S.P.Mandali's

Ramnarain Ruia Autonomous College

Syllabus for : <u>F.Y.B.A</u>.

Program: <u>BA</u>

Course: <u>STATISTICS (RUASTA)</u>

(Credit Based Semester and Grading System with effect from the academic year 2018–2019)

SEMESTER I

Course Code	UNIT	TITLE	Credits	Lecture / Week
		DESCRIPTIVE STATISTICS I		
RUASTA101	I	Types of Data and Data Condensation	2	1
	II	Measures of central tendency		1
	III	Measures of Dispersion, Skewness & Kurtosis		1
RUASTAP101	Practical based on course RUASTA101		1	3

SEMESTER II

Course Code	UNIT	TITLE	Credits	Lecture / Week
		DESCRIPTIVE STATISTICS II		
RUASTA201	I	Correlation and Regression Analysis	2	1
	II	Time Series		1
	III	Index Numbers		1
RUASTAP201	Practical based on course RUASTA201		1	3

Objective of Course

In the first year, there will be two courses in Statistics per semester. The following are the objectives of these courses:

1. To understand various data types and to learn visualization techniques.
2. To enable learners to summarize and classify the data
3. To enable learners with concepts of graphical methods.
4. To equip learners with requisite quantitative techniques.
5. To develop learner's presentation and communication skills.

Learning Outcomes

1. Learners will be able to visualize data using elementary graphs and diagrams and will be able to apply appropriate measures for quantitative and qualitative data.
2. Learners will be able to choose and apply an appropriate statistical analysis or modeling methods to solve problems arising in different fields.
3. Learners will be able to engage in interpretation of wide range of information from variety of disciplines including quantitative analysis.

	SEMESTER 1	
RUASTA101	**DESCRIPTIVE STATISTICS I**	
Unit I	**Types of Data and Data Condensation:** • **Global Success stories of Statistics/Analytics in various fields.** • Concept of Population and Sample. Finite, Infinite Population, Notion of SRS, SRSWOR and SRSWR • Different types of scales: Nominal, Ordinal, Interval and Ratio. • Methods of Data Collection: i) Primary data: concept of a Questionnaire and a Schedule, ii) Secondary Data • Types of data: Qualitative and Quantitative Data; Time Series Data and Cross Section Data, Discrete and Continuous Data • Tabulation • Dichotomous classification- for two and three attributes, Verification for consistency • Association of attributes: Yule's coefficient of association Q. Yule's coefficient of Colligation Y, Relation between Q and Y (with proof). • Univariate frequency distribution of discrete and continuous variables. Cumulative frequency distribution • Data Visualization: Graphs and Diagrams: Histogram, Polygon/curve, Ogives. Heat Map, Tree map. • Bivariate Frequency Distribution of discrete and continuous variables •	15 Lectures
Unit II	**Measures of central tendency** • Concept of central tendency of data, Requirements of good measures of central tendency. • Location parameters : Median, Quartiles, Deciles, and Percentiles • Mathematical averages Arithmetic mean (Simple, weighted mean, combined mean), Geometric mean, Harmonic mean, Mode, Trimmed mean. • Empirical relation between mean, median and mode • Merits and demerits of using different measures & their applicability.	15 Lectures

Unit III	**Measures of Dispersion, Skewness & Kurtosis**	15
	• Concept of dispersion, Requirements of good measure • Absolute and Relative measures of dispersion: Range, Quartile Deviation, Inter Quartile Range, Mean absolute deviation, Standard deviation. • Variance and Combined variance, raw moments and central moments and relations between them. Their properties • Concept of Skewness and Kurtosis: Measures of Skewness: Karl Pearson's, Bowley's and Coefficient of skewness based on moments. Measure of Kurtosis. Absolute and relative measures of skewness. • Box Plot: Outliers	Lectures

Distribution of topics for Practicals in Semester I

Course Code RUSSTAP101(A)	
Sr. No.	**Practicals based on course**
1	Tabulation
2	Classification of Data
3	Attributes
4	Diagrammatic representation
5	Measures of central tendency
6	Measures of dispersion
7	Practical using Excel and R i) Classification of Data and Diagrammatic representation ii) Measures of central tendency iii) Measures of dispersion

RUASTA201	DESCRIPTIVE STATISTICS II	Lectures
UNIT – I	**Correlation, Simple linear Regression Analysis and Fitting of curves** • Visualizing relationship using Bubble chart, Scatter Diagram, • Karl Pearson's Product moment correlation coefficient and its properties. • Spearman's Rank correlation.(With and without ties) • Concept of Simple linear regression. Principle of least squares. Fitting a straight line by method of least squares (Linear in Parameters) • Relationship between regression coefficients and correlation coefficient, cause and effect relationship, Spurious correlation. • Concept and use of coefficient of determination (R^2). • Measures of association with the help of Tau A, Tau B, Tau C, Gamma and Lambda, Somer's d • Fitting of curves reducible to linear form by transformation.	15 Lectures
UNIT – II	**Time Series** • Definition of time series. Components of time series. Models of time series. • Estimation of trend by: (i) Freehand Curve Method (ii) Method of Semi Average (iii)Method of Moving Average (iv) Method of Least Squares (Linear Trend only) • Estimation of seasonal component by i) Method of Simple Average ii) Ratio to Moving Average iii)Ratio to Trend Method • Simple exponential smoothing • Stationary Time series	15 Lectures
Unit - III	**Index Numbers** • Index numbers as comparative tool. Stages in the construction of Price Index Numbers. • Measures of Simple and Composite Index Numbers. Laspeyre's, Paasche's, Marshal-Edgeworth's, Dobisch & Bowley's and Fisher's Index Numbers formula • Quantity Index Numbers and Value Index Numbers Time reversal test, Factor reversal test, Circular test • Fixed base Index Numbers, Chain base Index Numbers. Base shifting, splicing and deflating • Cost of Living Index Number. Concept of Real Income.	15 Lectures

Course Code: RUASTAP201	
Sr. No.	Practicals based on course
1	Correlation analysis
2	Regression analysis
3	Fitting of curve
4	Time series
5	Index number-I
6	Index number-II
7	Practical using Excel and R i) Correlation analysis ii) Regression analysis iii) Fitting of curve

REFERENCES:

1. Medhi J.: "Statistical Methods, An Introductory Text", Second Edition, New Age International Ltd.

2. Agarwal B.L.:"Basic Statistics", New Age International Ltd.

3. Spiegel M.R.:"Theory and Problems of Statistics", Schaum's Publications series. Tata McGraw-Hill.

4. Kothari C.R.:"Research Methodology", Wiley Eastern Limited.

5. David S.:"Elementary Probability", Cambridge University Press.

6. Hoel P.G.:"Introduction to Mathematical Statistics", Asia Publishing House.

7. Hogg R.V. and Tannis E.P.:"Probability and Statistical Inference". McMillan Publishing Co. Inc.

8. PitanJim:"Probability", Narosa Publishing House.

9. Goon A.M., Gupta M.K., Dasgupta B.:"Fundamentals of Statistics", Volume II: The World Press Private Limited, Calcutta.

