



SRR & CVR GOVT. DEGREE COLLEGE (Autonomous)

PHONE NO : 9848732916

NAAC : B+ (III Cycle with CGPA : 2.60) - Estd: 1937

WEBSITE : www.srrcvr.ac.in

ISO 9001 - 2015 Certified

EMAIL : srrandcvr@gmail.com

Institution is ranked by NIRF 101 -150 band at NIRF - 2020



BOARD OF STUDIES

(Under Graduate)

A.Y 2019-2020



STATISTICS

VI SEMESTER

Minutes of Meeting
& Curriculum/Syllabi

DEPARTMENT OF STATISTICS



SRR & CVR GOVT. DEGREE COLLEGE

(Autonomous)

NAAC accredited with 'B' Grade

Machavaram, Vijayawada – 520 004, Krishna District.

Cell: 94922 34488 Ph: 0866-2430060 Fax: 0866-2441092 www.srrcvr.org srrandcvr@gmail.com




Dr. Velaga Joshi, Principal
M.A (PHI), M.A (HIS), M.A. (M.C.), B.L., M.Phil., Ph.D

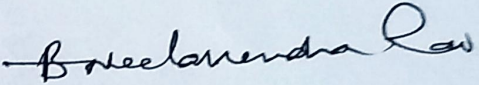
MINUTES OF THE MEETING ON UPGRADATION OF SYLLABUS OF DEPARTMENT OF STATISTICS(BOS)

A meeting on upgradation of syllabus of Department of Statistics held on 29-08-2019 in the Department of Mathematics and Statistics for 6th semester of □ III B.Sc(MSCS), course syllabus under the chairmanship of V.Chandrika Devi , Head of Statistics Department . The following members are present

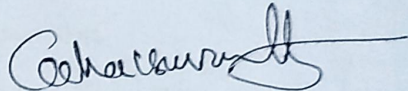
1. University Nominee
Prof.K. Rosaiah M.Sc, Ph.D
Professor of Statistics,
Acharya Nagarjuna University,
Nagarjuna Nagar, Guntur

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2. Subject expert
B.Neelavendra Rao M.Sc
Lecturer in Statistics,
Govt. Degree College (w)
Autonomous, Guntur Dist.

: 

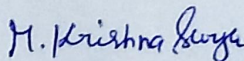
3. Subject expert
Sri. G. Chakravarthi M.Sc
Lecturer in Statistics,
P.B Siddhartha College of Arts & Science
Autonomous, Vijayawada.

: 

4. Chairman
Smt . V.Chandrika Devi,
Lecturer in Statistics,
SRR & CVR Govt.Degree College,
Autonomous, Vijayawada.

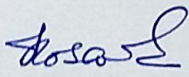
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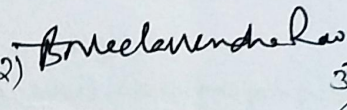
5. Alumni
M.Krishna Surya
SRR & CVR Govt.Degree College,
Vijayawada.

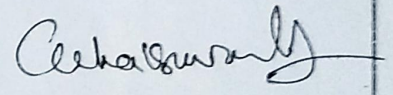
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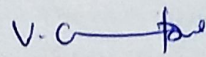
Agenda:

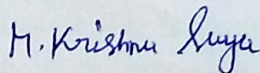
- To approve Statisticse Syllabus for 6th semesters of □ B.Sc(autonomous) for the academic year 2019-2020.
- To divide the syllabus into 5 units.
- To approve Model papers, Blue print.
- To divide 100 marks into two components.
- a) i)External 60 Marks, ii)Internal 40 Marks.
b)External 60 Marks further divided into two sections. Section-A consisting 20Marks,Section-B consisting – 40Marks is approved.
- To evaluate Internal Assessment as follows :-
 - (a) Internal exams (two) - 10
 - (b) Assignments (two) - 10
 - (c) Project - 10
 - (d) Attendance - 05
 - (e) Seminar - 05
 - Total = 40
- To approve paper setters and practical examiners.
- To divide the syllabus into FIVE units.
- To approve other Academic activities of the Department.
- To give permission to the Chairman for any small changes.

