

Semester	Paper	Subject	Hrs.	Credits	IA	ES	Total
FIRST YEAR							
Semester I	Paper-I	Descriptive Statistics & Probability	4	3	40	60	100
Semester I	Paper-I	Practical's	2	2	50	0	50
Semester II	Paper-II	Mathematical Expectation and Probability Distributions	4	3	40	60	100
Semester II	Paper-II	Practical's	2	2	50	0	50
SECOND YEAR							
Semester III	Paper-III	Statistical Methods	4	3	40	60	100
Semester III	Paper-III	Practical's	2	2	50	0	50
Semester IV	Paper-IV	Statistical Inference	4	3	40	60	100
Semester IV	Paper-IV	Practical's	2	2	50	0	50
THIRD YEAR							
Semester V	Paper-V	Sampling Techniques & Design of Experiments	3	3	40	60	100
	Paper-V	Practical's	2	2	0	50	50
	Paper-VI	Quality and Reliability	3	3	40	60	100
	Paper-VI	Practical's	2	2	0	50	50
Semester VI	Paper-VII	Elective-I Applied Statistics	3	3	40	60	100
		Elective-II Demography & Vital Statistics	3	3	40	60	100
		Elective-III Forecasting Methods	3	3	40	60	100
	Paper-VII	Practical's	2	2	0	50	50
Semester VI	Cluster (A)	(A1) Optimization Techniques	3	3	40	60	100
		Practical	2	2	0	50	50
		(A2) Operations Research	3	3	40	60	100
		Practical	2	2	0	50	50
		(A3) Project & Viva Voce	5	5	40	60	100
	Cluster (B)	(B1) Advanced Experimental Designs	3	3	40	60	100
		Practical	2	2	0	50	50
		(B2) Actuarial Statistics	3	3	40	60	100

		Practical	2	2	0	50	50
		(B3)Project & Viva Voce	5	5	40	60	100
	Cluster (C)	(C1) Regression Models	3	3	40	60	100
		Practical	2	2	0	50	50
		(C2) Decision making analysis	3	3	40	60	100
		Practical	2	2	0	50	50
		(C3) Project & Viva Voce	5	5	40	60	100

B.Sc. SYLLABUS (Semester Wise) 2018-19

I B.Sc. Statistics/Semester-II
(With Mathematics Combination)
Mathematical Expectation and Probability Distributions
Paper - II

Total hrs.Per week: 04

Total credits: 03

Unit –I

Mathematical Expectation: Mathematical expectation (ME) of a random variable and function of a random variable. Moments and covariance using mathematical expectation with examples. Addition and multiplication theorems on expectation. Definitions of M.G.F, C.G.F, P.G.F, C.F its properties Chebyshev and Cauchy-Schwartz inequalities

Unit-II

Discrete distributions: Binomial and Poisson distributions, their definitions, it's to 4 central moments, M.G.F, C.F, C.G.F, P.G.F, mean, variance, additive property if exists Poisson approximation to Binomial distribution.

Unit-III

Negative binomial, Geometric and Hyper-geometric distributions- Definitions, means, Variances, M.G.F, C.F, C.G.F, P.G.F, reproductive property if exists Binomial approximation to Hyper-geometric Distribution, Poisson approximation to Negative binomial distribution.

Unit-IV

Continuous distributions: Rectangular, Exponential, Gamma. Other properties such as mean, variance, M.G.F, C.G.F, C.F, reproductive property.

Unit-V

Normal Distribution: Definition, Importance, Properties, M.G.F, additive properties, Interrelation between Normal and Binomial, Normal & Poisson distribution, Cauchy Distribution.

Additional Input: Compound Distribution –Poisson ,Binomial Distribution

Practical's-Semester-II

Conduct any 6 (MS-excel is compulsory)

- 1. Fitting of Binomial Distribution- Recurrence relation method**
- 2. Fitting of Poisson Distribution- Recurrence relation method**
- 3. Fitting of Negative Binomial Distribution.**
- 4. Fitting of Geometric Distribution.**
- 5. Fitting of Normal Distribution- Areas Method.**
- 6. Fitting of Normal Distribution- Ordinates method.**
- 7. MS-Excel methods for the above Serial Numbers 1 and 2**

Text Books:

1. V.K.Kapoor and S.C.Gupta: Fundamentals of Mathematical Statistics, Sultan
2. BA/BSc I year Statistics-descriptive statistics, probability distribution-Telugu Academy- Dr M.Jaganmohan Rao, Dr. N.Srinivasa Rao, Dr P.Tirupathi Rao, Smt. D.Vijayalakshmi.
3. K.V.S. Sarma: statistics Made Simple: do it yourself on PC. PHI
4. B.A/B.Sc Statistics Descriptive Statistics and Probability, Kalyani Publishers by D.V.L.N. Jogiraju, C. Srikala and L.P.Raj Kumar.

Reference books:

1. William Feller: Introduction to Probability theory and its applications.Volume –I, Wiley
2. GoonAM, Gupta MK, Das Gupta B: Fundamentals of Statistics, Vol-I, the world Press Pvt.Ltd. Kolkata.
3. Hoel P.G: Introduction to mathematical statistics, Asia Publishing house.
4. M.JaganMohan Rao and Papa Rao: A Text book of Statistics Paper-I.
5. Sanjay Arora and Bansi Lal: New Mathematical Statistics: Satya Prakashan, New Delhi.
6. Hogg.Tanis.Rao: Probability and Statistical Inference. 7th edition. Pearson.
7. Sambhavyata Avadhi Siddantalu—Telugu Academy.

