4
IV	MS204	Design of Experiments (DOE)	4	3	80	20	100	4
PRACTICALS								
V	MS205	Statistical Inference and Applied Regression Analysis (SI, ARA)	9	3	100	***	100	4
VI	MS206	Multivariate Data Analysis and Design of Experiments (MDA, DOE)	9	3	100	***	100	4
VII	SEMINAR		2		20	5	25	1
Total			36	***	540	85	625	25
Semester Total					625			

Chairperson **University Nominee** **Members** **Principal**

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HINDI MAHAVIDYALAYA, NALLAKUNTA, HYDERABAD
(AUTONOMOUS)
BOS-DEPARTMENT OF STATISTICS

M.SC. APPLIED STATISTICS

MS 101 **SEMESTER – I**

Credits:4

PAPER – I : LINEAR ALGEBRA AND LINEAR MODELS (LA AND LM)

Objective: Linear algebra is central to almost all areas of mathematics & used in most sciences & engineering areas as it allows modeling many natural phenomena & efficiently computing with such models.

UNIT – I

Vector Spaces with an inner product, Gram –Schmidt orthogonalization process.Orthonormal basis and orthogonal projection of a vector. Moore penrose and generalized inverses and their properties. Solution of matrix equations. Sufficient conditions for the existence of homogeneous and non – homogeneous linear equations.

UNIT–II

Characteristic roots and vectors, Caley–Hamilton theorem algebraic and geometric multiplicity of a characteristic root and spectral decomposition of a real symmetric matrix. Real quadratic forms, reduction and classification of quadratic forms, Index and signature. Simultaneous reduction of two quadratic forms, Extreme of a quadratic form. Matrix Inequalities: Cauchy- Schwartz and Hadamard Inequalities.

UNIT – III

Formulation of a linear model through examples: Estimability of a linear parametric function. Guass-Markov linear model, BLUE for Linear functions of parameters, relationship between BLUEs and linear Zero-functions. Gauss Markov theorem, Aitkens generalized least squares. Concept of Multicollinearity.

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(AUTONOMOUS)
BOS-DEPARTMENT OF STATISTICS

M.SC. APPLIED STATISTICS

Code: MS 101 **SEMESTER – I**

Credits:4

PAPER – I : LINEAR ALGEBRA AND LINEAR MODELS (LA AND LM)

UNIT – IV

Simple Linear regression – precision of the estimated regression, examining the regression equation - lack of fit and pure error. Analysis of multiple regression model, estimation and testing of regression parameters, Sub-hypothesis. Testing a general linear hypothesis, Multiple and partial correlations - derivation and testing. Use of dummy variables in multiple regression. Polynomial regression- Use of orthogonal polynomials

REFERENCES

1. Graybill, F.A. (1983) : Matrices with applications in Statistics, 2nd ed., Wards worth.
2. Searle, S.R.(1982) : Matrix Algebra useful for Statistics, John Wiley & Sons.
3. Rao, C.R. and Mithra, S.K.(1971) : Generalized inverse of matrices and its applications, John Wiley & Sons.
4. Rao, A.R. and Bhimasankaram,P.(1992):Linear Algebra, Tata McGraw Hill Publishing Co. Ltd.
5. Draper and Smith:Applied Regression Analysis ,John Wiley
6. Montgomery :Introduction to Linear Regression Analysis .John Wiley.
7. Searle, S.R.(1982) : Linear models, John Wiley & Sons.
8. Kshirsagar.A.M. (1972) : A Course in Linear Models.

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M. Venu

K. Gangadhar

HINDI MAHAVIDYALAYA, NALLAKUNTA, HYDERABAD
(AUTONOMOUS)
BOS-DEPARTMENT OF STATISTICS

M.SC. APPLIED STATISTICS

Code: MS 102 | **SEMESTER – I** | **Credits:4**

PAPER – II : PROBABILITY THEORY (PT)

Objective: *Probability theory is essential to many human activities that involve quantitative analysis of data, methods of probability theory also apply to descriptions of complex systems given only partial knowledge of their state as in statistical mechanics .*

UNIT – I

Review axiomatic approach to Probability, Probability as a measure, conditional probability (and Baye's Theorem). Random Variable, distribution function and its properties. Riemann – Stieltjes integration, Statement of properties of Riemann – Stieltjes integrals, Examples. Expectations of functions of random variables – moments. Conditional expectation and conditional variances, applications (A list model, random graph, uniform priors, Polyas' urn model and Bose-Einstein distribution, mean time for patterns, the compound Poisson identity, the k-record values of discrete random variables).

UNIT – II

Characteristic function and its properties, Uniqueness theorem and Inversion theorem, examples. (Functions which can not be Characteristic functions). Statement of Levy's continuity theorem. Probability and moment inequalities : Chebychev's, Markov, Cauchy-Schwartz, Holder, Minkowsky, Liapunov and Jensen Inequalities.