1) 

2) 

3) 

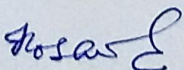
4) 

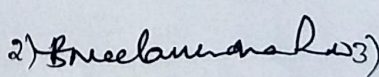
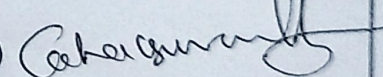
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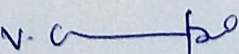
Resolutions:

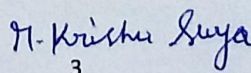
In BOS meeting the committee has unanimously resolved and approved the following items:-

- The syllabus for the Statistics of 6th semester for final B.Sc Statistics for 2019-2020 is approved.
- To divide 100 marks into two components.
 - a) i) External 60 Marks,
 - ii) Internal 40 Marks.
 - b) External 60 marks further divided into two sections. Section-A consisting 20 marks, Section-B consisting – 40 marks is approved.
- Internal exams(two) - 10
Assignment(two) - 10
Project - 10
Attendance - 05
Seminar - 05
Total = 40 is approved.
- In the Model paper Section -A consisting Questions of weightage 4 marks each. Five questions to be answered i.e. $5 \times 4 = 20$ marks and Section-B consisting of questions of weightage 8 marks each, Five questions to be answered $5 \times 8 = 40$ Marks is approved.
- To pass the exam student must get 40% of 60 and overall 40% combining both internal and external.
- For practical consisting of 50 marks(25 internal+ 25 external) , practical consists three hours duration , 2 credits, workload – 2 hours per batch, batch=15 students.
- Workload for this paper is 6 hours (4 theory+2 practical).
- The chairman is given empowerment to do any small changes.
- The panel of paper setter for theory and practical is approved.
- The controller of examinations is given empowerment for any changes in selecting paper setter and practical examiner in case of non-availability of examiners as are listed.

1) 

2)  3) 

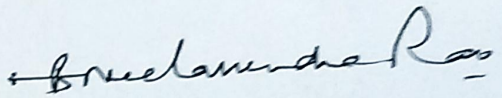
4) 

5) 

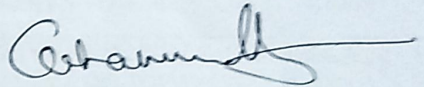
1. Prof . K. Rosaiah M.Sc, Ph.D

: 

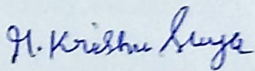
2. B.Neelavendra Rao M.Sc

: 


3. Sri. G. Chakravarthi M.Sc

: 

4. M.Krishna Surya

: 

5. Smt . V.Chandrika Devi

: 

DEPARTMENT OF STATISTICS

BOS MEETING APPROVED THE FOLLOWING EXAMINERS

LIST OF EXAMINERS FOR PRACTICALES AUTONOMOUS

S.NO	NAME OF THE LECTURER	DESIGNATION	COLLEGE
1	K.NARASIMHA RAO	LECTURER IN STATISTICS	CHAITANYA DEGREE COLLEGE, NANIGAMA, KRISHNA Dt.
2	G.CHAKRAVARTHI	LECTURER IN STATISTICS	P.B SIDDHARTHA COLLEGE OF ARTS & SCIENCE, VIJAYAWADA
3	DR.V.VASUNDHARA DEVI	LECTURER IN STATISTICS	GOWTHAM DEGREE COLLEGE, VIJAYAWADA.
4	T.NAGESH	LECTURER IN STATISTICS	TRIVENI DEGREE COLLEGE, VIJAYAWADA.
5	B.SHOBA RANI	LECTURER IN STATISTICS	SARADA DEGREE COLLEGE, VIJAYAWADA
6	DR.N. SRINIVAS	LECTURER IN STATISTICS	ANDHRA LOYOLA COLLEGE, VIJAYAWADA.
7	V.MURALI KRISHNA	LECTURER IN STATISTICS	P.B SIDDHARTHA COLLEGE OF ARTS & SCIENCE, VIJAYAWADA