10. Gupta S.C., Kapoor V.K.: "Fundamentals of Mathematical Statistics", Sultan Chand &Sons

11. Gupta S.C., Kapoor V.K.: "Fundamentals of Applied Statistics", Sultan Chand & Sons

MODALITY OF ASSESSMENT

Theory Examination Pattern:

A) Internal Assessment - (40%): 40 marks.

Sr No	Evaluation type	Marks
1	One Class Test/ Project / Assignment / Presentation	20
2	One class Test (multiple choice questions / objective)/ Project / Assignment / Presentation ………	20

B) External examination - (60 %): 60 Marks

Semester End Theory Assessment – (60 marks)

i.   Duration - These examinations shall be of **TWO hours** duration.

ii.   Paper Pattern:

    1. There shall be **THREE** questions each of **20** marks, there will be one question on each unit.

    2. All questions shall be compulsory with internal choice within the questions.

Questions	Options	Marks	Questions on
1	Compulsory Sub-question A and Sub-question B or C	20	Unit I
2	Compulsory Sub-question A and Sub-question B or C	20	Unit II
3	Compulsory Sub-question A and Sub-question B or C	20	Unit III

Practical Examination Pattern :

(A) Internal Examination: (40%) Per Semester per course (20 Marks)

Heading	Practical
Journal	05
Test	15
Total	20

(B) External (Semester end practical examination): (30 Marks)

Questions	Options	Marks	Questions on
1	Sub-question A or Sub-question B	10	Unit I
2	Sub-question A or Sub-question B	10	Unit II
3	Sub-question A or Sub-question B	10	Unit III

PRACTICAL BOOK/JOURNAL

The students are required to present a duly certified journal for appearing at the practical examination, failing which they will **not be allowed to appear for the examination.**

In case of loss of Journal and/or Report, a Lost Certificate should be obtained from Head/ Co-ordinator / Incharge of the department; failing which the student will not be allowed to appear for the practical examination.

Overall Examination and Marks Distribution Pattern Per Semester

Course	RUASTA 101			RUASTA201			Grand Total
	Internal	External	Total	Internal	External	Total	
Theory	40	60	100	40	60	100	200
Practicals	20	30	50	20	30	50	100

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RUIA COLLEGE

Explore ● Experience ● Excel

Syllabus for :- <u>S.Y.B.A</u>.

Program: B.A.

Course: <u>STATISTICS (RUASTA)</u>

(Credit Based Semester and Grading System with effect from the academic year 2018–2019)

SEMESTER III

Course Code	UNIT	TITLE	Credits	L / Week
		STATISTICAL METHODS - I		
RUASTA301	I	Elementary Probability Theory	2	1
	II	Discrete random variable		1
	III	Some Standard Discrete Distributions		1
Course Code	**UNIT**	**TITLE**	**Credits**	**L / Week**
		OPERATIONS RESEARCH		
RUASTA302	I	Linear Programming Problem.	2	1
	II	Transportation Problem		1
	III	Assignment & Sequencing Problem		1
RUASTAP301	Practical based on courses RUSSTA301, RUSSTA302		2	6

SEMESTER IV

Course code	UNIT	TITLE	Credits	L / Week
		STATISTICAL METHODS – II		
RUASTA401	I	Continuous random variable and Standard Continuous Distribution	2	1
	II	Normal Distribution		1
	III	Elementary topics on Estimation and Testing of hypothesis		1
		PROJECT MANAGEMENT AND INDUSTRIAL STATISTICS		
RUASTA402	I	CPM and PERT.	2	1
	II	Statistical Quality Control - I		1
	III	Statistical Quality Control - II		1
RUASTAP401	Practical based on courses RUASTA401, RUASTA402		2	6

Academic year 2018-19

Objective of Course

In the second year, there will be two courses in Statistics per semester. The following are the objectives of these courses:

1. To enable learners with concepts of probability and probability distributions
2. To equip learners with inference techniques used in Statistics
3. To equip learners with different optimization techniques
4. To equip learners with statistical quality control techniques used in industry
5. To equip learners with techniques in different applied/ industrial data.

Learning Outcomes:

1. Learners will be able to use pro to solve probability distributions to solve problems from different fields.
2. Learners will be able to choose and apply an appropriate statistical/ sampling distributions and analyze the data
3. Learners will be able to infer about the various types of data
4. Learners will be able to use different techniques of optimization using data from various fields
5. Learners will be able to use statistical quality control techniques for industrial data.

SEMESTER III

RUASTA301	STATISTICAL METHODS - I	Lectures
Unit I	**Elementary Probability Theory** • Trial, random experiment, sample point and sample space. • Definition of an event, Operation of events, mutually exclusive and exhaustive events. • Classical (Mathematical) and Empirical definitions of Probability and their properties. • Theorems on Addition and Multiplication of probabilities Independence of events, Pair-wise and Mutual Independence for three events, Conditional probability, Bayes' theorem and its applications	**15 Lectures**
Unit II	**Discrete random variable** • Random variable. Definition and properties of probability distribution and cumulative distribution function of discrete random variable. • Raw and Central moments and their relationships. • Concepts of Skewness and Kurtosis and their uses. • Expectation of a random variable. Theorems on Expectation & Variance. Concept of Generating function, Moment Generating function, Cumulant generating function, Probability generating function • Joint probability mass function of two discrete random variables. Independence of two random variables. • Marginal and conditional distributions. Theorems on Expectation &Variance, • Covariance and Coefficient of Correlation.	**15 Lectures**
Unit III	**Some Standard Discrete Distributions** • Degenerate (one point) :-Discrete Uniform, Bernoulli, Binomial, Poisson and Hypergeometric distributions	**15 Lectures**

| | derivation of their mean and variance for all the above distributions.

• Moment Generating Function and Cumulant Generating Function of Binomial and Poisson distribution.

