ANDHRA KESARI UNIVERSITY

Programme: B.Sc. Honours in Statistics (Major)

w.e.f. AY 2023-24

COURSE STRUCTURE

Year	Semester	Course	Title of the Course	No. of Hrs /Week	No. of Credits
I	I	1	Essentials and Applications of Mathematical, Physical and Chemical Sciences	3+2	4
		2	Advances in Mathematical, Physical and Chemical Sciences	3+2	4
	II	3	Descriptive Statistics	3	3
			Descriptive Statistics Practical Course	2	1
		4	Random Variables & Mathematical Expectations	3	3
			Random Variables & Mathematical Expectations Practical Course	2	1
II	III	5	Theoretical Discrete Distributions	3	3
			Theoretical Discrete Distributions Practical Course	2	1
		6	Theoretical Continuous Distributions	3	3
			Theoretical Continuous Distributions Practical Course	2	1
		7	Statistical Methods	3	3
			Statistical Methods Practical Course	2	1
		8	Inferential Statistics	3	3
			Inferential Statistics Practical Course	2	1
	IV	9	Sampling Techniques	3	3
			Sampling Techniques Practical Course	2	1
		10	Design and Analysis of Experiments	3	3
			Design and Analysis of Experiments Practical Course	2	1
		11	Numerical Analysis	3	3
			Numerical Analysis Practical Course	2	1

SEMESTER-II

COURSE 4: RANDOM VARIABLES AND MATHEMATICAL EXPECTATIONS

Theory Credits: 3 3 hrs/week

I. Learning Outcomes

After successful completion of the course students will be able to:

1. To deal with the data by the basic discrete distributions such as Uniform and Binomial distributions.
2. To acquaint the Poisson distribution applications.
3. To learn about the Negative Binomial distribution and its applications towards the real life problems.
4. To familiar with dealing the data by Geometric and Hyper Geometric distributions.

II. Syllabus

Unit – 1: Uniform, Bernoulli and Binomial distributions

Discrete Uniform distribution – definitions, mean, variance. Bernoulli distribution – definitions, mean, variance and its mgf. Binomial distribution – Definition, moments, M.G.F, C.F, C.G.F, P.G.F, additive property if exists, skewness, kurtosis and problems. First two moments obtained through mgf, recurrencerelation for probabilities, limiting case of Binomial Distribution to Normal distribution.

Unit – 2: Poisson Distribution

Poisson distribution - Definition, moments, M.G.F, C.F, C.G.F, P.G.F, additive property if exists,skewness, kurtosis and problems. First two moments obtained through mgf, recurrence relation for probabilities. Poisson distribution as a limiting case of Binomial distribution, limiting case of Poisson Distribution to Normal distribution.

Unit – 3: Negative Binomial Distribution

Negative Binomial Distribution - Definition, moments, M.G.F, C.F, C.G.F, P.G.F, additive property if exists, skewness, kurtosis and problems. First two moments obtained through mgf, recurrence relation for probabilities. Limiting case of Negative Binomial Distribution to Normal distribution.

Unit – 4: Geometric Distribution

Geometric Distribution – Definition, moments, M.G.F, C.F, C.G.F, P.G.F, additive property if exists, skewness, kurtosis and problems. First two moments obtained through mgf, Lack of memory property. Recurrence relation for probabilities.

Unit – 5: Hyper Geometric Distribution

Hyper Geometric Distribution – Definition, mean and variance, problems. Recurrence relation for probabilities. Limiting case of Hyper Geometric distribution to Binomial distribution.

SEMESTER-II

COURSE 4: RANDOM VARIABLES AND MATHEMATICAL EXPECTATIONS

Practical Credits: 1 2 hrs/week

Practical Syllabus

1. Fitting of Binomial distribution – Direct method.
2. Fitting of Binomial distribution – Recurrence relation Method.
3. Fitting of Poisson distribution – Direct method.
4. Fitting of Poisson distribution - Recurrence relation Method.
5. Fitting of Negative Binomial distribution – Direct method.
6. Fitting of Negative Binomial distribution – Recurrence relation Method.
7. Fitting of Geometric distribution – Direct method.
8. Fitting of Geometric distribution – Recurrence relation Method.
9. Fitting of Hyper Geometric distribution.