1) K. Narasimha Rao

2) G. Chakravarthi

3) Dr. V. Vasundhara Devi

4) T. Nagesh

5) B. Shoba Rani

DEPARTMENT OF STATISTICS

BOS MEETING APPROVED THE FOLLOWING EXAMINERS

PANEL FOR PAPER SETTERS FOR AUTONOMOUS

S.NO	NAME OF THE LECTURER	DESIGNATION	COLLEGE
1	DR. N. VISWAM	LECTURER IN STATISTICS	HINDU COLLEGE, GUNTUR
2	B.NEELAVENDRA RAO	LECTURER IN STATISTICS	GDC (W), GUNTUR.
3	P.RAGHU	LECTURER IN STATISTICS	JKC COLLEGE , GUNTUR
4	DR.VARA PRASAD	LECTURER IN STATISTICS	GDC,NELLORE
5	V.SAROJA	LECTURER IN STATISTICS	MARY STELLA COLLEGE, VIJAYAWADA.
6	B.RAMESH	LECTURER IN STATISTICS	ANR COLLEGE ,GUDIVADA
7	G.RADHIKA	LECTURER IN STATISTICS	K.B.N COLLEGE, VIJAYAWADA.
8	V.NARASIMHA RAJU	LECTURER IN STATISTICS	DNR COLLEGE, BHIMAVARAM
9	DR.MADHAVI	LECTURER IN STATISTICS	GDC RAJAHMUNDRY, EAST GODAVARI.
10	T.ASWINI SUBHADRA	LECTURER IN STATISTICS	NALANDA DEGREE COLLEGE ,VIJAYAWADA

1) *Viswas*

2) *B. Neelavendra Rao*

3) *R. Raghu*

4) *V. Varas*

5) *M. Krishna Raja*

S.R.R & C.V.R GOVT .DEGREE COLLEGE (A): 2019-2020
DEPARTMENT OF STATISTICS
III B.Sc STATISTICS CBCS SYLLABUS 2019-2020
(With mathematics combination)
SEMESTER-VI
PAPER VII(A): APPLIED STATISTICS

Time: 2 $\frac{1}{2}$ hrs

Max.Marks:100 (40 int+60 ext)

Unit-I: TIME SERIES

Time series and its components with illustration, additive, multiplicative and mixed models. Determination of Trend by Least square method, Moving average method. Determination of Seasonal indices by Ratio to trend method. Ratio to moving averages method and Link relative method.

Unit-II: INDEX NUMBERS

Concept, Construction, uses and Limitations of Simple and Weighted Index Numbers. Laspeyre's, Paasche's and Fisher's Index Numbers, Criterion of a good index number, Problems involved in the construction of index numbers. Fisher index number is an ideal index number. Fixed and Chain base index numbers. Cost of living index number and Wholesale Price Index Number. Base Shifting Splicing and Deflating of Index Numbers.

Unit-3: VITAL STATISTICS

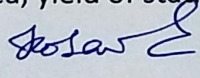
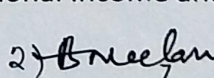
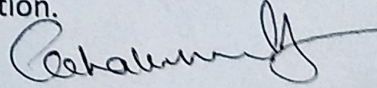
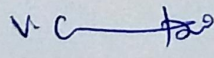
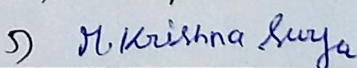
Vital Statistics: Meaning, Definition, uses, sources of vital statistics, various Death rates- CDR, ADR, and Birth rates-CBR, ASFR, TFR.

Unit-4: VITAL STATISTICS

Reproduction Rates: Measurement of population growth, crude rate of natural increase, Pearle's vital index, Gross Reproduction Rate [GRR], Net Reproduction Rates [NRR], Life tables, construction uses of life tables and abridged life tables.

