

S. P. Mandali's
Ramnarain Ruia Autonomous College
(Affiliated to University of Mumbai)



Syllabus for S.Y.B.A.

Program: B. A.

Program Code: (STATISTICS) RUASTA

(Choice Based Credit System for academic
year 2023–2024)

GRADUATE ATTRIBUTES

S. P. Mandali's Ramnarain Ruia Autonomous College has adopted the Outcome Based Education model to make its science graduates globally competent and capable of advancing in their careers. The Bachelors Program in Science also encourages students to reflect on the broader purpose of their education.

GA	GA Description
	A student completing Bachelor's Degree in Arts program will be able to:
GA 1	Demonstrate understanding and skills of application of knowledge of historical and contemporary issues in the social and linguistic settings with a transdisciplinary perspective to make an informed judgement.
GA 2	Analyse and evaluate theories of individual and social behaviour in the familiar contexts and extrapolate to unfamiliar contexts in order to resolve contemporary issues.
GA 3	Effectively and ethically use concepts, vocabularies, methods and modern technologies in human sciences to make meaningful contribution in creation of information and its effective dissemination
GA 4	Explore critical issues, ideas, phenomena and debates to define problems or to formulate hypotheses; as well as analyse evidences to formulate an opinion, identify strategies, evaluate outcomes, draw conclusions and/or develop and implement solutions.
GA 5	Demonstrate oral and written proficiency to analyse and synthesise information and apply a set of cognitive, affective, and behavioral skills to work individually and with diverse groups to foster personal growth and better appreciate the diverse social world in which we live.
GA 6	Develop a clear understanding of social institutional structures, systems, procedures, and policies existing across cultures, and interpret, compare and contrast ideas in diverse social- cultural contexts, to engage reasonably with diverse groups.
GA 7	React thoughtfully with emotional and moral competence to forms of expressive direct action and apply social strategies toward eradicating threats to a democratic society and a healthy planet.



GA 8	Articulate and apply values, principles, and ideals to the current societal challenges by integrating management and leadership skills to enhance the quality of life in the civic community through actions that enrich individual lives and benefit the community.
GA 9	Recognize and appreciate the diversity of human experience and thought, and apply intellect and creativity to contemporary scenario, to promote individual growth by practicing lifelong learning.

PROGRAM OUTCOMES

PO	Description
	A student completing Bachelor's Degree in Arts program in the subject of Statistics will be able to:
PO 1	Understand, condense, visualize, analyze and interpret various data types generated in various scenarios of scientific, industrial, or social problems.
PO 2	Apply Statistical tools for data analysis.
PO 3	Pursue their higher education programs leading to post-graduate and/or doctoral degrees in Statistics, Data Science, Business Analytics, Biostatistics, Econometrics, Management Studies.
PO 4	Compete globally to enter into promising careers.
PO 5	Make a pathway to a range of traditional avenues in Academia and Industry, Govt. Service, IAS, Indian Statistical/ Economic Services, Industries, Commerce, Investment Banking, Banks and Insurance Sectors, CSO and NSSO, Research Personnel/Investigator in Govt. organizations such as NCAER, IAMR, ICMR, Statistical and Economic Bureau & various PSUs., Market Research, Actuarial Sciences, Biostatistics, Demography etc.
PO 6	Seek employment or self-employment in different sectors like Stock trading, Pharmaceutical sector, Sports, Politics, Business, Financial



	services and Media Industry.
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COURSE OUTLINE

YEAR	SEM	COURSE CODE	COURSE TITLE	CREDITS
SYBA	III	RUASTA301	STATISTICAL METHODS - I	2
SYBA	III	RUASTA302	OPERATIONS RESEARCH	2
SYBA	III	RUASTAP301	Practical based on RUASTA301 & RUASTA302	2
SYBA	IV	RUASTA401	STATISTICAL METHODS – II	2
SYBA	IV	RUASTA402	PROJECT MANAGEMENT AND INDUSTRIAL STATISTICS	2
SYBA	IV	RUASTAP401	Practical based on RUASTA401 & RUASTA402	2

Course Code: RUASTA301
Course Title: STATISTICAL METHODS- I
Academic year 2023-24

COURSE OUTCOMES:

COURSE OUTCOME	DESCRIPTION
	A student completing this course will be able to:
CO 1	Explain and distinguish between random and non-random experiments, highlighting their respective characteristics.
CO 2	Calculate the probabilities associated with events and investigate their independence
CO 3	Grasp the notion of a random variable, analyze its probability distribution in both Univariate and Bivariate contexts, and utilize its properties effectively.
CO 4	Use standard discrete probability distributions to analyze real-life data scenarios.