UNIT – III

Sequence of random variables – Borel-Cantelli Lemma; Borel 0-1 law. Convergence of sequence of random variables – convergence in law; convergence in probability; convergence in quadratic mean; convergence with probability one (almost sure convergence); Their implications and/or counter implications; Slutzky's theorem and its applications. Statement of Glivenko- Cantelli lemma.

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(AUTONOMOUS)
BOS-DEPARTMENT OF STATISTICS

M.SC. APPLIED STATISTICS

Code: MS 102 **SEMESTER – I**

Credits:4

PAPER – II : PROBABILITY THEORY (PT)

UNIT – IV

Weak law of large numbers – Bernoulli and Khintchine's WLLNs. Kolmogorov inequality. Strong law of large numbers – Borel's SLLNs. Kolmogorov's SLLNs for independent random variables and i.i.d. random variables, examples. Central Limit Theorem – Demoviere-Laplace form of CLT, Levy-Lindeberg form of CLT, Liapunov's form of CLT and Statement of Lindberg – Feller form of CLT – examples.

REFERENCES

1. Bhat, B.R. (1985) : Modern Probability Theory – Wiley Eastern.
2. Rohatgi, V.K. (1993): An Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern.
3. Ross, S.M (2004) : Introduction to Probability Models, 8th Edition (Chapter 3) – Academic Press
4. Chandra, T.K. and Chatterji D (2001) : A First Course in Probability, Narosa Publishing House
5. Milton and Arnold – Introduction to probability and Statistics (4th Edition)-TMH publication.

ADDITIONAL REFERENCE

1. 1. Karlin, S and Taylor, S.J. (1975) : A First course in Stochastic Processes, Academic Press.

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BOS-DEPARTMENT OF STATISTICS

M.SC. APPLIED STATISTICS

Code: MS 103

SEMESTER – I
Credits:4

PAPER – III : DISTRIBUTION THEORY AND ESTIMATION THEORY
(DT AND ET)

Objective: *Estimation theory deals with estimating the values of parameters based on measured empirical data that has random component. It approximates unknown parameters using the measurements . Distribution theory provides students with the foundation of probabilistic & statistical analysis mostly used in varied applications in engineering and science.*

UNIT – I

Cauchy, Lognormal, Weibull, Pareto, Laplace distributions and their properties. Compound distributions (Binomial and Poisson only). Truncated distributions (Poisson, Exponential and Normal distributions). Mixture Distributions. Bivariate Normal distribution.

UNIT – II

Functions of random variables and their distributions using Jacobian of transformations and Characteristic function. Sampling Distributions of Sample mean and variance, independence of X and S^2. Central t, F and ⍰^{2} distributions and their properties. Non-central ⍰^{2}, t and F distributions and their properties (Statements only). Distributions of Quadratic forms under normality. Joint and Marginal Distributions of order statistics. Distributions of sample range.

UNIT – III

Concepts of point estimation – Criterion for good estimator, MVUE, Fisher's information, Cramer-Rao lower bound and its applications. Rao–Blackwell theorem, completeness, Lehmann– Scheff's theorem. Estimation of bias and standard deviation of point estimation by the Jackknife and Bootstrap methods with examples.

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M.SC. APPLIED STATISTICS

Code: MS 103 **SEMESTER – I**

Credits:4

PAPER – III : DISTRIBUTION THEORY AND ESTIMATION THEORY (DT AND ET)

UNIT – IV

Method of moments, MLE and its properties (statements only). Consistency and asymptotic **normality** of the consistent solutions of likelihood equations. Definition of CAN and BAN estimators **and** their properties, related examples, Concepts of loss, risk and decision functions, admissible and **optimal** decision functions, estimation and testing viewed as decision problems, apriori, aposteriori distributions, conjugate families, Baye's and minimax decision functions with applications to estimation with quadratic loss.

REFERENCES

1. Rohatgi,V.K. (1984) : An Introduction to Probability theory and Mathematical Statistics, Wiley Eastern.
2. Dudewicz,E.J. and Mishra,S.N. (1988) : Modern Mathematical Statistics, Wiley International, Students Edition.
3. Parimal Mukhopadhya: Mathematical Statistics.
4. Milton and Arnold – Introduction to probability and Statistics (4th Edition)-TMH publication.

ADDITIONAL REFERENCES

1. Ferguson, T.S. (1967) : Mathematical Statistics, A decision theoretic approach, Academic Press.
2. Rao,C.R.(1973) : Linear Statistical Inference and its applications,2/e, Wiley Eastern.
3. Johnson,S. and Kotz (1972) : Distribution in Statistics, Vol. I,II and III.
4. Lehman, E.L. (1983) : Theory of Point Estimation, John Wiley and Sons.

