

UNIVERSITY OF MUMBAI



**Syllabus for the S.Y.B.A.
Program: B.A.
Course :STATISTICS**

**(Choice Based Credit Grading Semester System
with effect from the academic year 2017–2018)**

S.Y.B.A. STATISTICS Syllabus
for Choice Based Credit Grading Semester System
To be implemented from the Academic year 2017-2018

Student must have passed 12th standard with mathematics. If not then he/she has to complete the required bridge course.

SEMESTER III

Course Code	UNIT	TOPICS	Credits	L / Week
UAST 301	I	Elementary Probability Theory:	2	1
	II	Concept of Discrete random variable and properties of its probability distribution		1
	III	Some Standard Discrete Distributions		1
UAST 302	I	Linear Programming Problem (L.P.P.)	2	1
	II	Transportation Problem		1
	III	Assignment Problem and Sequencing		1
UASTP3	Practicals based on both courses in theory		2	6
UASTP3				6
UASTP3(A)	Practicals based on UAST301		1	3
UASTP3(B)	Practicals based on UAST302		1	3

SEMESTER IV

Course Code	UNIT	TOPICS	Credits	L / Week	
UAST 401	I	Continuous random variable	2	1	
	II	Some Standard Continuous Distributions		1	
	III	Elementary topics on Estimation and Testing of hypothesis		1	
UAST 402	I	CPM and PERT	2	1	
	II	Game Theory		1	
	III	Decision Theory		1	
UASTP4	Practicals based on both courses in theory		2	6	
UASTP4				6	
UASTP4(A)			Practicals based on UAST401	1	3
UASTP4(B)			Practicals based on UAST402	1	3

SEMESTER III

Course Code	Title	Credits
UAST 301	STATISTICAL METHODS-1	2 Credits (45 lectures)
<p>Unit I: <u>Elementary Probability Theory:</u></p> <p>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. Axiomatic definition of probability. Theorems on Addition and Multiplication of probabilities, pair wise.(with proof) Independence of events and mutual independence for three-events. Conditional probability, Bayes' theorem (with proof) and its applications.</p>		15 Lectures
<p>Unit II : <u>Concept of Discrete random variable and properties of its probability distribution:</u></p> <p>Random variable. Definition and properties of probability distribution and cumulative distribution function of discrete random variable. Raw and Central moments (definition only) and their relationship. (upto order four without proof). Concepts of Skewness and Kurtosis and their uses. Expectation of a random variable. Theorems on Expectation and Variance. (with proof) Joint probability mass function of two discrete random variables. Marginal and conditional distributions. Covariance and Coefficient of Correlation. Independence of two random variables.</p>		15 Lectures
<p>Unit III : <u>Some Standard Discrete Distributions:</u></p> <p>Discrete Uniform, Binomial and Poisson distributions and derivation of their mean and variance. Recurrence relation for probabilities of Binomial and Poisson distributions and its applications (with derivations). Poisson approximation to Binomial distribution (Statement only). Hyper geometric distribution, Derivation of its mean and variance. Binomial approximation to hyper geometric distribution (statement only)</p>		15 Lectures

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

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

6. Hogg R.V. and Tannis E.P. : Probability and Statistical Inference.

McMillan Publishing Co. Inc.

7. PitanJim : Probability, Narosa Publishing House.

8. Goon A.M., Gupta M.K., Dasgupta B. : Fundamentals of Statistics, Volume II :

The World Press Private Limited, Calcutta.