• Recurrence relationship for probabilities of Binomial and Poisson distributions, Poisson approximation to Binomial distribution, Binomial approximation to hypergeometric distribution. | |

REFERENCES- RUASTA301:

1. A. M. Mood, F.A. Graybill, D. C. Boyes, Third Edition; McGraw-Hill Book Company. Introduction to the theory of statistics

2. R.V. Hogg, A.T. Craig; Fourth Edition; Collier McMillan Publishers: Introduction to Mathematical Statistics

3. R.V. Hogg, E. A. Tannis, Third Edition; Collier McMillan Publishers: Probability and Statistical Inference

4. I. Miller, M. Miller; Sixth Edition; Pearson Education Inc.: John E. Freund's Mathematical Statistics

5. P.G. Hoel; Fourth Edition; John Wiley & Sons Inc.: Introduction to Mathematical Statistics

6. S.C. Gupta, V.K. Kapoor; Eighth Edition; Sultan Chand & Sons.: Fundamentals of Mathematical Statistics

7. J.N. Kapur, H.C. Saxena; Fifteenth Edition; S. Chand & Company Ltd.: Mathematical Statistics

8. J. Medhi; Second edition; Wiley Eastern Ltd.: Statistical Methods: An Introductory Text

9. A.M. Goon, M.K. Gupta, B. DasGupta; Third Edition; The World Press Pvt. Ltd.: An Outline of Statistical Theory Vol. 1

RUASTA302	OPERATIONS RESEARCH	Lectures
Unit I	**Linear Programming Problem (L.P.P.) :** • Mathematical Formulation: Maximization & Minimization. Concepts of Solution, Feasible Solution, Basic Feasible Solution, Optimal solution. • Graphical Solution for problems with two variables. Simplex method of solving problems with two or more variables. Big M method. • Concept of Duality. Its use in solving L.P.P. Relationship between optimum solutions to Primal and Dual. Economic interpretation of Dual.	**15 Lectures**
Unit II	**Transportation Problem:** • Concept, Mathematical Formulation. Concepts of Solution, Feasible Solution. Initial Basic Feasible Solution by North-West Corner Rule, Matrix Minima Method, Vogel's Approximation Method. Optimal Solution by MODI Method. Optimality test, Improvement procedure. • Variants in Transportation Problem: Unbalanced, Maximization type, Restricted allocations.	**15 Lectures**
Unit III	**Assignment Problem:** • Concept. Mathematical Formulation • Solution by: Complete Enumeration Method and Hungarian method. • Variants in Assignment Problem: Unbalanced, Maximization type. • Airline Operating Problem • Travelling Salesman Problem **Sequencing :** • Processing n Jobs through 2 and 3 Machines , 2 Jobs through m Machines and n jobs through m machines	**15 Lectures**

REFERENCES RUASTA302:

1. Kantiswaroop and Manmohan Gupta. 4th Edition; S Chand & Sons: Operations Research
2. Richard Broson. 2nd edition Tata Mcgraw Hill Publishing Company Ltd.: Schaum Series book in O.R.
3. Methods and Problems: Maurice Sasieni, Arthur Yaspan and Lawrence Friedman, (1959), John Wiley & Sons: Operations Research
4. J K Sharma, (1989), Tata McGraw Hill Publishing Company Ltd.: Mathematical Models in Operations Research
5. Harvey M. Wagner, 2nd Edition, Prentice Hall of India Ltd.: Principles of Operations Research with Applications to Management Decisions
6. S.D.Sharma.11th edition, Kedar Nath Ram Nath & Company.: Operations Research
7. H. A.Taha.6th edition, Prentice Hall of India.: Operations Research
8. J.K.Sharma, (2001), MacMillan India Ltd.: Quantitative Techniques For Managerial Decisions

Distribution of topics for Practicals for Semester III

COURSE CODE RUASTAP301

Course Code RUASTAP301(A)		Course Code RUASTAP301(B)	
Sr. No.	**Practicals based on course RUASTA301**	Sr. No.	**Practicals based on course RUASTA302**
1	Probability	1	Formulation and Graphical Solution of L.P.P.
2	Discrete Random Variables	2	Simplex Method.
3	Bivariate Probability Distributions	3	Duality.
4	Binomial Distribution	4	Transportation.
5	Poisson Distribution	5	Assignment.
6	Hypergeometric Distribution	6	Sequencing.
7	Practical using Excel and R i) Binomial distribution ii) Poisson distribution iii) Hypergeometric distribution	7	Problems solving using TORA.

SEMESTER IV

RUASTA401	STATISTICAL METHODS – II	Lecture
Unit I	**Continuous random variable and some Standard Continuous Distributions** • Concept of Continuous random variable and properties of its probability distribution • Probability density function and cumulative distribution function. • Their graphical representation. • Expectation of a random variable and its properties. Concept of M.G.F. and C.G.F. characteristics. Measures of location, dispersion, skewness and kurtosis. • Raw and central moments (simple illustrations). • Uniform, Exponential distribution (location and scale parameter), memory less property of exponential distribution, • Derivations of mean, median, variance, MG.F. and C.G.F. for Uniform and Exponential distributions.	**15 Lectures**
Unit II	**Normal Distribution and Sampling Distribution** • Normal distribution • Properties of Normal distribution/curve (without proof). Use of normal tables. • Normal approximation to Binomial and Poisson distribution (statement only) • Sample from a distribution: Concept of a statistic, estimate and its sampling distribution. Parameter, its estimator and bias, unbiasedness, standard error of an estimator. • Concept of Central Limit theorem (statement only) • Sampling distribution of sample mean and sample proportion,	**15 Lectures**

	difference between two population means and two proportions.	
	• Standard errors of sample mean and sample proportion.	
Unit III	**Basics of Theory of Estimation and Testing of hypothesis**	**15 Lectures**
	• Point and Interval estimate of single mean, single proportion from sample of large size.	
	• Statistical tests: Concept of hypothesis, Null and Alternative Hypothesis, Types of Errors, Critical region, Level of significance, Power	
	• Large sample tests	
	• For testing specified value of population mean	
	• For testing specified value in difference of two means	
	• For testing specified value of population proportion	
	• For testing specified value of difference of population proportion	
	• Concept of p-value	

REFERENCES RUASTA401:

1. A M Mood, F.A. Graybill, D C Boyes; Third Edition; McGraw-Hill Book Company.: Introduction to the theory of statistics
2. R.V.Hogg, A.T. Craig; Fourth Edition; Collier McMillan Publishers.: Introduction to Mathematical Statistics
3. R.V.Hogg, E. A.Tannis, Third Edition; Collier McMillan Publishers.: Probability and Statistical Inference
4. I. Miller, M. Miller; Sixth Edition; Pearson Education Inc.: John E. Freund's Mathematical Statistics
5. P.G. Hoel; Fourth Edition; John Wiley & Sons Inc.: Introduction to Mathematical Statistics
6. S.C. Gupta, V.K. Kapoor; Eighth Edition; Sultan Chand & Sons.: Fundamentals of Mathematical Statistics
7. J.N. Kapur, H.C. Saxena; Fifteenth Edition; S. Chand & Company Ltd.: Mathematical Statistics
8. J. Medhi; Second edition; Wiley Eastern Ltd.: Statistical Methods- An Introductory Text
9. A.M. Goon, M.K. Gupta, B. DasGupta; Third Edition; The World Press Pvt. Ltd.: An Outline of Statistical Theory Vol. 1

RUASTA402	PROJECT MANAGEMENT AND INDUSTRIAL STATISTICS	Lecture
Unit I	**CPM and PERT:** • Objective and Outline of the techniques. Diagrammatic representation of activities in a project: Gantt Chart and Network Diagram. • Slack time and Float times. Determination of Critical path. Probability consideration in project scheduling. • Project cost analysis. • Updating.	**15 Lectures**
Unit II	**Statistical Quality Control-I:** • Principles of control. Process quality control of variables. X bar and R, Xbar and Sigma Chart and their uses. Problems involving setting up standards for future use. • Exponentially weighted moving average (EWMA) control charts, Cumulative Sum (CUSUM) control chart, Introduction to Six sigma limits. • Concept of Natural Tolerance Limits, Specification Limits and Detection of shift	**15 Lectures**
Unit III	**Statistical Quality Control-II:** • Principles of control. Process quality control of attributes p, c, np charts and their uses. p-chart and C-chart with variable sample size. Problems involving setting up standards for future use • Acceptance sampling plan • Single Sampling Plans (without curtailment). • OC function and OC curves. AQL, LTPD, ASN, ATI, AOQ, Consumer's risk, Producer's risk. • Double Sampling Plan (Concept only)	**15 Lectures**

REFERENCES:- RUASTA402:

1. E.L. Grant. (2nd edition) McGraw Hill, 1988.: Statistical Quality Control
2. Duncan. (3rd edition) D. Taraporewala sons & company.: Quality Control and Industrial Statistics
3. Bertrand L. Hansen, (1973), Prentice Hall of India Pvt. Ltd.: Quality Control: Theory and Applications
4. Douglas Montgomery, Arizona State University. John Wiley & Sons, Inc. (6th Edition): Statistical Quality Control
5. Gupta S.C., Kapoor V.K., Fundamentals of Applied Statistics, Sultan Chand &Sons
6. Srinath. 2nd edition, East-west press Pvt. Ltd.: PERT and CPM, Principles and Applications
7. Kantiswaroop and Manmohan Gupta. 4th Edition; S Chand & Sons.: Operations Research
8. Richard Broson. 2nd edition Tata Mcgraw Hill Publishing Company Ltd.: Schaum Series book in O.R.
9. Maurice Sasieni, Arthur Yaspan and Lawrence Friedman, (1959), John Wiley & Sons.: Operations Research: Methods and Problems
10. J K Sharma, (1989), Tata McGraw Hill Publishing Company Ltd.: Mathematical Models in Operations Research
11. S.D.Sharma.11th edition, Kedar Nath Ram Nath & Company.: Operations Research
12. H. A. Taha, 6th edition, Prentice Hall of India.: Operations Research
13. J.K.Sharma, (2001), MacMillan India Ltd.: Quantitative Techniques for Managerial Decisions

DISTRIBUTION OF TOPICS FOR PRACTICALS SEMESTER-IV COURSE CODE RUASTAP401

Course Code RUASTAP401(A)		Course Code RUASTAP401(B)	
Sr. No.	**Practicals based on course RUASTA401**	Sr. No.	**Practicals based on course RUASTA402**
1	Continuous Random Variables	1	PERT
2	Uniform and Exponential Distributions	2	CPM
3	Normal Distribution	3	Project cost analysis
4	Sampling Distribution	4	Updating
5	Testing of Hypothesis	5	Control Charts for attributes
6	Large sample Tests	6	Control Charts for variables
7	Practical using Excel and R i)Uniform and Exponential ii)Normal Distribution iii) Sampling Distribution iv) Testing of Hypotheses v) Large sample Tests	7	Acceptance Sampling Plans.
			Practical using EXCEL and TORA software

MODALITY OF ASSESSMENT

Theory Examination Pattern: (per Semester per course)

A) Internal Assessment :- 40% (40 marks)

Sr. No.	Evaluation type	Marks
1	One Class Test / Project / Assignment / Presentation	20
2	One Class Test (multiple choice questions / objective) / Project / Assignment / Presentation	20

B) External examination - (60 %): 60 Marks

Semester End Theory Assessment – (60 marks)

iii.   Duration - These examinations shall be of **TWO** **hours** duration.

iv.   Paper Pattern:

3. There shall be **THREE** questions each of **20** marks, there will be one question on each unit.

4. All questions shall be compulsory with internal choice within the questions.

Questions	Options	Marks	Questions on
1	Compulsory Sub-question A and Sub-question B or C	20	Unit I
2	Compulsory Sub-question A and Sub-question B or C	20	Unit II
3	Compulsory Sub-question A and Sub-question B or C	20	Unit III

Practical Examination Pattern (per Semester per course)

(A) Internal Examination: (40% Marks) 20 Marks

Heading	Practical I
One Class Test	15
Journal	05
Total	20

(B) External (Semester end practical examination): (30 Marks)

Questions	Options	Marks	Questions on
1	Sub-question A or Sub-question B	10	Unit I
2	Sub-question A or Sub-question B	10	Unit II
3	Sub-question A or Sub-question B	10	Unit III

PRACTICAL BOOK/JOURNAL

The students are required to present a duly certified journal for appearing at the practical examination, failing which they will **not be allowed to appear for the examination.**

In case of loss of Journal and/or Report, a Lost Certificate should be obtained from Head/ Co-ordinator / Incharge of the department; failing which the student will not be allowed to appear for the practical examination.

Overall Examination and Marks Distribution Pattern Per Semester

Course	RUASTA 301			RUASTA401			Grand Total
	Internal	External	Total	Internal	External	Total	
Theory	40	60	100	40	60	100	200
Practicals	20	30	50	20	30	50	100
Course	RUASTA 302			RUASTA402			Grand Total
	Internal	External	Total	Internal	External	Total	
Theory	40	60	100	40	60	100	200
Practicals	20	30	50	20	30	50	100

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RUIA COLLEGE

Explore ● Experience ● Excel

Syllabus for T.Y.B.A.