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BOS-DEPARTMENT OF STATISTICS

M.SC. APPLIED STATISTICS

Code: MS 104 **SEMESTER – I**

Credits:4

PAPER – IV : SAMPLING THEORY AND SURVEYS (ST)

UNIT – IV

Planning of Sample Surveys - Methods of data collection, problem of sampling frame, choice of **sampling design**, pilot survey, processing of survey data. Non-sampling errors - Sources and **treatment** of non-sampling errors. Non – sampling bias and variance.

REFERENCES

1. Parimal Mukhopadhyay (1998) : Theory and methods of Survey sampling, Prentice – Hall of India, New Delhi.
2. Cochran, W.C. (1977) : Sampling Techniques, Third Edition, Wiley Eastern.
3. Daroga Singh and Chowdary (1986) : Theory and Analysis of Sample Survey Designs – Wiley Eastern Ltd.

ADDITIONAL REFERENCES

1. Des Raj (1976) : Sampling Theory, Tata McGraw Hill, New Delhi.
2. Sukhatme et. Al (1984): Sampling Survey methods and its applications, Indian society of Agricultural Statistics.
3. Murthy, M.N. (1967) : Sampling theory, Tata McGraw Hill, New Delhi.

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BOS-DEPARTMENT OF STATISTICS

M.SC. APPLIED STATISTICS

Code: MS 105

SEMESTER – I

Credits:4

PAPER – V : PRACTICAL – I
STATISTICAL METHODS USING PYTHON PROGRAMMING

Objective: *To be able to write programs that use lists to manage a collection of information.*

Concepts to be covered: Introduction to Python Programming, Input, Processing and Output, Displaying Output with the Print Function, Comments, Variables, Reading Input from the Keyboard, Performing Calculations Operators. Type conversions, Expressions; *Decision Structures and Boolean Logic*: if, if-else, if-elif-else Statements, Nested Decision Structures, Comparing Strings, Logical Operators, Boolean Variables; *Repetition Structures*: recursion and non recursion, while loop, for loop, calculating a Running Total, Input Validation Loops, Nested Loops; Python-syntax, statements, functions, Built-in-functions and Methods, Modules in Python, Exception Handling. *Functions*: Defining and Calling a Void Function, Designing a Program to Use Functions, Local Variables, Passing Arguments to Functions, Global Variables and Global Constants, Value-Returning Functions, Generating Random Numbers, Writing Our Own Value- Returning Functions, The math Module, Storing Functions in Modules. *File and Exceptions*: Introduction to File Input and Output, Using Loops to Process Files, Processing Records, Exceptions. Finding Items in Lists with in-Operator, List Methods and Useful Built-in Functions, Copying Lists, Processing Lists, Two-Dimensional Lists, tuples. Strings: Basic String Operations, String Slicing, Testing, Searching, and Manipulating Strings **(25% weight for Theory).**

List of practical's using Python Programming: (75% weight for practical implementation)

1. Program to examine the given number is a prime number or not.
2. Program to find the Factorial of positive integer.
3. Program to find the largest among the given three numbers.
4. Program to generate Fibonacci sequence up to given number n.
5. Program for finding the roots of a quadratic equation.
6. Program to construct a Pascal Triangle.
7. Program to find the value of e^x, Sin x and Cos x using series expansion
8. Program to find the sum of two matrices $[A]_{mxp}$ and $[B]_{mxp}$
9. Program to find the product of two matrices $[A]_{mxp}$ and $[B]_{pxr}$.
10. Program to sort the given set of numbers using bubble sort and finding median.

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		K. Ganapathi Rao M. Venu	G. Jayasree. 3/9/19

HINDI MAHAVIDYALAYA, NALLAKUNTA, HYDERABAD
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BOS-DEPARTMENT OF STATISTICS

M.SC. APPLIED STATISTICS

Code: MS 105

SEMESTER – I

Credits:4

PAPER – V : PRACTICAL – I
STATISTICAL METHODS USING PYTHON PROGRAMMING

11. Program with a function that accepts a string as an argument and returns the no. of vowels that the string contains. Another function to return number of consonants.
12. Program that opens specified text file and then displays list of all unique words found in the file.
13. Program to find the Median, Mode for the given of array of elements.
14. Program to find the first four Central & Non-central moments to the given array of elements.
15. Program to generate random numbers from Uniform, Binomial, Poisson, Normal, Exponential.
16. Program for preparation of frequency tables and computing mean, median, mode, variance and standard deviation of the frequency distribution.
17. Program to Fitting of Binomial distribution for the given frequency distribution (recursive)
18. Program to Fitting of Poisson distribution for the given frequency distribution (recursive)
19. Program to Fitting of Negative Binomial distribution for the given frequency distribution (recursive).
20. Program to Fitting of Exponential Distribution for the given frequency distribution(recursive)
21. Program for finding the Correlation and regression lines for the given bivariate data.
22. Solution to simultaneous equations by Gauss - Siedal method (minimum 3 variables)