Course Code	Title	Credits
UAST 302	OPERATIONS RESEARCH AND INDUSTRIAL STATISTICS-1	2 Credits (45 lectures)
<p>Unit I : <u>Linear Programming Problem (L.P.P.)</u> :</p> <p>Definition, Mathematical Formulation(Maximization and Minimization) Concepts of Solution, Feasible Solution, Basic Feasible Solution, Optimal solution, Slack, Surplus & Artificial variable,</p> <p>Standard form, Canonical form</p> <p>Graphical Method & Simplex Algorithm to obtain the solution to an L.P.P. Problems involving Unique Solution, Multiple Solution, Unbounded Solution and Infeasible Solution.</p> <p>Big M method.</p> <p>Concept of Duality & its economic interpretation.</p>		15 Lectures
<p>Unit II : <u>Transportation Problem</u></p> <p>Definition, Mathematical Formulation Concepts of Feasible solution, Basic feasible solution, Optimal and multiple solutions.</p> <p>Initial Basic Feasible Solution using</p> <p>(i) North-West Corner rule.(ii) Matrix Minima Method.</p> <p>(iii)Vogel's Approximation Method.</p> <p>MODI Method for optimality.</p> <p>Problems involving unique solution, multiple solutions, degeneracy, maximization, prohibited route(s) and production costs. Unbalanced Transportation problem.</p>		15 Lectures
<p>Unit III : <u>Assignment Problem and sequencing</u></p> <p>Definition, Mathematical formulation. Solution by Hungarian Method.</p> <p>Unbalanced Assignment problems.</p> <p>Problems involving Maximization & prohibited assignments</p> <p>Travelling salesman problem</p> <p>Sequencing :</p> <p>Processing n Jobs through 2 and 3 Machines and 2 jobs through m Machines.</p>		15 Lectures

REFERENCES

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

DISTRIBUTION OF TOPICS FOR PRACTICALS

SEMESTER-III

COURSE CODE UASTP3

Sr. No	Semester III .Course UASTP3(A)
1	Probability.
2	Discrete Random Variable
3	Bivariate Probability Distributions
4	Binomial distribution
5	Poisson distribution
6	Hyper geometric distribution

Sr. No	Semester III .Course UASTP3(B)
1	Formulation and Graphical Method
2	Simplex Method
3	Transportation
4	Assignment
5	Sequencing

SEMESTER IV

Course Code	Title	Credits
UAST 401	STATISTICAL METHODS-2	2 Credits (45 lectures)
<p>Unit I : <u>Continuous random variable:</u></p> <p>Concept of Continuous random variable and properties of its probability distribution Probability density function and cumulative distribution function. Their graphical representation. Expectation and variance of a random variable and its properties (with proof). Measures of location, dispersion, skewness and kurtosis. Raw and central moments (simple illustrations).</p>		15 Lectures
<p>Unit II : <u>Some Standard Continuous Distributions :</u></p> <p>Uniform, Exponential (location scale parameter) , memory less property of Exponential distribution (without proof) Cumulative distribution function, derivations of mean, median and variance for Uniform and Exponential distributions. Properties of Normal distribution (without proof). Normal approximation to Binomial and Poisson distribution (statement only). Use of normal tables.</p>		15 Lectures
<p>Unit III : <u>Elementary topics on Estimation and Testing of hypothesis:</u></p> <p>Sample from a distribution : Concept of a statistic, estimate, sampling distribution, Parameter and its estimator. Unbiasedness: Concept of bias and standard error of an estimator. Central Limit theorem (with proof). Sampling distribution of sample mean and sample proportion. (For large sample only) Standard errors of sample mean and sample proportion. Point estimate and interval estimate of single mean, single proportion from sample of large size.</p> <p>Statistical tests :</p> <p>Concept of hypothesis Null and alternate hypothesis, Types of errors, Critical region, Level of significance. Large sample tests (using central limit theorem, if necessary) 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 (Development of critical region is not expected.) Use of central limit theorem.</p>		15 Lectures

REFERENCES:

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

Course Code	Title	Credits
UAST 402	OPERATIONS RESEARCH AND INDUSTRIAL STATISTICS-2	2 Credits (45 lectures)
Unit I : <u>CPM and PERT</u> Concept of project as an organized effort with time management. 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 : <u>GAME THEORY</u> Definitions of Two persons 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 (2x2) game. Graphical solution of (2xn) and (mx2) games. Reduction of game theory to LPP		15 Lectures
Unit III : <u>DECISION THEORY</u> Decision making under uncertainty: Laplace criterion, Maximax (Minimin) criterion, Maximin (Minimax) criterion, Hurwitz 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 along with Posterior probabilities.		15 Lectures

REFERENCES

1. Schaum Series book in O.R. Richard Bronson. 2nd edition Tata McGraw Hill Publishing Company Ltd.
2. Operations Research: Methods and Problems: Maurice Sasieni, Arthur Yaspan and Lawrence Friedman,(1959), John Wiley & Sons.
3. Mathematical Models in Operations Research : J K Sharma, (1989), Tata McGraw Hill Publishing Company Ltd.
4. Principles of Operations Research with Applications to Management Decisions: Harvey M. Wagner, 2nd Edition, Prentice Hall of India Ltd.
5. Operations Research: S.D.Sharma.11th edition, KedarNath Ram Nath& Company.
6. Operations Research: H. A.Taha.6th edition, Prentice Hall of India.
7. PERT and CPM, Principles and Applications: Srinath. 2nd edition, East-west press Pvt. Ltd.
- 10 Kantiswarup, P.K. Gupta, Manmohan : Operations Research, Twelfth edition, Sultan Chand & sons
- 11 Bronson R. : Theory and problems of Operations research, First edition, Schaum's Outline series
- 12 Vora N. D. : Quantitative Techniques in Management, Third edition, McGraw Hill Companies.
- 13 Bannerjee B. : Operation Research Techniques for Management, First edition, Business Books

DISTRIBUTION OF TOPICS FOR PRACTICALS

SEMESTER-IV **COURSE CODE UASTP4**

Sr. No	Semester IV Course UASTP4(A)
1	Continuous Random Variables
2	Uniform, Exponential and Normal Distributions
3	Applications of central limit theorem and normal approximation
4	Testing of Hypothesis
5	Large Sample Tests

Sr. No	Semester IV Course UASTP4(B)
1	CPM- Drawing Network
2	CPM- Determination of Critical Path and related problems
3	PERT
4	Game Theory 1
5	Game theory 2
6	Decision Theory-1: Decisions Under Uncertainty
7	Decision Theory-2 : Decisions Under Risk
8	Decision Theory-3 : Decision Tree analysis.

Assessment of Practical Core Courses Per Semester per course

- | | | | |
|----|---------------------------------------|-------|-----------|
| 1. | Semester work, Documentation, Journal | | 10 Marks. |
| 2. | Semester End Practical Examination | ----- | 40 Marks |

Semester End Examination

Theory: At the end of the semester, Theory examination of three hours duration and 100 marks based on the three units shall be held for each course.

Pattern of **Theory question** paper at the end of the semester for each course :

There shall be Five Questions of twenty marks each.

Question 1 based on all Three units. Ten sub-questions of two marks each.

Question 2 based on Unit I (Attempt any TWO out of THREE)

Question 3 based on Unit II (Attempt any TWO out of THREE)

Question 4 based on Unit III (Attempt any TWO out of THREE)

Question 5 based on all Three Units combined. (Attempt any TWO out of THREE)

Practicals: At the end of the semester, Practical examination of 2 hours duration and 40 marks shall be held for **each course**.

Marks for term work in each paper should be given out of 10.(5 for viva and 5 for journal)

Pattern of **Practical question** paper at the end of the semester for each course :

There shall be Four Questions of ten marks each. Students should attempt all questions.

Question 1 based on Unit I, Question 2 based on Unit II, Question 3 based on Unit III,

Question 4 based on all Three Units combined.

Students should attempt **any two** sub questions out of the **three** in each Question.

Workload

Theory : 3 lectures per week per course.

Practicals: 3 lecture periods per course per week per batch. All three lecture periods of the practicals shall be conducted in succession together on a single day