Program: B.A.

Course: STATISTICS (RUASTA)

(Credit Based Semester and Grading System with effect
from the academic year 2018–2019)

SEMESTER V

Course Code	UNIT	TITLE	Credits	L / Week
		PROBABILITY DISTRIBUTIONS		
RUASTA501	I	Univariate Random Variables. (Discrete and Continuous)	3	1
	II	Standard Discrete Probability Distributions.		1
	III	Bivariate Probability Distributions		1

Course Code	UNIT	TITLE	Credits	L / Week
		THEORY OF SAMPLING		
RUASTA502	I	Concepts of Sampling and Simple Random Sampling	3	1
	II	Stratified Sampling		1
	III	Ratio and Regression Estimation and Systematic Sampling		1

Course Code	UNIT	TITLE	Credits	L / Week
		APPLIED STATISTICS-I		
RUASTA503	I	Mortality tables	3	1
	II	Compound interest and annuities certain		1
	III	Life annuities and assurance benefits		1
RUASTAP501	Practical based on courses RUASTA501, RUASTA502 & RUASTA503		3	9

SEMESTER VI

Course code	UNIT	TITLE	Credits	L / Week
		PROBABILITY AND SAMPLING DISTRIBUTIONS		
RUASTA601	I	Standard Continuous Probability Distributions, Normal Distribution.	3	1
	II	Chi-Square Distribution		1
	III	t-Distribution and F Distribution		1
		ANALYSIS OF VARIANCE & DESIGN OF EXPERIMENTS		
RUASTA602	I	Analysis of Variance.	3	1
	II	Design Of Experiments, Completely Randomized design & Randomized Block Design		1
	III	Latin Square Design & Factorial Experiments		1
		APPLIED STATISTICS-II		
RUASTA603	I	Linear Regression	3	1
	II	Simulation		1
	III	Decision Theory and Game Theory		1
RUASTAP601		Practicals Based on Courses RUASTA601 RUASTA602, RUASTA603	3	9

Academic year 2018-19

Learning Objectives:

In the second year, there will be three courses in Statistics per semester. The following are the objectives of these courses:

1. To enable learners with the concepts of probability distributions and its applications.
2. To equip learners with methods of sampling and designs of experiments
3. To equip learners to use different sampling techniques and designs of experiments in various real life situations.
4. To equip learners to calculate present values and accumulated values of different types of annuities
5. To equip learners with requisite optimization techniques that they can employ.
6. To understand statistical quality control techniques and its applications using mathematical methods and their graphical representation.

Learning Outcomes:

1. Learners will be able to choose and apply appropriate statistical techniques to solve problems in different fields.
2. Learners will be able to use different sampling techniques and designs of experiments in various real life situations.
3. Student will be able to engage in interpretation of wide range of information from variety of disciplines including quantitative analysis.
4. Learners will be able to use optimization techniques in real life situation
5. Learners will be able to calculate values of different types of annuities and also the premiums

SEMESTER V

RUASTA501	PROBABILITY DISTRIBUTIONS	Lectures
Unit I	**Univariate Random Variables (Discrete and Continuous):** • Moment Generating Function, Cumulant generating Function- Their important properties. Relationship between moments and cumulants and their uses. • Characteristic Function- Its properties (without proof). • Transformation of random Variable	**15 Lectures**
Unit II	**Standard Discrete Probability Distributions:** • Uniform, Bernoulli, Binomial, Poisson, Geometric, Negative Binomial &Hypergeometric distributions. • The following aspects of the above distributions(wherever applicable) to be discussed: • Mean, Mode and Standard deviation. Moment Generating Function, Cumulant Generating Function, Additive property, Recurrence relation for central Moments, Skewness and Kurtosis (without proof), Limiting distribution.	**15 Lectures**
Unit III	**Bivariate Probability Distributions:** • Joint Probability mass function for Discrete random variables, • Joint Probability density function for continuous random variables. Their properties. • Marginal and conditional Distributions. Independence of Random Variables. Conditional Expectation & Variance. • Regression Function. Coefficient of Correlation. • Transformation of Random Variables(single and double) and Jacobian of transformation with illustrations.	**15 Lectures**

REFERENCES:

1. A. M. Mood, F.A. Graybill, D. C. Boyes, Third Edition; McGraw-Hill Book Company. Introduction to the theory of statistics

2. R.V. Hogg, A.T. Craig; Fourth Edition; Collier McMillan Publishers: Introduction to Mathematical Statistics

3. R.V. Hogg, E. A. Tannis, Third Edition; Collier McMillan Publishers: Probability and Statistical Inference

4. I. Miller, M. Miller; Sixth Edition; Pearson Education Inc.: John E. Freund's Mathematical Statistics

5. P.G. Hoel; Fourth Edition; John Wiley & Sons Inc.: Introduction to Mathematical Statistics

6. S.C. Gupta, V.K. Kapoor; Eighth Edition; Sultan Chand & Sons.: Fundamentals of Mathematical Statistics

7. J.N. Kapur, H.C. Saxena; Fifteenth Edition; S. Chand & Company Ltd.: Mathematical Statistics

8. J. Medhi; Second edition; Wiley Eastern Ltd.: Statistical Methods: An Introductory Text

9. A.M. Goon, M.K. Gupta, B. DasGupta; Third Edition; The World Press Pvt. Ltd.: An Outline of Statistical Theory Vol. 1

RUASTA502	THEORY OF SAMPLING	
Unit I	**Concepts:** • Population, Population unit, Sample, Sample unit, Parameter, Statistic, Estimator, Bias, Unbiasedness, Mean square error & Standard error. • Census survey, Sample Survey. Steps in conducting a sample survey. Concepts of Sampling and Non-sampling errors. • Concepts and methods of Probability and Non Probability sampling.	15 Lectures

	Simple Random Sampling: (SRS).	
	- Description of Simple Random Sampling with & without replacement. - Lottery method & use of Random numbers to select Simple random sample. - Estimation of population mean & total. Expectation & Variance of the estimators, Unbiased estimator of variance of these estimators. - Estimation of population proportion. Expectation & Variance of the estimators, - Unbiased estimator of variance of these estimators. - Estimation of Sample size based on a desired accuracy in case of SRS for variables & attributes.	
Unit II	**Stratified Sampling:** - Need for Stratification of population with suitable examples. Description of Stratified Random Sample. - Advantages of stratified random Sampling. **Stratified Random Sampling:** - Estimation of population mean & total in case of Stratified Random Sampling (WOR within each stratum). Expectation & Variance of the unbiased estimators, Unbiased estimators of variances of these estimators. - Equal Allocation, Proportional allocation, Optimum allocation with and without varying costs. - Comparison of Simple Random Sampling, Stratified Random Sampling using - Proportional allocation & Neyman allocation	15 Lectures