I B.Sc. Statistics/Semester-II
(With Mathematics Combination)
Mathematical Expectation and Probability Distributions
Paper - II

MODEL QUESTION PAPER (THEORY)

Time: 3 hrs.

Maxmarks: 60

(Candidates are permitted to use Non-Programmable Calculators)

SECTION-A **5x4 = 20M**
Answer any FIVE Questions

1. Define Moment Generating Function. Write its properties
2. State Cauchy-Schwartz inequality
3. Define Variance and write its properties
4. Derive the M.G.F of Binomial distribution.
5. State the additive property of Poisson distribution.
6. Derive the mean of Rectangular distribution.
7. Write the importance of Normal distribution.
8. Write the properties of Cauchy distribution.

SECTION-B **4x8=32M**
Answer ALL the questions.

9 a) State and prove Addition and Multiplication theorems of expectation

(Or)

b) State and Prove Chebychev's inequality.

10a) Derive the mean and variance of Binomial distribution.

(Or)

b) Derive Poisson distribution as a limiting form of a binomial distribution.

11a) Define Geometric distribution. Derive its mean and variance.

(Or)

- b) What is a Hyper-Geometric distribution? Find Moment generating function And Characteristic function.
- 12a) Define Exponential distribution. Derive the memory less property of Exponential distribution.

(Or)

- b) Derive the interrelation between Normal and Binomial distributions.

SECTION – C

Answer Any FOUR of the following questions (4 x 2=8M)

13. Define Expectation and write any two properties of expectation
14. Write the mean and variance of Negative binomial distribution
15. Write any four applications of Poisson distribution
16. Write the properties of Normal distribution
17. Define Cauchy distribution
18. Write Reproductive Property

CBCS SYLLABUS (Semester Wise) 2018-19
II B.Sc. Statistics/Semester-IV
(With Mathematics Combination)
Statistical Inference

Paper – IV

Total hrs.Per week: 04 Total credits: 03-----

Unit – I

Theory of estimation: Estimation of a parameter, criteria of a good estimator-Unbiasedness, consistency, efficiency and sufficiency. Statement of Nyman's factorization theorem. Methods of Estimation

Additional Input: BLUE Estimator

Unit-II

Concepts of Statistical hypothesis: Null and Alternative hypothesis, critical region, two types of errors, level of significance and power of a test. One and two tailed tests. Nyman-Pearson's fundamental lemma. Examples in case of Binomial, Poisson, Exponential and Normal distributions.

Unit – III

Large sample tests: Large sample tests for single mean, two means, single proportion, two proportions, Standard deviation of single and double samples and Fisher's Z transformation.

Unit – IV

Small sample tests: Tests of significance based on χ^2 , t and F. χ^2 -test for goodness of fit and test for independence of attributes. T-test for single, double and paired tests, Variance Ratio Test (F-test).

Unit – V

Non-parametric tests: Advantages and disadvantages, two sample run test, two sample Median test and two sample sign test.

Practical's Semester (IV)

Conduct any 6 (MS-Excel is compulsory)

1. Large sample tests for mean(s)
2. Large sample tests for proportion(s)
3. Large sample test for standard deviation(s)
4. Large sample tests for Fisher's Z-transformation
5. Small sample tests for Single and Double-test
6. Small sample tests for Paired t-test
7. F-test
8. Chi-Square test for independence of attributes.
9. Non-Parametric tests-run test
10. Non-parametric tests-median test.
11. Non-Parametric tests-sign tests.
12. MS-Excel methods for the above serial numbers 1, 2, 3, 4(any one of above).

Text Books:

1. B.A/B.Sc II Year statistics–statistical methods and inference–Telugu Academy by A.Mohanrao, N.SrinivasaRao, Dr.R.Sudhakara Reddy,Dr.T.C. Ravichandrakumar
2. K.V.S.Sarma Statistics Made simple: Do it yourself on PC, PHI.
3. B.A/B.Sc Statistics Descriptive Statistics and Probability, Kalyani Publishers by D.V.L.N. Jogiraju, C. Srikala and L.P. Raj Kumar.

Reference Books:

1. V.K.Kapoor and S.C.Gupta: Fundamentals of Mathematical Statistics, Sultan Chand&Sons, New Delhi
2. Goon AM, Gupta MK, Das Gupta B : Outlines of Statistics , Vol-II, the World Press Pvt.Ltd, Kolkata.
3. Hoel P.G: Introduction to mathematical statistics, Asia Publishing house.

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CBCS SYLLABUS (Semester Wise) 2018-19
II B.Sc. Statistics/Semester-IV
(With Mathematics Combination)
Statistical Inference
Paper – IV
MODEL QUESTION PAPER (THEORY)

Time: 3 hrs.

MaxMarks: 60

SECTION-A

Answer any FIVE questions.

5 x 4 = 20M

1. What is MLE and write its properties
2. Explain Confidence Intervals.
3. Explain Null hypothesis and Alternative hypothesis.
4. Define one tailed and two tailed tests.
5. Explain the difference between Parametric tests, Non-parametric tests
6. Explain paired t- test.
7. Explain Fisher's Z-transformation.
8. Explain chi-square test for independence of attributes.

SECTION-B

Answer ALL the questions. All questions carry equal marks.