DETAILED SYLLABUS

Course Code/ Unit	Unit	Course/ Unit Title	Credits/ Lectures
RUASTA301	Unit I	Elementary Probability Theory <ul style="list-style-type: none"> • 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
RUASTA301	Unit	Discrete random variable <ul style="list-style-type: none"> • Random variable. Definition and properties of 	15

	II	<p>probability distribution and cumulative distribution function of discrete random variable.</p> <ul style="list-style-type: none"> • Raw and Central moments and their relationships. • Concepts of Skewness and Kurtosis and their uses. • Expectation of a random variable. Theorems on Expectation & Variance. • 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. 	Lectures
RUASTA301	Unit III	<p>Some Standard Discrete Distributions</p> <ul style="list-style-type: none"> • Degenerate (one point): Discrete Uniform, Bernoulli, Binomial, Poisson and Hypergeometric distributions derivation of their mean and variance for all the above distributions. • Recurrence relationship for probabilities of Binomial and Poisson distributions, Poisson approximation to Binomial distribution, Binomial approximation to hypergeometric distribution 	15 Lectures

Distribution of topics for Practicals

Course Code RUASTAP301(A)	
Sr. No.	Practicals based on course
1	Probability
2	Discrete Random Variables
3	Bivariate Probability Distributions
4	Binomial Distribution
5	Poisson Distribution
6	Hypergeometric Distribution
7	Practical using Excel <ul style="list-style-type: none"> i) Binomial distribution ii) Poisson distribution iii) Hypergeometric distribution

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. Pitan Jim: "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

Course Code: RUASTA302
Course Title: OPERATIONS RESEARCH
Academic year 2023-24

COURSE OUTCOMES:

COURSE OUTCOME	DESCRIPTION
CO 1	Develop and resolve linear programming problems through graphical methods and the simplex method.
CO 2	Optimize transportation problems, assignment problems, and their variations.
CO 3	Create and establish the connection between the primal and dual forms of a given linear programming problem.
CO 4	Solve process sequencing problems utilizing Johnson's Method.

DETAILED SYLLABUS

Course Code/ Unit	Unit	Course/ Unit Title	Credits/ Lectures
RUASTA302	Unit I	Linear Programming Problem (L.P.P.): <ul style="list-style-type: none"> • 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
RUASTA302	Unit II	Transportation Problem: <ul style="list-style-type: none"> • 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
RUASTA302	Unit III	Assignment Problem: <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> • Processing n Jobs through 2 and 3 Machines, 2 Jobs through m Machines and n jobs through m machines 	15 Lectures

Distribution of topics for Practicals

Course Code RUASTAP301(B)	
Sr. No.	Practicals based on course
1	Formulation and Graphical Solution of L.P.P.
2	Simplex Method.
3	Duality.
4	Transportation.
5	Assignment.
6	Sequencing.
7	Problems solving using TORA / EXCEL Solver.

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

Modality of Assessment

Theory Examination Pattern:

A) Internal Assessment- 40%- 40 Marks

Sr No	Evaluation type	Marks
1	Class Test/ Project / Assignment / Presentation	20
2	Class Test/ Project / Assignment / Presentation	20
	TOTAL	40

B) External Examination- 60%- 60 Marks

Semester End Theory Examination:

1. Duration - These examinations shall be of **two hours duration**.
2. Theory question paper pattern:

Paper Pattern:

Question	Options	Marks	Questions Based on
1	Any 2 out of 3 subparts	20	Unit I
2	Any 2 out of 3 subparts	20	Unit II
3	Any 2 out of 3 subparts	20	Unit III
	TOTAL	60	

Practical Examination Pattern:

A) Internal Examination: 40%- 40 Marks

Particulars	Marks
Journal and attendance	5
Assignments using Statistical Software	15
Total	20

B) External Examination: 60%- 60 Marks**Semester End Practical Examination:**Duration - These examinations shall be of **one and half hour** duration.

Particulars	Paper
Exam (There shall be Three COMPULSORY Questions of 10 marks each with internal choice)	30
Total	30

Overall Examination & Marks Distribution Pattern**Semester III**

Course	RUASTA301			RUASTA302			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 Code: RUASTA401**Course Title: STATISTICAL METHODS - II****Academic year 2023-24****COURSE OUTCOMES:**

COURSE OUTCOME	DESCRIPTION
	A student completing this course will be able to:
CO 1	Derive probability density functions and cumulative distribution functions for continuous random variables.
CO 2	Utilize standard continuous probability distributions to analyze diverse situations
CO 3	Differentiate between point estimation and interval estimation methodologies
CO 4	Develop different types of hypotheses and conduct hypothesis testing using large samples.