Unit III	a. Ratio & Regression Estimation assuming SRSWOR:	15 Lectures
	• Ratio Estimators for population Ratio, Mean & Total. Expectation & MSE of the Estimators. Estimators of MSE. Uses of Ratio Estimator.	
	• Regression Estimators for population Mean & Total. Expectation & Variance of the Estimators assuming known value of regression coefficient 'b'.	
	• Estimation of 'b'. Resulting variance of the estimators. Uses of regression	
	• Estimator. Comparison of Ratio, Regression & mean per Unit estimators.	
	b. **Systematic sampling**: Estimator of Population Mean and its Variance. Comparison of Systematic Sampling with Simple Random sampling. Introduction to Cluster sampling & Two Stage sampling with suitable illustrations.	

REFERENCES:

1. W.G. Cochran; 3rd Edition; Wiley (1978): Sampling Techniques

2. M. N. Murthy; Statistical Publishing Society. (1967): Sampling Theory and methods

3. Des Raj; McGraw Hill Series in Probability and Statistics. (1968): Sampling Theory

4. P.V. Sukhatme and B.V. Sukhatme; 3rd Edition; Iowa State University Press (1984): Sampling Theory of Surveys with Applications

5. S. C. Gupta and V.K. Kapoor; 3rd Edition; Sultan Chand and Sons (2001): Fundamentals of Applied Statistics

6. Daroga Singh, F.S.Chaudhary, Wiley Eastern Ltd. (1986): Theory and Analysis of Sample Survey Designs:

7. S. Sampath, Second Edition (2005), Narosa: Sampling Theory and Methods

8. Parimal Mukhopadhyay, (1998), Prentice Hall Of India Pvt. Ltd.: Theory and Methods of Survey Sampling

RUASTA503	**ELEMENTS OF ACTUARIAL SCIENCE**	**Lectures**
Unit I	**MORTALITY TABLES:** • Various mortality functions. Probabilities of living and dying. • The force of mortality. Estimation of μ_x from the mortality table. • Central Mortality Rate. Laws of mortality: Gompertz's and Makeham's first law. Select, Ultimate and Aggregate mortality tables. Stationary population. Expectation of life and Average life at death.	**15 Lectures**
Unit II:	**COMPOUND INTEREST AND ANNUITIES CERTAIN:** • Accumulated value and present value, nominal and effective rates of interest. • Varying rates of interest. Equation of value. Equated time of payment. • Present and accumulated values of annuity certain (immediate and due) with and without deferment period. • Present value for perpetuity (immediate and due) with and without deferment Period. • Present and accumulated values of (i) increasing annuity (ii) increasing annuity when successive installments form i) arithmetic progression ii)Geometric progression • (iii) annuity with Frequency different from that with which interest is convertible. Redemption of loan.	**15 Lectures**

Unit III	**LIFE ANNUITIES AND ASSURANCE BENEFITS:**	**15**
	• Present value in terms of commutation functions of Life annuities and Temporary life annuities (immediate and due) with and without deferment period.	**Lectures**
	• Present values of Variable, increasing life annuities and increasing Temporary life annuities (immediate and due).	
	• Present value of Assurance benefits in terms of commutation functions of : (i) pure endowment assurance (ii) temporary assurance (iii) endowment assurance (iv) whole life assurance (v) special endowment assurance (vi) deferred temporary assurance	
	• Net premiums: Net level annual premiums (including limited period of payment) for various assurance plans.	
	• Office premiums.	
	• Double Endowment	

REFERENCES:
1. Kantiswaroop and Manmohan Gupta. 4th Edition; S Chand & Sons: Operations Research
2. Richard Broson. 2nd edition Tata Mcgraw Hill Publishing Company Ltd.: Schaum Series book in O.R.
3. Methods and Problems: Maurice Sasieni, Arthur Yaspan and Lawrence Friedman, (1959), John Wiley & Sons.: Operations Research
4. J K Sharma, (1989), Tata McGraw Hill Publishing Company Ltd.: Mathematical Models in Operations Research
5. Harvey M. Wagner, 2nd Edition, Prentice Hall of India Ltd.: Principles of Operations Research with Applications to Management Decisions
6. S.D.Sharma.11th edition, Kedar Nath Ram Nath & Company.: Operations Research
7. H. A.Taha.6th edition, Prentice Hall of India.: Operations Research
8. J.K.Sharma, (2001), MacMillan India Ltd.: Quantitative Techniques For Managerial Decisions

DISTRIBUTION OF TOPICS FOR PRACTICALS
SEMESTER-V
COURSE CODE RUASTAP501

Sr. No.	RUASTAP501(A)
1	Moment Generating Function, Moments.
2	Cumulant generating Function, Cumulants, Characteristic function.
3	Standard Discrete Distributions
4	Fitting Standard Discrete Distributions.
5	Bivariate Probability Distributions, Marginal & Conditional distributions, Conditional Mean, Conditional Variance, Correlation
6	Transformation of discrete & continuous random variables.
7	Applications of R.

Sr. No.	RUASTAP501(B)
1	Designing of Questionnaire.
2	Simple Random Sampling for Variables.
3	Simple Random Sampling for Attributes.
4	Estimation of Sample Size in Simple Random Sampling.
5	Stratified Random Sampling.
6	Ratio Estimation- Regression Estimation.
7	Systematic Sampling

Sr. No.	RUASTAP501(C)
5.4.1	Mortality tables 1
5.4.2	Mortality tables 2
5.4.3	Annuities 1
5.4.4	Annuities 2
5.4.5	Life annuities
5.4.6	Assurance benefits