References:

1. Tony Gaddis, Starting Out With Python (3e)
1. Kenneth A. Lambert, Fundamentals of Python
2. Clinton W. Brownley, Foundations for Analytics with Python
3. James Payne, Beginning Python using Python 2.6 and Python 3
4. Charles Dierach, Introduction to Computer Science using Python
5. Paul Gries, Practical Programming: An Introduction to Computer Science using Python 3

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HINDI MAHAVIDYALAYA, NALLAKUNTA, HYDERABAD
(AUTONOMOUS)
BOS-DEPARTMENT OF STATISTICS

M.SC. APPLIED STATISTICS

Code: MS 106

SEMESTER – I

Credits:4

PAPER – VI : PRACTICAL – II(LA, LM, DT, ET, ST)

PRACTICALS IN LINEAR ALGEBRA, LINEAR MODELS, DISTRIBUTION THEORY, ESTIMATION AND SAMPLING

LINEAR ALGEBRA

1. Inverse of a matrix by partition method.
2. Solutions of linear equations by sweep-out method.
3. Computation of Moore-Penrose inverse by Penrose method.
4. Computation of Generalized inverse of a matrix.
5. Formation of characteristic equation by using traces of successive powers.
6. Spectral decomposition of a square matrix of third order.

LINEAR MODELS

1. Fitting of a simple linear regression model - Computation of Pure error and lack of fit.
2. Fitting of Multiple Regression models with Two and Three Independent variables. and testing of regression parameters
3. Computation and Testing of Multiple Correlation coefficient.
4. Computation and Testing of Partial Correlation Coefficients.

DISTRIBUTION THEORY AND ESTIMATION

1. Distributions: Fitting of
   - (i) Lognormal
   - (ii) Weibull
   - (iii) Cauchy
   - (iv) Gamma with parameters

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BOS-DEPARTMENT OF STATISTICS

M.SC. APPLIED STATISTICS

Code: MS 106

SEMESTER – I

Credits:4

PAPER – VI : PRACTICAL – I (LA, LM, DT, ET, ST)

PRACTICALS IN LINEAR ALGEBRA, LINEAR MODELS, DISTRIBUTION THEORY, ESTIMATION AND SAMPLING

2. **Estimation:**
   a. Computation Jackknife estimator
   b. Computation of Bootstrap estimator
   c. Method of MLE (Scoring Method)
   d. Computation of Bayes estimator (Binomial)

SAMPLING THEORY

1. PPS sampling with and without replacements.
2. Ratio estimators in SRS , comparison with SRS
3. Separate and combined ratio estimators, Comparison.
4. Regression estimators in SRS, Comparison with SRS and Ratio estimators
5. Separate and combined Regression estimators, Comparison.
6. Cluster sampling with equal cluster sizes.
7. Sub sampling (Two–stage sampling) with equal first stage units.

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HINDI MAHAVIDYALAYA

(AUTONOMOUS & NAAC RE-ACCREDITED)

(Affiliated to Osmania University)

Nallakunta, Hyderabad-44

DEPARTMENT OF STATISTICS

M.Sc. APPLIED STATISTICS

Semester II

SYLLABUS

HINDI MAHAVIDYALAYA, NALLAKUNTA, HYDERABAD
(AUTONOMOUS)
BOS-DEPARTMENT OF STATISTICS

M.SC. APPLIED STATISTICS

Code: MS 201

SEMESTER – I

Credits:4

PAPER – I : STATISTICAL INFERENCE (SI)

Objective: It develops a process of using data analysis to deduce properties of an underlying probability distribution. It infers properties of a population.

UNIT – I

Concepts of Hypothesis, Types of errors, Statistical test, critical region, test functions, randomized and non–randomized tests. Concepts of MP and UMP tests, Neymann – Pearson lemma and its applications to one parameter exponential family of distributions.

UNIT – II

Concepts of unbiased and consistent tests. Likelihood Ratio Criterion with simple applications (including homogeneity of variances). Statements of asymptotic properties of LR test. Confidence Intervals (based on fixed sample size and distributions for the parameters of Normal, exponential, Binomial, Poisson distributions). Relationship between confidence intervals and hypothesis testing. The concept of robustness in testing.

UNIT – III

Concepts of non – parametric estimation. Non- parametric methods for one-sample problems based on Run test and Kolmogorov – Smirnov test. Wilcoxon Signed rank test for one sample and paired samples. Two sample problems based on Wilcoxon Mann Whitney test. Kolmogorov test (expectation and variances of above test statistics except for Kolmogorov – Smirnov test). Statements about their exact and asymptotic distributions, Wald Wolfowitz Runs test and Normal scores test. Kendall's Tau, Ansari – Bradley test for two-sample dispersion, Kruskal – Wallis test for one – way layout. (k-samples). Friedman test for two-way layout (randomized block).