Unit-5: Official STATISTICS

Official Statistics: Functions and Organization of CSO and NSSO. Agricultural, area, yield of statistics, National Income and its Computation.

- 1)  2)  3) 
4)  5) 

Text Books:

1. Fundamentals of applied statistics: VK Kapoor and SC Gupta.
2. BA/BSc III year paper – III Statistics –Applied Statistics –Telugu Academy by Prof ,K. Srinivasa Rao, Dr D.Giri, Dr A.Anand, Dr V.Papaiah Sastry.

Reference Books:

1. Indian Official Statistics – MR Saluja.
2. Anuvarthita Sankyaka Sastram – Telugu Academy

PRACTICALS

SEMESTER VI

TIME: 3hrs

1. Measurement of seasonal indices –Ratio Trend Method
2. Measurement of seasonal indices –Link Relatives Method
3. Weighted index numbers.
4. Cost of living index numbers.
5. Mortality, Fertility
6. Life tables.
7. MS-Excel Practical

PRACTICAL QUESTION PAPER MODEL Max Marks:50

EXTERNAL : TIME: 3hrs

Answer any two questions out of three,each question carry 12 ½ marks

Total Marks 2x12 ½ =25 Marks

AIM: 1

PROCEDURE: 4

CALCULATION: 6.5

INFERENCE: 1

INTERNAL :

Total Marks : 25

Record : 10

Viva : 10

Lab Attendance : 5

1) *K. Srinivasa Rao*

2) *B. Srinivasa Rao* 3) *C. Srinivasa Rao*

4) *V. Srinivasa Rao*

5) *M. Srinivasa Rao*

INTERNAL ASSESSMENT:

EXISTING PROCEDURE MAY BE FOLLOWED

Blue Print:

Unit no:	Long questions	Short questions	total
1	2	2	4
2	2	2	4
3	2	2	4
4	2	2	4
5	2	2	4
Total	10	10	20

- 1) ~~Sosar~~ 2) ~~Anandam~~ 3) ~~Chandrasekhar~~
- 4) ~~V. G. Das~~ 5) M. Krishna Sanyal

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DEPARTMENT OF STATISTICS
MODEL PAPER
SEMESTER-VI

Max.Marks:100 (Int.40+Ext.60)
Time:2½ hrs.

Paper VII(A): Applied Statistics

Section-A

Answer Any Five Questions

5x4=20

1. Explain Mathematical Models in Time Series
2. Explain uses of Time series
3. Define Fixed, Chain base index numbers
4. Define Splicing
5. Define Base Shifting
6. Explain CDR and its merits, demerits
7. Explain the uses of Vital statistics
8. Explain Rates and Ratios of Mortality
9. Explain Pearl's Vital Index
10. Explain Area Statistics

Section-B

Answer Any One Question From Each Unit

5x8=40

UNIT-1

11. Define Time Series and components of Time series
(Or)

12. Explain Link Relative method for measuring Seasonal variations

UNIT-2

13. Define Index number and what are the Problems in the construction of an Index numbers
(Or)

14. Define Cost of living index number. Write the steps involved in the construction of the cost of living index number

UNIT-3

15. Define Vital Statistics. Explain various sources of obtaining Vital Statistics data
(Or)

16. Describe the various measures of Mortality

UNIT-4

17. Give the complete description of complete life table
(Or)

18. Explain NRR and GRR

UNIT-5

19. Explain the functions and organisation of CSO and NSSO

(Or)

20. Discuss the Agricultural Statistics in India

1) Joshi

2) Breckanndhoko 3) Coburn

4) V. C. Rao

5) H. Krishna Sanyal

S.R.R & C.V.R GOVT .DEGREE COLLEGE (A)::2019-2020

DEPARTMENT OF STATISTICS

III B.Sc STATISTICS CBCS SYLLABUS 2019-2020

(With mathematics combination)

SEMESTER-VI

PAPER VIII (A-1): OPERATIONAL RESEARCH

TIME 2 ½ hrs

Max.Marks.100 (40 int+60 ext)

Unit-I

Introduction to OR, The nature and Meaning of OR, Application of OR, Modelling in OR, Characteristic of Operational Research, Scope of OR.