4 x 8 = 32M

- 9a) Explain the criteria of a good estimator.
(OR)
b) Explain Concept of MLE?
- 10a) State and prove Neyman-Pearson's Lemma.
(OR)
b) How do you apply Neyman's Pearson's lemma in case of Binomial distribution?
- 11a) Explain the test procedure for (i) Testing of Mean and (ii) Equality of two means
(OR)
b) The following samples have been drawn from normal population to test the null Hypothesis that $\sigma = 2$.
0.468, 0.270, 0.074, 1.574, 1.680, 4.984, 1.596, 0.568, 4.040, 2.440

- 12a) The following data obtained from a survey conducted about 320 families who are having five children. Fit a Binomial distribution for the data with $p = \frac{1}{2}$ and test the goodness of fit.

No. of boys	0	1	2	3	4	5
No. Of families	14	56	110	88	40	12

(OR)

- b) Explain the test procedure for Median test

SECTION-C

Answer Any FOUR of the following questions

(4 x 2 = 8M)

13. Define Estimate and Estimator
14. Define Type I error and Type II errors
15. Define Simple and Composite Hypothesis
16. Write the assumptions of non-parametric tests
17. Define Variance Ratio test
18. Write any four different types of non-parametric tests

(With Mathematics Combination)
APPLIED STATISTICS (Elective– 1)

Paper – VII

Total no. of hrs.Per week: 03

Total credits: 03

Unit-I

Analysis of Time series: Components of time series: meaning and examples, trend by least squares (straight-line and parabola) methods and moving average methods. Seasonal indices by Simple averages, ratio to moving average, ratio to trend and link relative methods.

Unit-II

Index Numbers: Meaning, problems involved in the construction of index numbers, simple and weighted index numbers, Criteria of good index numbers, fixed base and chain base index numbers. Cost of living index numbers, Wholesale price index numbers, Base shifting, Splicing and deflation of index numbers.

Unit-III

Official Statistics: Functions and organization of CSO and NSSO. Agricultural Statistics, area and yield statistics. National Income and its computation, utility and difficulties in estimation of national income

Additional Input: Demand Analysis

Unit –IV

Vital statistics: Meaning, Definition, Uses, Sources of vital statistics, Various Death rates- CDR, ASDR, STDR and Birth rates- CBR, ASFR, TFR.

Unit-V

Reproduction Rates: Measurement of population growth, crude rate of natural increase, Pearl's Vital index, Gross reproductive rate(GRR) and Net reproductive rate(NRR), Life tables, construction and uses of life tables and Abridged life tables.

Practical's Semester-VI

Conduct any 6 (MS-Excel is compulsory)

1. Measurement of Linear Trend
2. Measurement of Seasonal Indices-Link Relatives method
3. Reversal tests
4. Cost of Living Index Numbers.
5. Mortality, Fertility and Reproduction rates.
6. Life Tables.
7. MS-Excel Practical

Text Books:

1. Fundamentals of Applied Statistics: VK Kapoor and SC Gupta
2. B.A/B.Sc III year paper-IV Statistics- Applied Statistics- Telugu Academy by Prof K. Srinivasa Rao, Dr. D. Giri, Dr A. Anand, Dr V. Papaya Sastry.
3. B.A/B.Sc Statistics Applied Statistics, Kalyani Publishers by D.V.L.N. Jogiraju, C. Srikala and L.P. Raj Kumar.

Reference Books:

1. Indian Official Statistics- MR Saluja
2. Anuvartita Sankhyaka sastram – Telugu Academy

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CBCS SYLLABUS (Semester Wise) 2018-19
III B.Sc. Statistics/Semester-VI
(With Mathematics Combination)
APPLIED STATISTICS (Elective -1)
Paper -VII

MODEL QUESTION PAPER (THEORY)

Time: 3 hrs.

MaxMarks: 60

SECTION-A

Answer any FIVE questions.

5 x 4 = 20M

1. Explain the method of Simple averages
2. Explain Cost of living Index numbers
3. Explain NSSO
4. What are the sources of vital statistics
5. Explain Abridged life tables.
6. Explain the use of National income
7. Explain Gross reproduction rate and Net reproduction rate.
8. Explain Link Relative Method

SECTION-B

Answer ALL the questions.

4 x 8 = 32M

9 a) How do you determine trend by least squares method

(OR)

b) Explain the ratio to moving average method in Seasonal indices

10 a) Explain the problems involved in the construction of Index numbers

(OR)

b) Explain the criteria of a good index number.

11 a) Explain the functions and organization of CSO?

(OR)

b) Explain National Income and its computation.

12 a) Explain about various Death rates

(OR)

b) Explain Life tables and its construction.

SECTION-C

Answer Any FOUR questions

(4 x 2 = 8M)

13. Mention the components of time series

14. Define an index number

15. Define Agricultural statistics

16. Define National Income

17. Define Vital Statistics

18. Define Pearl's vital index

**III B.Sc. Statistics/Semester-VI
(With Mathematics Combination)
DEMOGRAPHY & VITAL STATISTICS (Elective -2)**

Paper - VII

Total no. of hrs.Per week: 03 Total credits: 03

Unit-I

Population Theories: Converge and Content errors in demographic data, use of balancing equations and Chandra Sekharan-Deming formula to check completeness of registration date. Introduction and Sources of collecting data on Vital Statistics, errors in Census and registration data.