Note: Training shall be on establishing formulae in Excel cells and derive the results. The excel output shallbe exported to MS word for writing inference.

III. Text Books/References

1. S. C. Gupta & V. K. Kapoor: Fundamentals of Mathematical Statistics, Sultan & Chand Sons, New Delhi.
2. O. P. Gupta: Mathematical Statistics, Kedar nath Ram nath & Co.
3. P. N. Arora & S. Arora: Quantitative Aptitude Statistics – Vol II, S. Chand & Company Ltd.
4. K. Rohatgi & Ehsanes Saleh: An Introduction to Probability and Statistics, John Wiley & Sons.

IV. Suggested Co-curricular Activities:

1. Training of students by related industrial experts
2. Assignments including technical assignments if any.
3. Seminars, Group Discussions, Quiz, Debates etc on related topics.
4. Preparation of audio and videos on tools of diagrammatic and graphical representations.
5. Collection of material/figures/photos/author photoes of related topics.
6. Invited lectures and presentations of stalwarts to those topics.
7. Visits/field trips of firms, research organizations etc.

SEMESTER-III

COURSE 5: THEORETICAL DISCRETE DISTRIBUTIONS

Theory Credits: 3 3 hrs/week

I. Learning Outcomes

After successful completion of the course students will be able to:

1. To deal with the data by the basic continuous distribution such as Uniform Binomial distribution.
2. To acquaint the Exponential distribution applications.
3. To learn about the Gamma and Beta distributions and their applications towards the real lifeproblems.
4. To get familiarity of the most important distributions such as Normal and Standard Normaldistribution and their applications in research and various fields.
5. To acquire the knowledge of exact sampling distributions.

II.Syllabus

Unit – 1: Continuous Uniform distribution

Uniform distribution – Definition, moments, M.G.F, C.F, C.G.F, skewness, kurtosis and Distributionfunction. Mean Deviation about mean.

Unit – 2: Exponential Distribution

Exponential distribution – Definition, moments, M.G.F, C.F, C.G.F, skewness, kurtosis and Distributionfunction. Memory less property.

Unit – 3: Gamma and Beta Distributions

Gamma Distribution - Definition, moments, M.G.F, C.F, C.G.F, skewness, kurtosis and additiveproperty. Limiting form of gamma distribution.

Beta Distribution of first and second kind – Definition, mean, variance and harmonic mean.

Unit – 4: Normal Distribution

Normal Distribution – Definition, properties, importance, M.G.F, C.F, C.G.F, additive property, skewness, kurtosis and problems. Obtain mean, median and mode, Even and Odd order moments about mean, linear combination of normal variates, points of inflexion of normal probability curve.

Unit – 5: Standard Normal and Sampling Distributions

Standard Normal Distribution – Definition, mgf, mean and variance, Area property, problems. Student's t- distribution, F – Distribution, χ^2- Distribution: Definitions, properties and their applications.

SEMESTER-III

COURSE 5: THEORETICAL DISCRETE DISTRIBUTIONS

Practical Credits: 1 2 hrs/week

Practical Syllabus

1. Calculation of moments of Uniform distribution.
2. Calculation of skewness and kurtosis of Uniform distribution.
3. Fitting of Exponential distribution.
4. Gamma distribution application oriented problems.
5. Fitting of Normal distribution – Areas method.
6. Fitting of Normal distribution – Ordinates method.
7. Problems related to Standard Normal distribution.

Note: Training shall be on establishing formulae in Excel cells and derive the results. The excel output shallbe exported to MS word for writing inference.

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1. S. C. Gupta & V. K. Kapoor: Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi.
2. O. P. Gupta: Mathematical Statistics, Kedar nath Ram nath & Co.
3. P. N. Arora & S. Arora: Quantitative Aptitude Statistics – Vol II, S. Chand & Company Ltd.
4. K. Rohatgi & Ehsanes Saleh: An Introduction to Probability and Statistics, John Wiley & Sons.

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SEMESTER-III

COURSE 7: STATISTICAL METHODS

Theory Credits: 3 3 hrs/week

I. Learning Outcomes

After successful completion of the course students will be able to:

1. To get the knowledge of estimating future values by using curve fitting.
2. To calculate the relationship between bivariate data.
3. To find the relationship about the multivariate data.
4. To acquaint about the forecasting of the data by using regression techniques.
5. To find the association of the categorical data by using attributes.