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BOS-DEPARTMENT OF STATISTICS

M.SC. APPLIED STATISTICS

Code: MS 201 **SEMESTER – II**

Credits:4

PAPER – I : STATISTICAL INFERENCE (SI)

UNIT – IV

Notions of sequential vs. fixed sample size techniques. Wald's sequential probability Ratio Test (SPRT) for testing Simple null Hypothesis vs. simple alternative. Termination property of SPRT. SPRT procedures for Binomial, Poisson, Normal and exponential distributions and associated OC and ASN functions. Statement of optimality properties of SPRT.

REFERENCES

1. Rohatgi, V.K.: An Introduction to Probability Theory and Mathematical Statistics (Wiley Eastern)
2. Gibbons : Non Parametric Statistical Inference,(Tata Mc Graw Hill)
3. Myles Hooander and Douglas A. Wolfe – Non parametric Statistical methods (John Wiley and sons)
4. Wald,A. : Sequential Analysis (Dover Publications)
5. Milton and Arnold – Introduction to probability and Statistics (4th Edition)-TMH publication.
6. Lehman, E. L. : Testing of hypothesis, John Wiey
7. Goon, Gupta and Das Gupta : Outlines of Statistics, Vol. II, World Press.

ADDITIONAL REFERENCES

1. C.R. Rao – Linear Statistical Inference (John Wiley)
2. W.J. Conovar – Practical Non parametric Statistics (John Wiley)

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BOS-DEPARTMENT OF STATISTICS

M.SC. APPLIED STATISTICS

Code: MS 202 **SEMESTER – II**

Credits:4

PAPER – II : APPLIED REGRESSION ANALYSIS (ARA)

Objective: It is used to infer casual relationships between the independent & dependent variables & explore them.

Unit-I

Review of the general regression situation, extra sum of squares principle, orthogonal columns in the X–matrix, partial and sequential F-tests. Bias in regression estimates. Weighted least squares. Introduction to examination of residuals, overall plot, time sequence plot, plot against Y_i, predictor variables X_{ij} .Correlations and serial correlations among the residuals, Durbin Watson Test. Concept of outliers, Detecting of outliers, standardized residuals. Testing of outliers in linear models.

UNIT – II

Introduction of selecting the best regression equation, all possible regressions: backward, stepwise regression procedures. Variations on these methods. Stagewise regression procedures. Polynomial regression–use of orthogonal Polynomials. Ridge regression: Introduction, basic form of ridge regression, ridge regression on a selection procedure. Robust regression: Introduction, Least absolute deviation regression(L_1-regression),M- Estimation Procedure, Least Median squares regression, ranked residuals regression(RREG).

UNIT – III

Logistic regression model – Introduction, Fitting the Logistic regression model, testing for the significance of the coefficients, Introduction to multiple Logistic regression, the multiple Logistic regression models, fitting the multiple logistic regression model, testing for the significance of the model. Interpretation of the fitted Logistic regression model – Introduction, Dichotomous independent variable. Probit Analysis: Introduction, Analysis of Biological data, sigmoid curve, fitting a Probit Regression line through least squares method.

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M.SC. APPLIED STATISTICS

Code: MS 202

SEMESTER – II

Credits:4

PAPER – II : APPLIED REGRESSION ANALYSIS (ARA)

UNIT – IV

Non-linear regression – Introduction to non-linear regression model, some commonly used families of non-linear regression functions, statistical assumptions and inferences for non- linear regression, linearizable models, determining the Least squares estimates, The Gauss – Newton method, ML estimation, (D and S), Statements of asymptotic properties, Non–linear growth models – Types of models – the Logistic model, the Gompertz model.

REFERENCES

1. Draper and Smith: Applied Regression Analysis- John Wiley
2. Dennis Cook. R and Sanford Weisberg (1999) Applied Regression Including Computing and Graphics – John Wiley
3. Galton: Applied Regression Analysis
4. Regression Analysis: Concepts and Applications, Franklin A. Graybill and Hariharan K. Iyer
5. Applied Regression Analysis, linear models and related methods: John Fox
6. Non–linear Regression Analysis and its Applications: Douglas M. Bates and Donald G. Watts
7. Applied Logistic Regression: David W. Hosme and Stanley Lemeshow.
8. Linear Models for unbalanced Data: Shayler Searle
9. Residuals and Influence in Regression: R. Dennis Cook and Sanford Weisberg
10. Log–linear models and Logistic Regression: Ronald Christensen.

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M.SC. APPLIED STATISTICS

Code: MS 203 | **SEMESTER – II** | **Credits:4**

PAPER – III : MULTIVARIATE DATA ANALYSIS (MDA)

Objective: The techniques allow researchers to look at relationships between variables in an overarching way and to quantity the relationship between them.