Unit-II

Introduction, Formulation of Linear Programming Problems, Graphical Procedure, Graphical Solutions of LPProblems

Unit-III

General Formulation of LPP, Slack and Surplus Variables, Solution of LPP, Feasible Solution, Basic Solution, Basic Feasible Solution, Unbounded Solution. Assumption in LPP, Limitations of LPP, Advantages of LPP, Procedure of Simplex Method.

Unit-IV

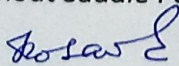
TWO Phase Method (artificial variable technique), Big-M Method (Penalty method) and Simple Problems.

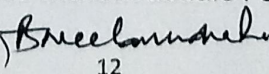
What is Degeneracy problem method to resolve degeneracy (tie?)

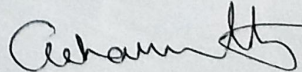
Computational procedure of Dual Simplex Method. Advantages of Dual Simplex Method over Simplex method.

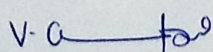
Unit-V

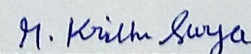
Introduction, Characteristics of Game Theory, Basic Definitions, Optimal Strategy and MINIMAX(MAXIMINI) criterion, Saddle Point, Optimal Strategies And value of the Game, Solutions of Game with Saddle Point, Rectangular game Without Saddle Point, 2*2 games without Saddle Point.

1) 

2) 
12

3) 

4) 

5) 

Text Books

1. Kanti Swaroop, P.K.Guptha and Man Mohan: Operation Research, Sultan Chand.
2. BA/BSc III Year Paper-IV Statistics-Quality, reliability and Operations Research –Telugu Academy by Dr T.C.Ravichandra Kumar, Dr R.V.S.Prasad, Dr D. Giri, Dr G.S.Devasena.
3. Operationa Research –S.D. Sharma.

List of Reference books

1. S.K Sinha: Reliability and Life testing. Wiley Eastern.
2. Operations Research –Models and methods by Chandrasekhar Salimath, Bhupendar Parashar.
3. Operation research - Taha

PRACTICALS SEMESTER VI

TIME: 3hrs

1. Graphical Solution.
2. Simplex Method.
3. Big-M Method.
4. Two-Phase Method.
5. MINIMAX MAXIMINI Principle.
6. Dominance Property.
7. MS-Excel Practical's.

PRACTICAL QUESTION PAPER MODEL Max Marks:50

EXTERNAL :

TIME: 3hrs

Answer any two questions out of three, each question carry 12 ½ marks

Total Marks 2x12 ½ =25 Marks

AIM: 1

PROCEDURE: 4

CALCULATION: 6.5

INFERENCE: 1

INTERNAL :

Total Marks : 25

Record : 10

Viva : 10

Lab Attendance : 5

1) *[Signature]*

2) *[Signature]*

3) *[Signature]*

4) *[Signature]*

5) *[Signature]*

INTERNAL ASSESSMENT:

EXISTING PROCEDURE MAY BE FOLLOWED
Blue Print:

Unit no:	Long questions	Short questions	Total
1	2	2	4
2	2	2	4
3	2	2	4
4	2	2	4
5	2	2	4
Total	10	10	20

1) P. S. S. S.

2) B. S. S. S. S.

3) C. S. S. S. S.

4) V. C. S. S. S.

5) H. Krishna Sanyal

S.R.R & C.V.R GOVT . Degree college(A) ::2019-20

DEPARTMENT OF STATISTICS

MODEL PAPER

SEMESTER-VI

Max.Marks:100 (Int.40+Ext.60)

Time:2½ hrs.