II.Syllabus

Unit – 1: Curve fitting

Bivariate data, Principle of least squares, fitting of k^{th} degree polynomial. Fitting of straight line, Fitting of Second degree polynomial or parabola, fitting of family of exponential curves and power curve.

Unit – 2: Correlation

Meaning, Types of Correlation, Measures of Correlation – Scatter diagram, Karl Pearson's Coefficient ofCorrelation, Rank Correlation Coefficient (with and without ties), Properties. Bivariate frequency distribution, correlation coefficient for bivariate data and problems. Lag and Lead in correlation.

Unit – 3:

Coefficient of concurrent deviation, probable error and its properties, coefficient of determination,Concept of multiple and partial correlation coefficients (three variables only), properties and problems, intra-class correlation and correlation ratio.

Unit – 4: Regression

Concept of Regression, Linear and Non Linear regression. Linear Regression – Regression lines, Regression coefficients and it properties, Angle between two lines of regression. Regressions lines for bivariate data and simple problems. Correlation vs regression. Explained and Unexplained variations.

Unit – 5: Attributes

Notations, Class, Order of class frequencies, Ultimate class frequencies, Consistency of data, Conditions for consistency of data for 2 and 3 attributes only , Independence of attributes , Association of attributes and its measures, Relationship between association and colligation of attributes, Contingency table: Square contingency**,** Mean square contingency, Coefficient of mean square contingency, Tschuprow's coefficient of contingency.

SEMESTER-III

COURSE 7: STATISTICAL METHODS

Practical Credits: 1 2 hrs/week

Practical Syllabus

1. Fitting of straight line by the method of least squares
2. Fitting of parabola by the method of least squares
3. Fitting of exponential curve of two types by the method of least squares.
4. Fitting of power curve of the type by the method of least squares.
5. Computation of correlation coefficient and regression lines for ungrouped data.
6. Computation of correlation coefficient for bivariate frequency distribution.
7. Computation of correlation coefficient, forming regression lines for grouped data.
8. Computation of partial and multiple correlation coefficients.
9. Computation of Yule's coefficient of association and colligation.
10. Computation of Pearson's, Tschuprow's coefficient of contingency.

Note: Training shall be on establishing formulae in Excel cells and derive the results. The excel output shall beexported to MS word for writing inference.

III. References

1. S. C. Gupta & V. K. Kapoor: Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi.
2. O. P. Gupta: Mathematical Statistics, Kedar nath Ram nath & Co.
3. P. N. Arora & S. Arora: Quantitative Aptitude Statistics – Vol II, S. Chand & Company Ltd.
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Semester-III
Course:8 INFERENTIAL STATISTICS

Theory Credits: 3 3 hrs/week

I. Learning Outcomes

After successful completion of the course students will be able to:

1. To acquaint with estimator, estimates, estimation techniques and its properties.
2. To acquire knowledge of testing the hypothesis of different distributions.
3. To learn about the large sample techniques by using various tools.
4. To learn about the small sample techniques by using various tools.
5. To deal with the situation where there is no parameters to the distributions.

II.Syllabus

Unit – 1: Theory of estimation

Estimation of a parameter, criteria of a good estimator – unbiasedness, consistency, efficiency, &sufficiency. Statement of Neyman's factorization theorem. Estimation of parameters by the method of moments and maximum likelihood (M.L), properties of MLE's. Rao – Cramer Inequality, properties. Binomial, Poisson & Normal Population parameters estimate by MLE method. Confidence Intervals.

Unit – 2: Testing of Hypothesis

Concepts of statistical hypotheses, null and alternative hypothesis, critical region, two types of errors, level of significance and power of a test. One and two tailed tests. Neyman-Pearson's lemma. Examples in case of Binomial, Poisson, Exponential and Normal distributions.

Unit – 3: Large sample Tests

Large sample test for single mean and difference of two means, confidence intervals for mean(s). Large sample test for single proportion, difference of proportions. standard deviation(s) and correlation coefficient(s**).**

Unit – 4: Small Sample tests

Assumptions and t-test for single mean, difference of means and paired t-test. χ^2 test for goodnessof fit and independence of attributes. χ^2 test for single variance, F-test for equality of variances.