DETAILED SYLLABUS

Course Code/ Unit	Unit	Course/ Unit Title	Credits/ Lectures
RUASTA401	UNIT I	Continuous random variable and some Standard Continuous Distributions <ul style="list-style-type: none"> • 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. 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 for Uniform and Exponential distributions. 	15 Lectures
RUASTA401	UNIT II	Normal Distribution and Sampling Distribution <ul style="list-style-type: none"> • 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 difference between two population means and two proportions. • Standard errors of sample mean and sample proportion. 	15 Lectures
RUASTA401	UNIT III	Basics of Theory of Estimation and Testing of hypothesis <ul style="list-style-type: none"> • 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 	15 Lectures



	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	
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Distribution of topics for Practicals

Course Code RUA STAP401(A)	
Sr. No.	Practicals based on course
1	Continuous Random Variables
2	Uniform and Exponential Distributions
3	Normal Distribution
4	Sampling Distribution
5	Testing of Hypothesis
6	Large sample Tests
7	Practical using Excel and R (i) Binomial and Poisson (ii) Uniform and Exponential (iii) Normal Distribution (iv) Sampling Distribution (v) Testing of Hypotheses (vi) Large Sample Tests

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. Pitan Jim: "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

Course Code: RUASTA402

Course Title: PROJECT MANAGEMENT AND INDUSTRIAL STATISTICS

Academic year 2023-24

COURSE OUTCOMES:

COURSE OUTCOME	DESCRIPTION
	A student completing this course will be able to:
CO 1	CO 1: Create project networks depicting both probabilistic and deterministic time estimates to identify critical paths. Illustrate decision networks.
CO 2	Accelerate activities to minimize project costs and regularly revise networks.
CO 3	Develop diverse control charts for variables and attributes to establish standard benchmarks for future reference.
CO 4	Devise a single sampling plan, analyze its characteristics, and comprehend the principles behind Double Sampling Plans.
CO 5	Assess various types of games and appraise decision-making processes across different scenarios.

DETAILED SYLLABUS

Course Code/ Unit	Unit	Course/ Unit Title	Credits/ Lectures
RUASTA402	Unit I	CPM and PERT: <ul style="list-style-type: none"> • 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
RUASTA402	Unit	Statistical Quality Control:	15



	II	<ul style="list-style-type: none"> Principles of control. Process quality control of variables. \bar{X} and R, \bar{X} and Sigma Chart and their uses. Problems involving setting up standards for future use. Introduction to Six sigma limits. Concept of Natural Tolerance Limits, Specification Limits and Detection of shift 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) 	Lectures
RUASTA402	Unit III	<p>Game Theory and Decision Theory:</p> <ul style="list-style-type: none"> <u>GAME THEORY:</u> 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. Dominance property, Derivation of formulae for (2×2) game. Graphical solution of $(2 \times n)$ and $(m \times 2)$ games. <u>DECISION THEORY</u> 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. Decision tree analysis. 	15 Lectures

Distribution of topics for Practicals

Course Code: RUASTAP401(B)	
Sr. No.	Practicals based on course

1	PERT
2	CPM
3	Project cost analysis
4	Updating
5	Control Charts for attributes and Control Charts for variables
6	Acceptance Sampling Plans.
7	Game theory.
8	Decision theory.
9	Practical using EXCEL and TORA software

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.
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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

Modality of Assessment

Theory Examination Pattern:

A) Internal Assessment- 40%- 40 Marks

Sr No	Evaluation type	Marks
1	Class Test/ Project / Assignment / Presentation	20
2	Class Test/ Project / Assignment / Presentation	20
	TOTAL	40

B) External Examination- 60%- 60 Marks

Semester End Theory Examination:

1. Duration - These examinations shall be of **two hours** duration.
2. Theory question paper pattern:

Paper Pattern:

Question	Options	Marks	Questions Based on
1	Any 2 out of 3 subparts	20	Unit I
2	Any 2 out of 3 subparts	20	Unit II
3	Any 2 out of 3 subparts	20	Unit III
	TOTAL	60	

Practical Examination Pattern:

A) Internal Examination: 40%- 40 Marks

Particulars	Marks



Journal and attendance	5
Assignments using Statistical Software	15
Total	20

B) External Examination: 60%- 60 Marks

Semester End Practical Examination:

Duration - These examinations shall be of **one and half hour** duration.

Particulars	Paper
Exam (There shall be Three COMPULSORY Questions of 10 marks each with internal choice)	30
Total	30

Overall Examination & Marks Distribution Pattern

Semester IV

Course	RUASTA401			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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