Unit-I

Concept of Bivariate and multivariate random variables, concept of random vector, its expectation, and variance-covariance matrix, marginal and joint distributions, stochastic independence of random vectors, conditional distributions. Multinomial Distribution and its properties (Marginal, Conditional, MGF, Ch.F, Correlation), Multivariate normal distributions and its properties (Marginal, Conditional, MGF, Ch.F, Correlation), Distribution of sample mean vector, Independence of sample mean vector and sample variance-covariance matrix, Maximum likelihood estimates of parameters (Mean vector and covariance matrix).

UNIT – II

Sample dispersion matrix, statement of Wishart distribution and its simple properties; Wilk's Λ criterion and its distribution, statements of its properties; Hotelling's T^2 statistic, Null distribution of Hotellings' T^2 and Applications of Hotelling T^2 Statistic (single and two sample mean vector cases), Mahalanobis D^2 statistic,

UNIT - III

Concepts of Discriminant analysis, Computation of linear discriminant function using likelihood ratios based on Multivariate normal populations and Fisher's Linear Disciminent Function, Bayes Mis-classification, Relationship between Discriminant function and Mahalanobis D^2 statistic. Path analysis and computation of path coefficients. Correspondence analysis. Introduction to multidimensional scaling, some related theoretical results, similarities, metric and non-metric multidimensional scaling methods.

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M.SC. APPLIED STATISTICS

Code: MS 203

SEMESTER – II

Credits:4

PAPER – III: MULTIVARIATE DATA ANALYSIS (MDA)

UNIT – IV

Principal component analysis: Introduction, Derivation of Principal components and statements of its properties; Factor analysis: Introduction, simple factor model, Orthogonal factor model construction. Canonical variables and canonical correlations, Cluster analysis: Introduction, similarities and dissimilarities, Single, Complete and average linkage methods.

REFERENCES

1. Johnson, R.A, and Dean W. Wichern: Applied Multivariate Statistical Analysis.
2. Morrison, D: An Introduction to Multivariate Analysis.
3. Seber : Multivariate Observations
4. Anderson: An Introduction to Multivariate Analysis.
5. Bishop: Analysis of Categorical data.

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M.SC. APPLIED STATISTICS

e: MS 204 **SEMESTER – II**

Credits:4

PAPER – IV: DESIGN OF EXPERIMENTS (DOE)

Objective: It is a systematic method to determine the relationship between factors affecting a process and the output of the process implying cause-and-effect relationships.

Outcomes: This information is needed to manages process inputs in order to optimize the output.

UNIT – I

Analysis of co-variance: one–way and two–way classifications. Estimation of main effects, interactions and analysis of 2^k factorial experiment in general with particular reference to k = 2,3 and 4 and 3^2 factorial experiments. Multiple comparisons, Fisher Least Significance Difference (L.S.D) test and Duncan's Multiple range test (DMRT).

UNIT – II

Total and partial confounding in case of 2^3, 2^4 and 3^2 factorial designs. Concept of Balanced partial confounding. Fractional replications of factorial designs – one-half replication of 2^3 & 2^4 design, one-quarter replication of 2^5 and 2^6 designs. Resolution of a design, Split – plot design.

UNIT – III

Balanced incomplete block design (BIBD) – parametric relations, intra-block analysis, recovery of inter-block information. Partially balanced incomplete block design with two associate classes PBIBD (2) – Parametric relations, intra block analysis. Simple lattice design and Youden-square design.

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de: MS 204 **SEMESTER – II**

Credits:4

PAPER – IV: DESIGN OF EXPERIMENTS (DOE)

UNIT – IV

Concept of Response surface methodology (RSM), the method of steepest ascent. Response surface designs. Design for fitting first – order and second – order models. Variance of estimated response. Second order rotatable designs (SORD), Central composite designs(CCD): Role of CCD as an alternative to 3^k design, Notatability of CCD.

REFERENCES

1. Das, M.N. and Giri,N.: Design and Analysis of Experiments, Wiley Eastern.
2. Montogomery, D.C. : Design and Analysis of Experiments, JohnWiley.
3. Draper and Smith : Applied Regression Analysis, John Wiley.
4. Parimal Mukhopadhyay : Applied Statistics, New Central BookAgency.

ADDITIONAL REFERENCES

1. Cochran and Cox : Experimental designs, John Wiley.
2. Kempthrone : Desing and Analysis of Experiments, John Wiley.
3. Kapoor and Gupta : Applied Statistics, Sultan Chand.
4. Alok Dey : Theory of Block Desings, Wiley Eastern.