Unit – 5: Non-parametric tests

Advantages and disadvantages, comparison with parametric tests. One sample runs test, sign test and Wilcoxon – signed rank tests (single and paired samples). Two independent sample tests: Median test, Wilcoxon – Mann – Whitney U test, Wald Wolfowitz's runs test**.**

Semester-III
Course:8 INFERENTIAL STATISTICS

Practical Credits: 1 2 hrs/week

Practical Syllabus

1. Large sample test for single mean
2. Large sample test for difference of means
3. Large sample test for single proportion
4. Large sample test for difference of proportions
5. Large sample test for difference of standard deviations
6. Large sample test for correlation coefficient
7. Small sample test for single mean
8. Small sample test for difference of means
9. Small sample test for correlation coefficient
10. Paired t-test (paired samples).
11. Small sample test for single variance (χ^2 test)
12. Small sample test for difference of variances (F test)
13. χ^2 test for goodness of fit and independence of attributes
14. Nonparametric tests for single sample(run test, sign test and Wilcoxon signed rank test)
15. Nonparametric tests for related samples (sign test and Wilcoxon signed rank test)
16. Nonparametric tests for two independent samples (Median test, Wilcoxon –Mann-Whitney - U test,Wald - Wolfowitz' s runs test)

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III. References

1. S. C. Gupta & V. K. Kapoor: Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi.
2. O. P. Gupta: Mathematical Statistics, Kedar nath Ram nath & Co.
3. P. N. Arora & S. Arora: Quantitative Aptitude Statistics – Vol II, S. Chand & Company Ltd.
4. K. Rohatgi & Ehsanes Saleh: An Introduction to Probability and Statistics, John Wiley & Sons.

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SEMESTER-IV

COURSE 9: SAMPLING TECHNIQUES

Theory Credits: 3 3 hrs/week

I. Learning Outcomes

After successful completion of the course students will be able to:

1. To review about the population and its concepts also methods to collect data and errors to deal.
2. Introduced to various statistical sampling schemes such as simple, stratified and systematicsampling.
3. An idea of conducting the sample surveys and selecting appropriate sampling techniques.
4. Knowledge about comparing various sampling techniques.
5. To use appropriate factorial experimental to analyze the experimental data.

Syllabus

Unit – 1:

Brief review of parameter and statistic, sampling distribution. Principal steps and principles in a sample survey, sampling and non – sampling errors, advantages of sampling over census, limitations, types of sampling – concept of subjective, probability and mixed sampling.

Unit – 2: Simple Random Sampling (with and without replacement)

Notations and terminology, various probabilities of selection. Random numbers tables and its uses. Methods of selecting simple random sample, lottery method, method based on random numbers. Estimates of population total, mean and theirvariances and standard errors, determination of sample size, simple random sampling of attributes.

Unit – 3: Stratified random sampling

Stratified random sampling, Advantages and Disadvantages of StratifiedRandom sampling, Estimation ofpopulation mean, and its variance. Stratified random sampling with proportional and optimum allocations. Comparison between proportional and optimum allocations with SRSWOR.

Unit – 4: Systematic sampling

Systematic sampling definition when N = nk and merits and demerits of systematic sampling - estimate of mean and its variance. Comparison of systematic sampling with Stratified and SRSWOR. Comparison of variance of SRS, StRS and SYS for a linear trend. Concept of Cluster Sampling, Multistage Sampling and Quota Sampling.

Unit – 5: National and International Official Statistical System

National Statistical Organization: vision and mission, NSSO and CSO, roles and responsibilities,important activities, publications etc.

National Statistical Commission: Need, Constitution, its role, functions, important acts.