Unit-II

Measurement of Mortality: Crude Death Rate (CDR), Specific death rate (SDR), Infant MortalityRate (IMR) and Standardized death rates. Adjustment of age data, Use of Myer and UN indices, Population Composition, dependancy ratio.

Unit-III

Stationary and Stable population, Central Mortality Rates and Force of Mortality, Life (Mortality) tables, Assumption, Description, Construction of life tables and use of life tables.

Unit -IV

Abridged life tables: Concept and construction of abridged life tables by Reed-Merrell method, Goreville's method and King's method, Measurement of Fertility, Crude Birth Rate (CBR), General Fertility Rate (GFR), Specific Fertility Rate (SFR) and Total Fertility Rate (TFR).

Unit-V

Reproduction Rates: Measurement of population growth, crude rate of natural increase, Pearl's Vital index, Gross reproductive rate (GRR) and Net reproductive rate (NRR).

Text Books:

1. Mukhopadhyaya. P (1999) Applied Statistics, Books and Allied(P) Ltd
2. Goon, A.M, Gupta M.K and Dasgupta, B.(2008) : Fundamentals of Statistics, Vol11, 9th edition, World Press.
3. Biswas. S(1998), Stochastic Process in Demography & Application, Wiley Eastern Ltd.
4. K.Srinivas Basic demographic techniques & application
5. R. Ramakumar, Technical demography
6. K.V.Pathal & F.Rama, Techniques of demographic agency

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III B.Sc. Statistics/Semester-VI
(With Mathematics Combination)
DEMOGRAPHY & VITAL STATISTICS (Elective -2)
Paper - VII

MODEL QUESTION PAPER (THEORY)
Time: 3 hrs. MaxMarks: 60

SECTION-A

Answer any FIVE questions. $5 \times 4 = 20M$

1. What are the errors that occur in the census and registration data
2. Explain about population composition
3. Distinguish between Stationary and Stable population
4. Mention the uses of life tables
5. Explain abridged life tables
6. Explain Crude rate of natural increase
7. What are the uses of vital statistics
8. What are the assumptions of life table

SECTION-B

Answer ALL the questions. $4 \times 8 = 32M$

- 9 a) Derive the Chandra Sekharan-Deming Formula

(OR)

- b) Explain the sources of collecting data in Vital Statistics

- 10 a) Explain the Various Mortality Rates

(OR)

- b) Explain the Uses of Myer and UN indices.

- 11 a) Explain Central Mortality Rate, Force of Mortality and Life tables
(OR)

- b) Describe the Description and Construction of life tables

12a) Describe any two methods of constructing abridged life tables

(OR)

b) Explain about the measurement of population growth

SECTION-C

Answer any FOUR the questions. 4x 2= 8M

13. What is Demographic data

14. Define Population

15. Define Infant mortality rate

16. Define Life table

17. Define Pearl's vital index

18. Define Fertility rate

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III B.Sc. Statistics/Semester-VI
(With Mathematics Combination)

Forecasting Methods (Elective– 3)

Paper – VII

Total no. of hrs. Per week: 03

Total credits: 03

Unit-I

Smoothing Methods. Averaging methods, Exponential Smoothing methods, a Comparison of methods, general aspects of smoothing methods

Unit-II

Decomposition methods: Trend fitting, the ratio to moving averages classical decomposition method. Different types of moving averages

Unit-III Modes for time Series data: Auto-covariance and auto correlation functions, stationary process, white noise process, moving averages (MA) process, Auto Regressive (AR) process, Auto regressive and Moving Average (ARMA) Process, Auto Regressive Integrated and Moving Average (ARIMA) Process

Unit –IV

BOX-Jennings Models: Identification, Estimation and diagnostic checking
For the models, Simulation and Monte Carlo Methods

Unit-V

Application of Time –Series Analysis:
Determining randomness of data, Examining stationary of a time series, removing non- stationary in a time series, recognizing seasonality in a Time series

Practical's Semester-VI

Conduct any 6

1. Averaging methods
2. Measurement of Exponential Smoothing methods
3. Decomposition methods
4. Auto Regressive (AR) process.
5. Auto Regressive Integrated and Moving Average (ARIMA) Process.
6. Auto regressive and Moving Average (ARMA) Process.
7. Monte Carlo Methods

Text Books-Reference Books:

1. Fundamentals of Applied Statistics: VK Kapoor and SC Gupta
2. BOX, GEP and Jenkins, G.M(1976), Time series Analysis –Forecasting and Control, Holden-dav, San Francisco
3. Forecasting Methods by Makridakis
4. Montgomery, DC and Johnson L.A(1977) Forecasting and Time Series Analysis

**III B.Sc. Statistics/Semester-VI
(With Mathematics Combination)
Forecasting Methods (Elective -3)
Paper -VII**

MODEL QUESTION PAPER (THEORY)

Time: 3 hrs.

MaxMarks: 60

SECTION-A

Answer any FIVE questions.

$5 \times 4 = 20M$

1. Explain Simulation Method
2. Explain Time series
3. Explain Stationary and non-Stationary methods
4. What are the sources of Smoothing methods
5. Explain White Noise process
6. Explain different types of moving averages method
7. Explain Decomposition Method
8. Explain AR & ARMA

SECTION-B

Answer ALL the questions.

$4 \times 8 = 32M$

9 a) Explain about Averaging methods

(OR)

b) Explain Exponential Methods

10 a) Explain ARIMA

(OR)

b) Explain ratio to trend Moving averages method.