PAPER VIII (A-1): OPERATIONAL RESEARCH

Section-A

Answer Any Five Questions

5x4=20

1. Models in Operations Research
2. Characteristic of Operations Research
3. How to solve LPP Graphically
4. Formulation of Linear Programming Problem
5. Explain Slack and Surplus variables
6. Advantages of Dual Simplex Method
7. Feasible solution, Basic Solution, Basic Feasible Solution
8. What is Degeneracy Problem?
9. Explain Optimal Strategy, Saddle point
10. Explain Pure Strategy and Mixed Strategy

Section-B

Answer Any One Question From Each Unit

5x8=40

UNIT-1

11. Explain meaning and scope of OR
(OR)
12. Explain Applications of OR

UNIT-2

13. Explain the Graphic method to solve LPP.
(OR)
14. Solve the following LPP by using Graphical method
Max $Z=X_1+X_2$ subject to
 $X_1+2X_2 \leq 2000$
 $X_1+X_2 < 1500$
 $X_2 \leq 600$ and $X_1, X_2 \geq 0$

UNIT-3

15. Explain Simplex algorithm to Solve LPP

(OR)

16. Solve the following LPP using Simplex method

$$\text{Max } Z = 3X_1 + 2X_2 + 5X_3$$

Subject to

$$X_1 + 2X_2 + X_3 \leq 430$$

$$X_1 + 4X_2 \leq 420$$

$$3X_1 + 2X_3 \leq 460 \quad \text{and } X_1, X_2 \& X_3 \geq 0$$

UNIT-4

17. Explain Dual Simplex Method to solve LPP

(OR)

18. Solve the following LPP by using Two-Phase simplex method

$$\text{MIN } Z = 15X_1 + 3X_2$$

Subject to

$$3X_1 - X_2 - X_3 \geq 3$$

$$X_1 - X_2 + X_3 \geq 2 \quad \text{and } X_1, X_2 \& X_3 \geq 0$$

UNIT-5

19. Solution of 2X2 game without Saddle point

(OR)

20. Explain the concept of Dominance Property

1) *Kosar E*

2) *Bruelbunde Rao* 3) *Celha Surnally*

4) *V. O. P. O*

5) *M. Krishna Suya*

S.R.R & C.V.R GOVT .DEGREE COLLEGE (A)::2019-2020

DEPARTMENT OF STATISTICS

III B.Sc STATISTICS CBCS SYLLABUS 2019-2020

(With mathematics combination)

SEMESTER-VI

PAPER VIII (A-2): OPTIMIIZATION TECHNIQUES

TIME 2 ½ hrs

Max.Marks.100 (40 int+60 ext)

Unit – I :

ASSIGNMENT PROBLEMS

Introduction, Mathematical model of assignment problems, Assignment Algorithm (Hungarian Method) Hungarian method for Assignment problems. Unbalanced Assignment Problems, Maximal Assignment problem

Unit – II:

SEQUENCING PROBLEM

Travelling – Salesman (Routing) Problem. Sequencing Problems: Introduction, Principal Assumptions, Solution of Sequencing Problems processing n jobs through 2 machines, processing n jobs 3 machines

Unit – III:

TRANSPORTATION PROBLEMS

Introduction, Mathematical formulation, Assignment problem as special case of transportation problem feasible solution. Basic feasible solution, Optimum Solution. IBFS to Transportation problem, Methods for initial basic feasible solution: North-West corner rule, The Row Minima method, The column minima method, Lowest cost entry method (Matrix Minima method).

Unit – IV:

Vogel's approximation method (unit cost penalty method, Unbalanced Transportation Problems, Modi method, Transshipment problems, Main characteristics of Transshipment problem)

Unit – V:

PROJECT MANAGEMENT BY PERT-CPM

Introduction, Application of PERT, CPM techniques, basic steps in PERT/CPM Time Estimates and critical path in networking analysis Determination of critical path simple problems

1) *Sosar S*

2) *Bruelavendhe Red*

3) *Chandramouli*

4) *V. A. Jale*

5) *H. Kiran Singh*

Text Books:

1. S.K. Sinha: Reliability and life testing. Wiley Eastern.
2. Operation Research – Models and methods by Chandrasekar Salimath, Bhupendar Parashar.
3. Operation Research – Taha

Practical – Paper VIII (A-2): OPTIMIZATION TECHNIQUES

Conduct any 6 (Ms-excel is compulsory)

Note

MS-Excel Practical to be made mandatory for all the Semesters after proper training only to the Teaching staff by the University concerned

1. Assignment Problem
2. Travelling Salesman Problem
3. Sequencing Problem
4. IBFS for Transportation Problems
5. MODI method
6. CPM method
7. MS – Excel Practical

PRACTICAL QUESTION PAPER MODEL (Max Marks: 50)

➤ **External**

Time: 3 Hours

Answer any two questions out of THREE. Each question carry 12 ½ marks

Total Marks 2 x 12 ½ = 25 Marks

Aim:1

Procedure & formula:6

Calculation:4 ½

Inference:1

***Each Practical Batch 15 students, Spillover 8 Students treated as 2nd Batch**

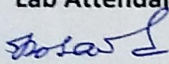
➤ **Internal**

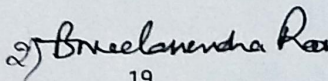
Total Marks:25

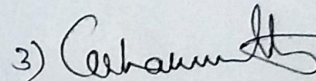
Record: 10


Viva: 10

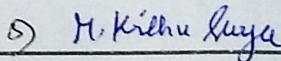
Lab Attendance: 5

1) 

2) 
19

3) 

6) 

5) 

S.R.R & C.V.R GOVT . Degree college(A) ::2019-20
DEPARTMENT OF STATISTICS
MODEL PAPER
SEMESTER-VI

Max.Marks:100 (Int.40+Ext.60)
Time:2½ hrs.

PAPER VIII (A-2): OPERATIONAL RESEARCH

Section-A

Answer Any Five Questions

5x4=20

1. Mathematical model of assignment problem
2. Explain un balanced assignment problem
3. Explain travelling sales man problem
4. Assumptions of assignment problem
5. Mathematical formulation of transportation problem
6. Explain slack and surplus variables
7. Assingment problem as a case of transportation problem
8. Explain north west corner rule method
9. Explain critical path in networking analysis
10. Explain PERT method

Section-B

Answer Any One Question From Each Unit

5x8=40

UNIT-1

11. Explain Hungarian method

(or)

12. A company as five jobs to be done.the following matrix shows the return in rupees on assignment ($i=1,2,3,4,5$) machine to the j^{th} job ($j=A,B,C,D,E$). Assing the five jobs to the five machines so as to maximize the total expected profit

jobs machines	A	B	C	D	E
1	5	11	10	12	4
2	2	4	9	3	5
3	3	12	5	14	6
4	6	14	4	11	7
5	7	9	8	12	5

UNIT-2

13. Explain the travelling sales man problem and illustrate with example.

(or)

14. All jobs have go through two machines M1 and M2. The time required for jobs on each machine in hours is given below. Find the optimum sequence that minimizes total elapsed time

Task	A	B	C	D	E	F	G	H	I
Machine-I	2	5	4	9	6	8	7	5	4
Machine-II	6	8	7	4	3	9	3	8	11

UNIT-3

15. Define transportation problem and explain row minima ,column minima method

(or)

16. Explain the procedure for MODI method

UNIT-4

17.Explain VAM method

(or)

18. Define transshipment problem with main characteristics

UNIT-5

19. Application and basic steps in PERT/CMP

UNIT-6 (OR)

20. A project as the following time schedule

Activity	1-2	1-3	1-4	2-5	3-6	3-7	4-6	5-8	6-9	7-8	8-9
Time In Month	2	2	1	4	8	5	3	1	5	4	3

Construct PERT network and compute

(i) Total float for each activity

(ii) Critical path and duration

1) *Rosale*

2) *Bruelamendha Rao* 3) *Chakraborty*

4) *V. A. Rao*

5) *M. Krishna Suresh*