SEMESTER-IV

COURSE 9: SAMPLING TECHNIQUES

Practical Credits: 1 2 hrs/week

Practical Syllabus

1. Show the sample mean is unbiased estimator of population mean in SRSWOR and also find varianceof sample mean.
2. Show the sample mean square is unbiased estimator of population mean square in SRSWOR.
3. Show the sample mean is unbiased estimator of population mean in SRSWR and also find varianceof sample mean.
4. Compare means and variances between SRSWR and SRSWOR.
5. Allocation of sample sizes to various strata in proportional and in optimum allocations to draw aStratified random sample.
6. Compare precision in proportional and optimum allocations with SRSWOR and gain in efficiencydue to proportional and optimum allocations.
7. Systematic sampling with N = nk and Compare the precision of an estimate in systematic samplingwith that of in Stratified andin SRSWOR.

Note: Training shall be on establishing formulae in Excel cells and derive the results. The excel output shall beexported to MS word for writing inference.

II. References

1. S. C. Gupta & V. K. Kapoor: Fundamentals of Applied Statistics, Sultan Chand&Sons, New Delhi.
2. K.V.S. Sarma: Statistics Made Simple: Do it yourself on PC. PHI.
3. M. R. Saluja: Indian Official Statistics. ISI publications.

III. Suggested Co-curricular Activities:

1. Training of students by related industrial experts
2. Assignments including technical assignments if any.
3. Seminars, Group Discussions, Quiz, Debates etc on related topics.
4. Preparation of audio and videos on tools of diagrammatic and graphical representations.
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SEMESTER-IV
COURSE:10 DESIGN AND ANALYSIS OF EXPIREMENT

Theory Credits: 3 3 hrs/week

I. Learning Outcomes

After successful completion of the course students will be able to:

1. To acquaint with the role of statistics in different fields with special reference to agriculture.
2. Learn to apply the one of the design of experiment to agricultural fields.
3. Learn to apply the randomization to the blocks of various fields in agriculture.
4. To get the familiarity about applications of three principles.
5. Learn to deal the agricultural fields with different factors and levels.
6. To use appropriate experimental designs to analyze the experimental data.

II.Syllabus

Unit – 1: Analysis of variance (ANOVA)

Concept, Definition and assumptions. ANOVA one way classification – mathematical model, analysis
– with equal and unequal classification. ANOVA two way classification – mathematical model, analysisand problems.

Unit – 2: Completely Randomised Design (CRD)

Definition, terminology, Principles of design of experiments, CRD – Concept, advantages and disadvantages, applications, Layout, Statistical analysis. Critical Differences when hypothesis is significant.

Unit – 3: Randomised Block Design (RBD)

Concept, advantages and disadvantages, applications, Layout, Statistical analysis and Critical Differences. Efficiency of RBD relative to CRD. RBD with one missing value and its analysis, problems.

Unit – 4: Latin Square Design

Concept, advantages and disadvantages, applications, Layout, Statistical analysis and Critical Differences. Efficiency of LSD over RBD and CRD. Estimation of one missing value in LSD and its analysis, problems.

Unit – 5: Factorial experiments

Main effects and interaction effects of 2^2 and 2^3 factorial experiments and their Statistical analysis. Yates procedure to find factorial effect totals.

SEMESTER-IV
COURSE:10 DESIGN AND ANALYSIS OF EXPIREMENT

Practical Credits: 1 2 hrs/week

Practical Syllabus

1. ANOVA - one - way classification with equal number of observations.
2. ANOVA - one - way classification with unequal number of observations.
3. ANOVA Two-way classification.
4. Analysis of CRD and critical differences.
5. Analysis of RBD and critical differences. Relative efficiency of CRD with RBD.
6. Estimation of single missing observation in RBD and its analysis.
7. Analysis of LSD and efficiency of LSD over CRD and RBD.
8. Estimation of single missing observation in LSD and its analysis.
9. Analysis of 2^2 with RBD layout.
10. Analysis of 2^3 with RBD layout.

Note: Training shall be on establishing formulae in Excel cells and derive the results. The excel output shall beexported to MS word for writing inference.

V. References

1. S. C. Gupta & V. K. Kapoor: Fundamentals of Applied Statistics, Sultan Chand&Sons, New Delhi.
2. K.V.S. Sarma: Statistics Made Simple: Do it yourself on PC. PHI.
3. M. R. Saluja: Indian Official Statistics. ISI publications.

VI. Suggested Co-curricular Activities:

1. Training of students by related industrial experts
2. Assignments including technical assignments if any.
3. Seminars, Group Discussions, Quiz, Debates etc on related topics.
4. Preparation of audio and videos on tools of diagrammatic and graphical representations.
5. Collection of material/figures/photos/author photoes of related topics.
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7. Visits/field trips of firms, research organizations etc.