11 a) Explain BOX-Jenkins models

(OR)

b) Explain the identification and estimation of the Box-Jenkins models.

12 a) Explain Auto correlation and Auto Covariance process

(OR)

b) Explain the procedure of Non-stationary in a time series.

SECTION-C

Answer Any FOUR questions

(4 x2=8M)

- 13. Mention the components of time series.**
 - 14. Define Simulation**
 - 15. Define Forecasting.**
 - 16. Define Monto-carlo method.**
 - 17. Define trend.**
 - 18. Define uses of Forecasting methods.**
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III B.Sc. Statistics/Semester-VI
(With Mathematics Combination)
OPTIMIZATION TECHNIQUES ((Cluster-1, Paper-1)
Paper –VIII-A1

Total no. of hrs.Per week: 03

Total credits:03

Unit-I

Operations Research:Introduction to O.R. Origin and development of OR, Nature and features of O.R, Meaning, Definition of O.R, Scope of O.R, Phases of O.R, Advantages and Disadvantages of O.R,Convex sets and their properties.

Unit-II

Linear Programming Problems :(LPP), Definitions of LPP, Components, basic assumptions, Formulation of LPP, Solutions of LPP by Graphical method, Some exceptional cases in graphical method, Alternative Optima, Unbounded solution and Infeasible solution

Unit-III

Linear programming problem-Simplex method: General LPP, Objective function, Constraints, Non-negative restrictions, Solutions of LPP, feasible solution and optimum solution, Canonical and Standard forms of LPP, Basic solution, Definition, degenerate solution, Basic feasible solution, Associated cost vector, Improved Basic feasible solution, Optimum basic feasible solution and Net evaluation, Fundamental theorem of LPP, the computational procedure of Simplex algorithm and problems.

Additional Input: Revised Simplex thoery

Unit –IV

Linear Programming problem-Simplex method-II:Artificial Variable Technique-The Big-M Method or Method of Penalties, Two Phase Simplex method, Concept of degeneracy and resolving it.

Unit- V

Duality in Linear Programming:Concept of duality, Formation of dual LPP, Primal and dual relationship, primal dual pair in matrix form. Statement of fundamental theorem of duality, Dual Simplex method and problems.

Text Books:

- 1) Operations Research by Kanthi Swaroop k.GUPTA AND ManMohan –Sultan Chand
- 2)Operation Research- S.D Sharma
- 3) Operation Research – Taha

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CBCS SYLLABUS (Semester Wise) 2018-19
III B.Sc. Statistics/Semester-VI
(With Mathematics Combination)
OPTIMIZATION TECHNIQUES ((Cluster-1, Paper-1)
Paper –VIII-A1

MODEL QUESTION PAPER (THEORY)
Time: 3 hrs. MaxMarks: 60

SECTION-A

Answer any FIVE questions. 5 x 4=20M

1. Explain the formulation of LPP
2. Write advantages and disadvantages of O.R
3. Explain General LPP
4. Mention components of LPP
5. Explain Concept of Two –Phase Method
6. Explain the slack and surplus Variables
7. Explain the Primal and Dual Relationships
8. Explain the concept of Artificial Variable Technique

SECTION-B

Answer any FOUR the questions. 4x 8 = 32M

- 9 a) Describe the Nature and Scope of O.R
(OR)
b) Explain the Phases of O.R and origin of O.R
- 10 a) Explain the concept of LPP and its mathematical formulation
(OR)
b) Solve the Following LPP by using Graphical Method
Maximize $Z=45X_1+80X_2$
Subject to const: $5X_1 + 20X_2 \leq 400$
 $10X_1 + 15X_2 \leq 450$.

$$X_1, X_2 \geq 0$$

11 a) Explain Simplex algorithm

(OR)

b) Use simplex Method to solve the following LPP

$$\text{Maximize } Z = X_1 - X_2 + 3X_3$$

$$\text{Subject to const: } X_1 + X_2 + X_3 \leq 10$$

$$2X_1 - X_3 \leq 2$$

$$2X_1 - 2X_2 + 3X_3 \leq 0,$$

$$X_1, X_2, X_3 \geq 0$$

12 a) Solve the Dual of the Following LPP

$$\text{Minimize } Z = 2X_1 + 3X_2 + 4X_3$$

$$\text{Subject to const: } 2X_1 + 3X_2 + 5X_3 \geq 2$$

$$3X_1 + X_2 + 7X_3 = 3$$

$$X_1 + 4X_2 + 6X_3 \leq 5$$

$$X_1, X_2 \geq 0 \text{ and } X_3 \text{ is unrestricted}$$

(OR)

b) Solve the Following LPP by using Big-M Method

$$\text{Minimize } Z = 2X_1 + 3X_2$$

$$\text{Subject to const: } X_1 + X_2 \geq 5$$

$$X_1 + 2X_2 \geq 6$$

$$X_1, X_2 \geq 0$$

SECTION-C

Answer any FOUR questions. 4x 2= 8M

13. Define Basic Feasible solution

14. Write any two assumptions of LPP

15. Define Simplex

16. Define Duality

17. Define Unbounded

18. What is degeneracy

CBCS SYLLABUS (Semester Wise) 2018-19
III B.Sc. Statistics/Semester-VI
(With Mathematics Combination)
OPERATION RESEARCH
(Cluster-1, Paper-2)
Paper –VIII-A2

Total hrs.Per week: 03

Total credits: 03

Unit-I

Definition and scope of Operation Research, Phases and Models in OR . Linear Programming problem, Formulation of LPP, Solving the LPP by graphical Method.