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K. Sudhir Kumar

G. Jayasree. 3/9/19

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BOS-DEPARTMENT OF STATISTICS
M.SC. APPLIED STATISTICS

ode: MS 205

SEMESTER – II

Credits:4

PAPER – V: PRACTICALS IN STATISTICAL INFERENCE AND APPLIED REGRESSION ANALYSIS (SI AND ARA)

STATISTICAL INFERENCE

1. Type I and Type II errors
2. MP tests
3. UMP tests
4. L.R. Tests
5. Wilcoxon Signed rank test
6. Wilcoxon Mann-Whitney test
7. Kolmogorov – Smirnov one sample, two sample tests
8. Ansari – Bradley test for two sample dispersion
9. Krusakal Walli's test for one way layout
10. Friedman test for two way layout
11. Normal Scores test
12. Kendall's Tau
13. SPRT procedures for
    (i) Binomial
    (ii) Poisson
    (iii) Normal and computation of their OC function.

APPLIED REGRESSION ANALYSIS

1. Computation of residuals and their plots.
2. Computation and testing of Serial Correlation.
3. Computation of all possible regression for three variables using R2.
4. Probit and Logit analysis
5. Step wise Regression for four variables
6. Forward selection for four variables
7. Backward elimination for four variables

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Code: MS 206

SEMESTER – II

Credits:4

PAPER – VI: PRACTICALS IN MULTIVARIATE DATA ANALYSIS AND DESIGN OF EXPERIMENTS (MDA AND DOE)

MULTIVARIATE DATA ANALYSIS

1. MLE of parameters of multivariate normal distribution.
2. Computation of Hotellings T^2 and Mahalanobis D^2.
3. Computation Path coefficients.
4. Classification between two normal populations by discriminant analysis.
5. Computation of Principle Components.
6. Computation of canonical correlations
7. Estimating the factor loading in single factor model.
8. Computation of single linkage method.
9. Single linkage dendogram for dissimilarity matrix.

DESIGN OF EXPERIMENTS

1. Analysis of 23 and 24 factorial experiments.
2. Analysis of 32 factorial experiment.
3. Analysis of Total and partial confounding of 23 factorial design.
4. Analysis of one-half fraction of 24 design and one-quarter fraction of 25 design.
5. Analysis of Split-plot Design
6. Intra-block analysis of BIBD
7. Intra-block analysis of PBIBD(2)
8. Analysis of Youden-square design
9. Analysis of Simple Lattice design

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HINDI MAHAVIDYALAYA

(AUTONOMOUS & NAAC RE-ACCREDITED)
(Affiliated to Osmania University)
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DEPARTMENT OF STATISTICS
M.Sc. APPLIED STATISTICS
PANEL OF EXAMINERS

SEMESTER I			
Subject With Code	**Name of the Examiner**	**Institution Name**	**Contact No**
LINEAR ALGEBRA AND LINEAR MODELS (LA AND LM) MS 101	Prof. C. Jayalakshmi	Osmania University, Hyderabad	9014751123
	Dr. K. Vani	Osmania University, Hyderabad	9703627050
	Dr. S.A. Jyoti Rani	Osmania University,Hyderabad	9866844679
	[illegible]	[illegible]	9701880796
PROBABILITY THEORY (PT) MS102	Prof. C. Jayalakshmi	Osmania University, Hyderabad	
	Dr. G. Jayasree	Osmania University,Hyderabad	
	Dr. N Ch. Bhatracharyulu	Osmania University,Hyderabad	9553417182
	[illegible]	[illegible]	
DISTRIBUTION THEORY AND ESTIMATION THEORY (DT AND ET) MS 103	Dr. G. Sirisha	Osmania University,Hyderabad	9440929490
	Prof. C. Jayalakshmi	Osmania University, Hyderabad	
	Dr. G. Jayasree	Osmania University,Hyderabad	8501091000
SAMPLING THEORY AND SURVEYS (ST) MS 104	Ms. J.L. Padmashree	Osmania University, Hyderabad	8886375986
	Dr. K. Vani	Osmania University,Hyderabad	
	Dr.M.Raghavender S.[illegible]ma	Osmania University, Hyderabad	7013555496
Practical – I STATISTICAL METHODS USING PYTHON PROGRAMMING, MS 105	Dr. N.Ch.Bhatracharyulu		
	Dr. G. Sirisha		
	Mrs. J.L. Padmashree		
Practical – II (LA, LM, DT, ET, ST) MS106	Dr. K. Vani		
	Dr. G. Sirisha		
	Dr. N.Ch. Bhatracharyulu		