SEMESTER-IV
COURSE11: NUMERICAL ANALYSIS

Theory Credits: 3 3 hrs/week

I. Learning Outcomes

After learning this course the student will be able

1. Learn the different difference operators and applications.
2. Accustom with the interpolation techniques with equal and unequal intervals.
3. Able to use numerical differentiation tools.
4. Familiar to use numerical integration methods.

Syllabus

Unit 1

Definitions of Forward difference operator (Δ), Backward difference operator, Shift or Extension (displacement) operator (E), Central Differences operator(μ), Differentiation operator(D), Mean value operator Symbolic relations between operators, properties of difference and shift operators, fundamental theorem on finite differences and simple problems.

Unit 2

Interpolation with equal intervals: Concept of interpolation and extrapolation, assumptions and uses of interpolation, difference tables, methods of interpolation with equal intervals - Newton's formula for forward and backward interpolation, Central differences, Gauss forward and backward, Sterling, Bessel's and Laplace - Everett's Formulae.

Unit 3

Interpolation with unequal intervals: Divided differences and their properties. Methods of interpolation with unequal intervals – Newton's Divided difference formula and Lagrange's formula. Inverse interpolation - Lagrange's formula.

Unit 4

Numerical Differentiation: Introduction to Numerical differentiation. Determination of First and Second order derivatives for the given data using Newton's forward and backward, Gauss forward and backward, Sterling, Bessel's and Newton's Divided difference formula.

Unit 5

Numerical Integration: Introduction to numerical integration, General Quadrature formula for equidistant ordinates, Trapezoidal rule, Simpson's $1/3^{rd}$, Simpson's $3/8^{th}$ rule and Weddle's rule.

SEMESTER-IV
COURSE11: NUMERICAL ANALYSIS

Practical Credits: 1 2 hrs/week

Practical Syllabus

1. Interpolation by using Newton-Gregory forward and backward difference formulae.
2. Interpolation by using Gauss forward and backward difference formulae.
3. Interpolation by using Sterling and Bessel's formulae.
4. Interpolation by using Laplace-Everett's Formula.
5. Interpolation by using Newton's divided difference and Lagrange's formulae.
6. Inverse interpolation by using Lagrange's formula.
7. Determination of first and second order derivatives by using Newton-Gregory forward andbackward difference formulae.
8. Determination of first and second order derivatives by using Gauss forward and backwarddifference formulae.
9. Determination of first and second order derivatives by using Newton's divided difference formula.
10. Numerical Integration by using Trapezoidal rule, Simpson's $1/3^{rd}$, Simpson's $3/8^{th}$ rule andWeddle's rule.

II. References

1. H. C. Saxena: Finite Differences and Numerical Analysis, S. Chand and Company, New Delhi.
2. P. P. Gupta, G. S. Malik & Sanjay Gupta: Calculus of Finite Differences and Numerical Analysis,Krishna Prakashan Media(P) Ltd., Meerut(UP), India.
3. S. S. Sastry: Introductory Methods Numerical Analysis, Prentice- Hall of India.
4. C. F. Gerald and P. O. Wheatley: Applied Numerical Analysis, Addison- Wesley, 1998.

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1. Training of students by related industrial experts
2. Assignments including technical assignments if any.
3. Seminars, Group Discussions, Quiz, Debates etc on related topics.
4. Preparation of audio and videos on tools of diagrammatic and graphical representations.
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ANDHRA KESARI UNIVERSITY-ONGOLE, PRAKASAM DISTRICT
Single Major Programme from the Year 2023-24 Onwards
Programme- B. Sc. Statistics -Question Paper model,
Second Year-Semester-III & IV

Time: 3 Hours Total Marks: 75

PART –A

Answer any Five of the following

5X5=25 Marks

1.

2.

3.

4.

5.

6.

7.

8.

9.

10

PART –B

Answer the following One question from each unit

5x10=50 Marks

11a.

Or

11b.

12a.

Or

12b.

13a.

Or

13b.

14a.

Or

14b.

15a.

Or

15b.