Unit-II

Transportation Problem: Definition of transportation problem, TPP as a special case of LPP, General Mathematical Transportation of LPP , Transportation table ,feasible solutions by North-West corner , Matrix minimum and VAM methods and problems.

Additional Input: Game Theory

Unit-III

Transportation problem : Test for optimum ,closed loop in transportation table and its properties optimal solution through the MODI (U- V) method and stepping stone method for balanced and unbalanced , transportation problem degeneracy in LPP

Unit-IV

Assignment problem: Formulation and description of Assignment problem and its Variations. Unbalanced assignment problem, traveling salesman problem, Hungarian method for optimal solution.

Unit-V

Sequencing problem: Optimal Sequencing of N jobs on two and three machines without passing

Text Books:

1. Kanti Swaroop, P.K.Gupta and Man Mohan: Operations Research. Sultan Chand.
2. Taha: Operations Research: An Introduction: Mac Millan

Practical's-Semester-VI

1. Solving LPP by Graphical method
2. Solving the TP by NWCR, Matrix Minimum and VAM methods
3. Game theory-obtaining saddle point and pure, mixed strategies
4. Finding solution for Hungarian Method
5. Optimal solution for Assignment problem
6. Solving sequencing problem for jobs on two machines.

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CBCS SYLLABUS (Semester Wise) 2018-19
III B.Sc. Statistics/Semester-VI
(With Mathematics Combination)
OPERATION RESEARCH (Cluster-1, Paper-2)
Paper –VIII-A2

MODEL QUESTION PAPER (THEORY)

Time: 3 hrs.

Max Marks: 60

SECTION-A

Answer any five questions.

5 x 4= 20M

1. Explain the formulation of LPP
2. Explain general LPP
3. Explain the standard form of LPP?
4. Define feasible solution in a transportation problems
5. Define unbalanced assignment problem
6. How do you obtain a sequence?
7. Explain assignment problem as a special case of TP
8. Explain travelling salesman problem

SECTION-B

Answer ALL the questions.

4x 8 = 32M

9 a) Describe the definition and scope of Operation Research

(OR)

b) Solve the following LPP by using Graphical method

$$\begin{aligned} \text{Maximize } Z &= 45X_1 + 80X_2 \\ \text{Subject to const: } & 5X_1 + 20X_2 \leq 400 \\ & 10X_1 + 15X_2 \leq 450 \\ & X_1, X_2 \geq 0 \end{aligned}$$

10a) Explain two person games and zero sum games with examples

(OR)

b) Explain the method of solving 2xn game

11a) Explain North-West Corner Rule and Least Cost Entry Methods for a given TP.

(OR)

b) Solve the following Transportation Problem by using VAM.

	D₁	D₂	D₃	Supply
O₁	50	30	220	1
O₂	90	45	170	3
O₃	400	200	50	5
Demand	5	2	2	9

12a) Solve the following assignment problem by using Hungarian method

	Machines			
	1	2	3	4
A	10	40	15	20
B	15	30	5	15
C	35	20	12	24
D	17	40	24	20

(OR)

b) Give an algorithm for n job-2 machines problem.

SECTION-C

Answer ANY FOUR questions.

4 x 2 = 8M

13. Define OR

14. Define Transportation Problem

15. How many methods are there to obtain IBFS in a TP

16. Explain transportation table

17. What are the basic assumptions underlying in a sequencing problem

18. Define total elapsed time in sequencing problem

CBCS SYLLABUS (Semester Wise) 2018-19
III B.Sc. Statistics/Semester-VI
(With Mathematics Combination)
ADVANCED EXPERIMENTAL DESIGHS
(Cluster-2, Paper-1)

Paper –VIII –B1

Total hrs.Per week: 03

Total credits: 03

Unit-I

Review of Completely Randomized design (C.R.D), Randomized block design (R.B.D) and Latin square design (L.S.D.)

Unit-II

Missing Plot technique: Analysis of Randomized Block Design (R.B.D) with one and two missing observations and Latin Square Design (L.S.D) with one missing observation.

Unit-III

Analysis of Covariance (ANCOVA) : Analysis of covariance for a one-way classification with one concomitant variable in C.R.D. Layout and for two-way classification with one concomitant variable in R.B.D.

Unit-IV

Factorial Design: Estimation of main effects, interactions and analysis of $2^2, 2^3$ and 3^2 factorial experiments.

Unit V

Balanced Incomplete Block design (BIBD) and Partially Incomplete block design (PBIBD).

Practical's-Semester-VI

Conduct any Six Practical with Excel Practical

1. Analysis of CRD and RBD with missing observation
2. Analysis of CRD and RBD with missing observation using MS Excel or using Stat disk.
3. Analysis of LSD with missing observation
4. Analysis of LSD with missing observation using MS Excel
5. Analysis for covariance for a one-way classification with one concomitant variable in
C.R.D
6. Analysis for covariance for a one-way classification with one concomitant variable in
R.B.D
7. Analysis of 2^2 -Factorial Experiment
8. Analysis of 2^3 - Factorial Experiment
9. Analysis of 2^3 - Factorial Experiment using MS Excel

Text Books:

1. S.C. Gupta and V.K.Kapoor, Fundamentals of Applied Statistics, Sultan Chand and Sons.
2. Das, M.N. and N.C.Giri, Design and Analysis of Experiments, 2nd edition, New Age International (P) Limite Publishers, 1986.
3. Montgomery, D.C: Design of Analysis of Experiments, John Wiley.
4. Murthy, M.N., Sampling theory and methods, Tata McGraw Hill, New Delhi, 1967.
5. DesRaj, Sampling Theory, Tata MC GrW HILL, New Delhi, 1976

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(With Mathematics Combination)
ADVANCED EXPERIMENTAL DESIGNS
(Cluster-2, Paper-1)

Paper –VIII –B1

MODEL QUESTION PAPER (THEORY)

Time: 3 hrs.