Semester VI

RUASTA601	PROBABILITY AND SAMPLING DISTRIBUTIONS	Lectures
Unit I	**Standard Continuous Probability Distributions:** • Rectangular, Triangular, Exponential, Gamma (with Single & Double parameter), Beta (Type I & Type II). • The following aspects of the above distributions(wherever applicable) to be discussed: • Mean, Median, Mode & Standard deviation. Moment Generating Function, Additive property, Cumulant Generating Function. Skewness and Kurtosis (without proof). Interrelation between the distributions. **Normal Distribution:** • Mean, Median, Mode, Standard deviation, Moment Generating function, Cumulant Generating function, Moments &Cumulants (up to fourth order). Recurrence relation for central moments, skewness& kurtosis, Mean absolute deviation. Distribution of linear function of independent Normal variables. Fitting of Normal Distribution. • Central Limit theorem for i.i.d. random variables. • Log Normal Distribution: Derivation of mean & variance.	**15 Lectures**
Unit II	**Chi-Square Distribution:** • Concept of degrees of freedom. Mean, Median, Mode & Standard deviation. • Moment generating function, Cumulant generating function. Additive property, Distribution of the sum of squares of independent Standard Normal variables. • Sampling distributions of sample mean and sample variance and their independence for a sample drawn from Normal distribution (without proof).	**15 Lectures**

	Applications of Chi-Square:	
	• Test of significance for specified value of variance of a Normal population.	
	• Test for goodness of fit & Test for independence of attributes (derivation of	
	• test statistics is not expected)	
Unit III	**t-distribution:**	**15 Lectures**
	• Mean, Median, Mode & Standard deviation. Derivation of t Distribution using Fisher's t. Student's t. Asymptotic properties.	
	Applications of t:	
	• Confidence interval for: Mean of Normal population, difference between means of two independent Normal populations having the same variance.	
	• Test of significance of: mean of a Normal population, difference in means of two Normal populations (based on: (i) independent samples with equal variances. (Effect Size, Cohen's d) (ii) dependent samples).	
	F-distribution:	
	• Mean, Mode & Standard deviation. Distribution of: reciprocal of an F variate, Ratio of two independent Chi-squares divided by their respective degrees of freedom.	
	• Interrelationship of F with: t-distribution, Chi-square distribution & Normal distribution.	
	Applications of F: Test for equality of variances of two independent Normal populations.	

REFERENCES:

1. A M Mood, F.A. Graybill, D C Boyes; Third Edition; McGraw-Hill Book Company.: Introduction to the theory of statistics

2. R.V.Hogg, A.T. Craig; Fourth Edition; Collier McMillan Publishers.: Introduction to Mathematical Statistics

3. R.V.Hogg, E. A.Tannis, Third Edition; Collier McMillan Publishers.: Probability and Statistical Inference

4. I. Miller, M. Miller; Sixth Edition; Pearson Education Inc.: John E. Freund's Mathematical Statistics

5. P.G. Hoel; Fourth Edition; John Wiley & Sons Inc.: Introduction to Mathematical Statistics

6. S.C. Gupta, V.K. Kapoor; Eighth Edition; Sultan Chand & Sons.: Fundamentals of Mathematical Statistics

7. J.N. Kapur, H.C. Saxena; Fifteenth Edition; S. Chand & Company Ltd.: Mathematical Statistics

8. J. Medhi; Second edition; Wiley Eastern Ltd.: Statistical Methods- An Introductory Text

9. A.M. Goon, M.K. Gupta, B. DasGupta; Third Edition; The World Press Pvt. Ltd.: An Outline of Statistical Theory Vol. 1

RUSSTA602	ANALYSIS OF VARIANCE & DESIGNS OF EXPERIMENTS	Lectures
Unit I	**Analysis of Variance:** • Introduction, Uses, Cochran's Theorem (Statement only). • One way classification with equal & unequal observations per class, • Two way classification with one observation per cell. • For both the cases: Mathematical Model, Assumptions, Expectation of various sums of squares, F- test, Analysis of variance table. Least square estimators of the parameters, Expectation and Variance of the estimators, Estimation of linear contrasts, Standard Error and Confidence limits Testing for significance of elementary linear contrasts.	15
Unit II	**Design Of Experiments:** • Concepts of Experiments, Experimental unit, Treatment, Yield, Block, • Replicate, Experimental Error, Precision. • Principles of Design of Experiments: Replication, Randomization & Local Control. • Efficiency of design D_1 with respect to design D_2. • Choice of size, shape of plots & blocks in agricultural & non agricultural experiments. **Completely Randomized Design (CRD) & Randomized Block Design (RBD):** • Mathematical Model, Assumptions, Expectation of various sums of squares, F-test, Analysis of variance table. • Least square estimators of the parameters, Variance of the estimators, Estimation of linear contrasts, Standard Error and Confidence limits Testing for significance of elementary linear contrasts. Efficiency of RBD relative to a CRD.	15 **Lectures**

Unit III	**Latin Square Design (LSD):**	15
	• Mathematical Model, Assumptions, Expectation of various sums of squares, F-test, Analysis of variance table.	**Lectures**
	• Least square estimators of the parameters, Variance of the estimators, Estimation of treatment contrasts, Standard error and Confidence limits for elementary treatment contrasts.	
	• Efficiency of the design relative to RBD, CRD.	
	• Missing plot technique for one missing observation in case of CRD, RBD & LSD.	
	Factorial Experiments:	
	• Definition, Purpose & Advantages. 2^2, 2^3 Experiments.	
	• Calculation of Main & interaction Effects. Yates' method. Analysis of 2^2 & 2^3 factorial Experiments. Concept of Confounding. **(partial and total)**	

REFERENCES:

1. W.G. Cochran and G.M.Cox; Second Edition;John Wiley and Sons.: Experimental Designs

2. Oscar Kempthorne, John Wiley and Sons.: The Design and Analysis of Experiments

3. Douglas C Montgomery; 6th Edition;John Wiley & Sons.: Design and Analysis of Experiments

4. M.N.Das and N.C.Giri, 2nd Edition; New Age International (P) Limited; 1986: Design and Analysis of Experiments

5. Walter T Federer; Oxford & IBH Publishing Co. Pvt. Ltd.: Experimental Design, Theory and Application

6. S.C.Gupta and V.K.Kapoor; 3rd Edition; Sultan Chand and Sons (2001): Fundamentals of Applied Statistics

7. B.J. Winer, McGraw Hill Book Company.: Statistical Principles in Experimental Design

RUASTA603	APPLIED STATISTICS-II	Lectures

Unit I	**LINEAR REGRESSION I**
	
	• Linear regression model with one or more explanatory variables. Assumptions of the model, Derivation of Ordinary Least Square (OLS) estimators of regression coefficients, (for one and two explanatory variables models). Properties of least square estimators (without proof). Coefficient of determination R^2 and adjusted R^2.
	
	• Procedure of testing :
	    ➢ Overall significance of the model
	    ➢ Significance of individual coefficients
	
	• Significance of incremental contribution of explanatory variable for two explanatory variables model.
	