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M.Sc. APPLIED STATISTICS

PANEL OF EXAMINERS

SEMESTER II			
Subject With Code	Name of the Examiner	Institution Name	Contact No
STATISTICAL INFERENCE (SI) MS 201	Dr. G. Jayasree	Osmania University, Hyderabad	
	Prof. C. Jayalakshmi	Osmania University, Hyderabad	
	Dr. K. Vani	Osmania University, Hyderabad	
APPLIED REGRESSION ANALYSIS (ARA) MS202	Prof. C. Jayalakshmi	Osmania University, Hyderabad	
	Dr. N Ch. Bhatracharyulu	Osmania University,Hyderabad	
	Dr. K. Vani	Osmania University,Hyderabad	
	Dr. K. Srinivasa Rao	OU, MSB	
MULTIVARIATE DATA ANALYSIS (MDA) MS 203	Dr. N Ch. Bhatracharyulu	Osmania University,Hyderabad	
	Dr. G. Sirisha	Osmania University, Hyderabad	
	Dr. G. Jayasree	Osmania University,Hyderabad	
	Dr. K. Srinivasa Rao	OU, MSB	
DESIGN OF EXPERIMENTS (DOE) MS 204	Ms. J.L. Padmashree	Osmania University, Hyderabad	
	Dr. N Ch. Bhatracharyulu	Osmania University,Hyderabad	
	Dr. G. Sirisha	Osmania University, Hyderabad	
Practical - I (SI, ARA) MS 205	Prof. C. Jayalakshmi		
	Dr. N. Ch. Bhatracharyulu		
	Dr. K. Vani		
Practical - II (MVA, DOE) MS206	Dr. N. Ch. Bhatracharyulu		
	Prof. C. Jayalakshmi		
	Dr. G. Sirisha		

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(Affiliated to Osmania University)
Nallakunta, Hyderabad-44

DEPARTMENT OF STATISTICS

M.Sc. APPLIED STATISTICS
Semester I & Semester II

PATTERN OF
INTERNAL ASSESSMENT QUESTION PAPER AND
THEORY QUESTION PAPER

HINDI MAHAVIDYALAYA, NALLAKUNTA, HYDERABAD
(AUTONOMOUS)
BOS-DEPARTMENT OF STATISTICS
M.SC. APPLIED STATISTICS

he pattern of internal assessment test from the academic year 2018-2019 with the following specifications:

Two internal Assessment Tests of 15 Marks each (Average to taken)
One Assignment : 05 Marks
Total : 20 Marks

Internal Tests
I test to be conducted at the end of the 9th week of instruction (Covering 2/3 units of the syllabus).
II test to be conducted at the end of the 14th week of instruction (Covering the rest of the units).
Assignment
One Assignment (Topic to be assigned in the 6th week of instruction).
The assignment will consist of hand written (students own handwriting).

Definition /Explication of 20key concepts worth ¼ mark each. To be submitted for assessment in the 13th week of instruction.

Total marks for assignment 20 x ¼ =05 Marks

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(AUTONOMOUS)
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M.SC. APPLIED STATISTICS

INTERNAL ASSESSMENT MODEL (I-II SEMESTER)

Max. Marks :15

Note answer all the questions

Multiple choice questions — **10 x ½ =05 Marks**
Q1. – Q10.

Fill in the Blanks — **10 x ½ =05 Marks**
Q1. – Q10.

Short Answers type Questions — **5 x 1 =05 Marks**
Q1. – Q10.5

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BOS-DEPARTMENT OF STATISTICS
M.SC. APPLIED STATISTICS
MODEL PAPERS FOR SEMESTER EXAMINATION
(I-II SEMESTER)

me: 3 Hours **Max. Marks :80**

SECTION-A

Marks : = 8 x 4 =32

Unit-I

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Unit-II

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Unit-III

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Unit-IV

7.
8.

SECTION-B

Marks : = 4 x 12 =48

Unit-I

9. a) (OR) b)

Unit-II

10. a) (OR) b)

Unit-III

11. a) (OR) b)

Unit-IV

12. a) (OR) b)

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M.SC. APPLIED STATISTICS

MODEL PAPERS FOR PRACTICAL EXAMINATION
(I SEMESTER)

PAPER – V: STATISTICAL METHODS USING PYTHON PROGRAMMING

Time: 3 Hours

Credits-4
Max. Marks :100

SECTION-A

Marks : = 5 x 5 =25

Note: *Answer any five questions. Each question carries five marks.*

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SECTION-B

Marks : 75

Note: *Answer any three questions. Each question carries twenty marks. Execute one out of the three answered, asked by the external examiner. It carries 15 marks.*

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M.SC. APPLIED STATISTICS

MODEL PAPERS FOR PRACTICAL EXAMINATION
(I SEMESTER / II SEMESTER)

PAPER – VI: LA, DT,ET & ST (SEMESTER – I)
PAPER –V : SI, ARA (SEMESTER – II)
PAPER –VI : MDA AND DOE (SEMESTER – II)

Credits-4
Max. Marks :100

Time: 3 Hours

SECTION-A

Note: Answer any three questions. Choosing at least one question from each section. All question carries equal marks.

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SECTION-B

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