Max Marks: 60

SECTION-A

Answer Any FIVE Questions. All questions carry equal marks 5X4=20M

- 1. Give the Advantages of CRD**
- 2. Write two Disadvantages of LSD**
- 3. Explain missing Plot Techniques**
- 4. Define ANCOVA**
- 5. Define MAIN EFFECTS OF 2^2 Experiments**
- 6. What is 3^2 Experiment?**
- 7. Define the Parameters in BIBD**
- 8. Define the parameters in PBIBD**

SECTION-B

Answer any FOUR questions. 4 x 8 = 32M

9A. Explain the Analysis of CRD

(OR)

B. Explain the Analysis of RBD

10 A. Explain the Missing plot Technique of RBD with two missing observations

(OR)

B. Explain the Missing plot Technique of LSD with one missing observations

11A. Explain the ANCOVA for CRD

(OR)

B. Explain the ANCOVA for RBD

12A. Explain PBIBD

(OR)

B. Explain 2^3 Factorial design of experiment

SECTION-C

Answer any FOUR questions 4X2=8M

13. What is use of CRD

14. Give the Layout of LSD

15. Write merits of RBD

16. What Basic principal are using in RBD

17. What is the Use of Factorial Design

18. Define BIBD

CBCS SYLLABUS (Semester Wise) 2018-19
III B.Sc. Statistics/Semester-VI
(With Mathematics Combination)

Actuarial statistics (Cluster-2, Paper-2)
Paper –VIII-B2

Total hrs.Per week: 03

Total credits: 03

Unit-I

Introductory to Statistics and Insurance

Applications: Discrete, Continuous and mixed probability distributions. Insurance applications, sum of random variables. Utility theory: Utility functions, expected utility criterion, types of utility function, insurance and utility theory.

Unit-II

Principles of Premium Calculations Properties of Premium

principles, examples of premium principles. Individual risk models: models for individual claims, the sum of independent claims, approximations and their applications.

Unit-III

Survival Distribution and Life Tables: Uncertainty of age at

death, Survival function, time-until-death for a person, curate future lifetime, force of mortality, life tables with examples, deterministic Survivorship group, life table characteristics, assumptions for fractional age, some analytical laws of mortality.

Unit-IV

Life Insurance: Models for insurance payable at the moment of

death, insurance payable at the end of the year of death and their relationships. Life annuities: Continuous life annuities, discrete life annuities, life annuities with periodic payments, Premiums: Continuous and discrete premiums.

Suggested Reading:

1. Dickson, C.M.D.(2005) : Insurance Risk And Ruin (International Series on Actuarial Science), Cambridge University Press.
2. Browers, N.L., Gerber, H.U. Hickman, J.C., Jones, D.A. And Nesbitt, C.J.(1997): Actuarial Mathematics

CBCS SYLLABUS (Semester Wise) 2018-19
III B.Sc. Statistics/Semester-VI
(With Mathematics Combination)
Actuarial statistics (Cluster-2, Paper-2)
Paper –VIII-B2

MODEL QUESTION PAPER (THEORY)

Time: 3 hrs.

Max Marks: 60

SECTION-A

Answer Any Five of the following questions.

5 x 4 = 20M

1. Explain About Insurance Applications
2. Explain Utility Theory
3. Explain the applications of individual risk Models
4. Explain the sum of independent terms
5. Define current future life time and force of Mortality
6. Give the assumptions for Fractional Age
7. Explain about Premiums
8. Explain determine Survivorship group

SECTION-B

Answer ALL the following questions

4X8=32M

9A.Explain about Discrete, Continuous and mixed probability distribution

(OR)

b. Explain about the Utility Functions and its types

10A.Explain about the Principles of Premium calculations and properties of

(OR)

B. Describe the modes for Individual claims

11A.Define Life table? Explain the characteristics of Life tables with Examples

(OR)

B. Describe the analytical laws of Mortality

12A. Explain the models for Insurance payable at the Moment of death and insurance payable at the end of year of Death

(OR)

B. Explain about Discrete and continuous Life annuities

SECTION-C

Answer all FOUR questions 4X2=8M

13. Define Actuarial Science

14. Define Insurance

15. Define Life Annuity

16. Define Premium

17. Define Utility

18. Define Mortality

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CBCS SYLLABUS (Semester Wise) 2018-19

III B.Sc. Statistics/Semester-VI

(With Mathematics Combination)

REGRESSION ANALYSIS (Cluster-3, Paper-1)

Paper –VIII-C1

Total hrs. Per week: 03

Total credits: 03

UNIT-1

Simple Regression model: Description of data model Estimation and test of hypotheses Index of fit – Predicted values and standard errors Evaluation of fit Analysis of residuals

UNIT-2

Simple Regression model: Effect of outliers in simple linear regression Model adequacy and residual plots Deletion of data points Transformation of variables – transformation to stabilize variance – Removal of heteroscedasticity Principle of weighted least squares

UNIT-3

Multiple regression model: Description of data model Properties of least square estimators Predicted values and standard errors Multiple correlation coefficient - Selection of variables Forward selection procedure Backward elimination procedure Stepwise method (algorithm only).