	• Confidence intervals for the regression coefficients.
	
	• Multiple Linear Regression with Qualitative Independent Variable.
	
	• Autocorrelation, Multicollinearity, Heteroscedasticity : Concept Only
		15 Lectures

Unit II	**SIMULATION** • Scope of simulation applications. Types of simulation. Monte Carlo Technique of Simulation. Bootstrapping. • Elements of discrete event simulation. • Generation of random numbers. Sampling from probability distribution. Inverse method. Generation of random observations from i) Uniform distribution ii) Exponential distribution iii) Gamma distribution, iv) Normal distribution. • Applications of Simulation techniques to real life situation.	**15 Lectures**

Unit III	**GAME THEORY:**	**15**
	• Definitions of Two-person Zero Sum Game, Saddle Point, Value of the Game, Pure and Mixed strategy. Optimal solution of two person zero sum games.	**Lectures**
	• Dominance property, Derivation of formulae for (2x2) game.	
	• Graphical solution of (2xn) and (mx2) games. Solution to Game using Linear Programming Approach.	
	DECISION THEORY	
	• Decision making under uncertainty: Laplace criterion, Maximax (Minimin) criterion, Maximin (Minimax) criterion, Hurwicz α criterion, Minimax Regret criterion.	
	• Decision making under risk: Expected Monetary Value criterion, Expected Opportunity Loss criterion, EPPI, EVPI. Bayesian Decision rule for Posterior analysis.	
	• Decision tree analysis.	

REFERENCES:

1. E.L. Grant. (2nd edition) McGraw Hill, 1988.: Statistical Quality Control
2. Duncan. (3rd edition) D. Taraporewala sons & company.: Quality Control and Industrial Statistics
3. Bertrand L. Hansen, (1973), Prentice Hall of India Pvt. Ltd.: Quality Control: Theory and Applications
4. Douglas Montgomery, Arizona State University. John Wiley & Sons, Inc. (6th Edition): Statistical Quality Control
5. Gupta S.C., Kapoor V.K., Fundamentals of Applied Statistics, Sultan Chand &Sons
6. Srinath. 2nd edition, East-west press Pvt. Ltd.: PERT and CPM, Principles and Applications
7. Kantiswaroop and Manmohan Gupta. 4th Edition; S Chand & Sons.: Operations Research

8. Richard Broson. 2nd edition Tata Mcgraw Hill Publishing Company Ltd.: Schaum Series book in O.R.

9. Maurice Sasieni, Arthur Yaspan and Lawrence Friedman, (1959), John Wiley & Sons.: Operations Research: Methods and Problems

10. J K Sharma, (1989), Tata McGraw Hill Publishing Company Ltd.: Mathematical Models in Operations Research

11. S.D.Sharma.11th edition, Kedar Nath Ram Nath & Company.: Operations Research

12. H. A. Taha, 6th edition, Prentice Hall of India.: Operations Research

13. J.K.Sharma, (2001), MacMillan India Ltd.: Quantitative Techniques for Managerial Decisions

DISTRIBUTION OF TOPICS FOR PRACTICALS
SEMESTER-VI

COURSE CODE RUASTAP601

Sr. No.	Course Code: RUASTAP601(A) PROBABILITY AND SAMPLING DISTRIBUTIONS
1	Standard Continuous distributions.
2	Normal Distribution
3	Central Limit Theorem
4	Chi Square distribution
5	t distribution
6	F distribution
7	Practical using Excel, R software

Sr. No.	Course Code: RUASTAP601(B) ANALYSIS OF VARIANCE & DESIGN OF EXPERIMENTS
1	Analysis of Variance- One Way
2	Analysis of Variance- Two Way
3	Completely Randomized Design
4	Randomized Block Design
5	Latin Square Design.
6	Missing Observations in CRD, RBD & LSD
7	Factorial Experiments
8	Practical using Excel and R software

Sr. No.	Course Code: RUASTAP601(C) APPLIED STATISTICS-II
1	Multiple regression model -1
2	Simulation
3	Decision Theory-1
4	Decision Theory-2
5	Game Theory
6	Use of R in MLR

MODALITY OF ASSESSMENT

Theory Examination Pattern: (per Semester per course)

A) Internal Assessment :- 40% (40 marks)

Sr. No.	Evaluation type	Marks
1	One Class Test / Project / Assignment / Presentation	20
2	One Class Test (multiple choice questions / objective) / Project / Assignment / Presentation	20

B) External examination - (60 %) : 60 Marks

Semester End Theory Assessment – (60 marks)

    i.   Duration - These examinations shall be of **TWO** **hours** duration.

    ii.   Paper Pattern:

1. There shall be **THREE** questions each of **20** marks, there will be one question on each unit.
2. All questions shall be compulsory with internal choice within the questions.

Questions	Options	Marks	Questions on
1	Compulsory Sub-question A and Sub-question B or C	20	Unit I
2	Compulsory Sub-question A and Sub-question B or C	20	Unit II
3	Compulsory Sub-question A and Sub-question B or C	20	Unit III

Practical Examination Pattern (per Semester per course)

(A) Internal Examination: (40% Marks) 20 Marks

Heading	Practical I
One Class Test	15
Journal	05
Total	20

(B) External (Semester end practical examination): (30 Marks)

Questions	Options	Marks	Questions on
1	Sub-question A or Sub-question B	10	Unit I
2	Sub-question A or Sub-question B	10	Unit II
3	Sub-question A or Sub-question B	10	Unit III

PRACTICAL BOOK/JOURNAL

The students are required to present a duly certified journal for appearing at the practical examination, failing which they will **not be allowed to appear for the examination.**

In case of loss of Journal and/or Report, a Lost Certificate should be obtained from Head/ Co-ordinator / Incharge of the department; failing which the student will not be allowed to appear for the practical examination.

Overall Examination and Marks Distribution Pattern Per Semester

Course	RUASTA 501			RUASTA601			Grand Total
	Internal	External	Total	Internal	External	Total	
Theory	40	60	100	40	60	100	200
Practicals	20	30	50	20	30	50	100
Course	RUASTA 502			RUASTA602			Grand Total
	Internal	External	Total	Internal	External	Total	
Theory	40	60	100	40	60	100	200
Practicals	20	30	50	20	30	50	100
Course	RUASTA 503			RUASTA603			Grand Total
	Internal	External	Total	Internal	External	Total	
Theory	40	60	100	40	60	100	200
Practicals	20	30	50	20	30	50	100

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