UNIT 4

Test of hypothesis on the linear model, Assumption about the explanatory variable Testing a subset of regression coefficients equal to zero. Testing of equality of regression coefficients.

Unit 5

Multicollinearity and its effects on inference and forecasting Detection of multicollinearity Searching of linear functions of regression coefficients Method of overcoming multicollinearity problem, Ridge method.

Books for study:

1. S.Chatterjee and B.Price(1977):Regression Analysis by Example, John Wiley &

Sons, New York. Chapter 1, 2, 3 and relevant portions in chapters 4, 5, 6, 7, 8, 9
2. N.R. Draper & H. Smith (1981), Applied Regression Analysis, Second Edition.

Books for Reference:

Johnston J. (1984): Econometric Methods

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III B.Sc. Statistics/Semester-VI
(With Mathematics Combination)
REGRESSION ANALYSIS (Cluster-3, Paper-1)
Paper –VIII –C1
MODEL QUESTION PAPER THEORY**

Time: 3 hrs.

Max Marks: 60

SECTION-A

Answer Any Five of the following questions.

5 x 4 = 20M

- 1. Explain Regression**
- 2. Explain Simple Regression model**
- 3. Explain Deletion of data points**
- 4. Explain the Transformation of variables**
- 5. Explain Least squares method**
- 6. Give the assumptions for Regression**
- 7. Explain about Multiple regression model**
- 8. Explain Auto correlation**

SECTION-B

Answer All the following questions

4X8=32M

9A. Explain Scope and objectives of Econometrics

(OR)

b. Explain reasons for introducing error term in the model

10A.Explain Least Squares method

(OR)

B. Describe general linear model

11A.Define Selection of variables Forward selection procedure Backward Elimination procedure Stepwise method

(OR)

B. Describe Ridge method

12A.Explain Multi co-Linearity

(OR)

B. Testing of Hypothesis for linear model

SECTION-C

Answer any FOUR questions.

4X2=8M

13. Define Regression

14. Define Linearity

15. Define Multi Co-linearity

16. Define Specification Errors

17. Define Auto Correlation

18. Define Correlation

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CBCS SYLLABUS (Semester Wise) 2018-19
III B.Sc. Statistics/Semester-VI
(With Mathematics Combination)
Decision Making Analysis (Cluster-3, Paper-2) Paper –VIII –C2

Total hrs. Per week: 03

Total credits: 03

Unit 1

- **Decision Problem: Goals and objectives, Conflict between Possible solutions – Constraints-Feasible solutions Objective function Costs and benefits, notional and criteria for optimality.**

Unit 2

Steps in decision-making: Determining objective(s), identifying alternative feasible solutions, determining (expected) costs and benefits associated with a feasible solution, developing a measure of effectiveness, finding the optimal solution Sensitivity analysis and post-optimality problems, controlling a solution.

Unit 3

Structure of decision, Development of the pay-off measure Bernoulli and utility Expected value, Pay-off without a natural measure, – Standard gamble, Strategies and states of nature – Analysis of decisions – Pay-off matrix Decisions under certainty, uncertainty, risk and competition, Optimality criteria of pessimism, optimism and regret A decision among decision criteria Laplace criterion.

Unit 4

Sequential decisions- Decision trees, Informal analysis of decision trees- Cutting decision trees Decision making using expected money value and utility. Expected profit with perfect information Value of sample information. Expected net gain due to sampling

Unit 5

Decision problems in marketing Brand-loyalty model Brand-share model Pricing problem – Competitive bidding Allocation of advertising funds Decision problems in finance Investment decision trees Risk analysis Portfolio selection Dividend policy

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III B.Sc. Statistics/Semester-VI

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Decision Making Analysis (Cluster-3, Paper-2)
Paper –VIII–C2

MODEL QUESTION PAPER THEORY

Time: 3 hrs.

Max Marks: 60

SECTION-A

Answer Any Five of the following questions.

5 x 4 = 20M

1. Explain Decision Problem
2. Explain Criteria for optimality
3. Explain Structure of decision
4. Explain Risk analysis
5. Explain **Dividend policy**
6. Give the controlling solution
7. Explain Optimality criteria of pessimism
8. Explain Standard gamble

SECTION-B

Answer all the following questions

4X8=32M

9A. Explain Scope and objectives of Decision Making

(OR)

b. Explain feasible solutions Objective function Costs and benefits

10A. Explain determining costs and benefits associated with a feasible solution

(OR)

B. Describe developing a measure of effectiveness

11A. Define Sequential decisions-Decision trees, Informal analysis of decision trees-

Cutting decision trees

(OR)

B. Describe Pay-off matrix Decisions under certainty

12A. Expected profit with perfect information Value of sample information

(OR)

B. Portfolio selection Dividend policy

SECTION-C

Answer any FOUR questions. $4 \times 2 = 8M$

13. Define Decision
14. Define Feasible solution
15. Define Allocation of advertising funds
16. Define Pay-off matrix
17. Define Risk analysis
18. Define optimality