

JAYASREE K G



GEMS ARTS & SCIENCE COLLEGE

RAMAPURAM

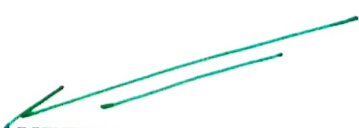
S2 BCA 2021-22

OPERATIONS RESEARCH

TEACHER'S DIARY



Name of the Faculty : Jayaraj. K. G
Designation : Asst. Professor
Department : Mathematics
Class : BCA
Subject : Operations Research
Name of the Paper : Operations Research
Semester : Second
Duration of Semester : From 11/02/2022 To 30/6/2022


Dr. NAVEEN MOHAN
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MADAPPURAM DT., KERALA-679 321

SYLLABUS OF THE PAPER

BCA2C04 - Operations Research

Course Number: 13

Contact Hours per Week: 4

Number of Credits: 3

Number of Contact Hours: 64Hrs.

Course Evaluation: Internal – 15 Marks + External – 60 Marks

Objective

- To get a general introduction in solving linear programming problems.
- To get a general understanding of network analysis technique.
- To get a general understanding of different mathematical models.

34 | Page Board of Studies UG | Computer Science & Applications | University of Calicut

BCA (Academic Year 2019-20 Onwards)

Prerequisites

- Basic Mathematical knowledge

Course Outline

UNIT I (12T)

Operation research and LPP; Operation Research and Decision making, Advantages of O.R approach in decision making, Application of O.R, uses and limitations of O.R.

UNIT II (14T)

LPP: Introduction, mathematical formulation the problem, canonical and standard forms of LPP. Simplex method, artificial variable technique - Big M and two phase method - problem of degeneracy - concept of duality - dual simplex method.

UNIT III (12T)

Transportation model - North West corner rule, Least cost method, Vogel's approximation method - loops in transportation table - Degeneracy in transportation table - Transshipment problem.

UNIT IV (12T)

Assignment model: Mathematical formulation of the problem - assignment algorithm impossible algorithms - travelling salesman problem

UNIT V (14T)

Network Scheduling: Concept of network, basic components, PERT and CPM, Rules of network construction, maximal flow problem, project scheduling critical path calculations, advantages of network (PERT/CPM).

Sequencing models: processing n jobs through two machines, n jobs through three machines, two jobs through m machines.

Textbook

1. Operation Research, Kanti Swarup, Gupta P.K Man Mohan, Sultan Chand & Sons

References:

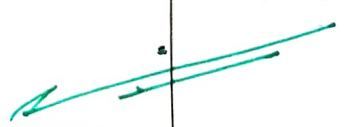
1. Operation Research: An Introduction, Tahah, A, McMillan 1982
2. Operations Research, Prof. K. Venogopal, Calicut University Central Co-Operative Stores

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TIME TABLE

| Hour → Day ↓ | I | II | III | IV | V |
|-----------------------|---|----|-----|----|---|
| MON | | | | | |
| TUE | | | | | ✓ |
| WED | | ✓ | | | |
| THUR | ✓ | | | | |
| FRI | | ✓ | | | |


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COURSE OBJECTIVES

MODULE

OBJECTIVES

I

Introduction to
operation Research

Knowledge about
operation research.
Skill of understanding

II

Linear programming
problems

Knowledge skill
Problems solving skill

III

Transportational model

Knowledge skill
Problems solving skill

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COURSE OBJECTIVES

MODULE

OBJECTIVES

IV

Assignment model

Knowledge skill
Problem solving skill

V

Network scheduling
and
sequencing model

Knowledge skill
Problem solving skill

Signature of Faculty

Date

23/2/2022

Signature of HOD






Date


1/6/2022

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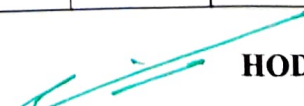
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SEMESTER WISE COURSE PLAN

| Sl. No. | Name of Module | No. of Hrs Allocated | Date | | Actual Period Taken | | Sign of HOD with Date |
|---------|---|----------------------|-------------------|--------------------|---------------------|--------------------|---|
| | | | From | To | From | To | |
| | Module : <u>II</u> LPP (Linear Programming Problems) | 14 | 29/3/22 | 1/5/22 | 29/3/22 | 31/5/22 |  1/6/22 |
| | Module : <u>III</u> TP (Transportation Problems) | 12 | 09/5/22 | 25/5/22 | 17/6/22 | 24/6/22 |  1/7/22 |
| | Module : <u>IV</u> AP (Assignment Problems) | 12 | 26/5/22 | 10/6/22 | 29/6/22 | 02/7/22 |  1/7/22 |
| | Module : <u>V</u> N.S (Network Scheduling) S.P (Queuing Problems) | 14 | 1/4/22 11/6/22 | 30/5/22 30/6/22 | 1/4/22 27/6/22 | 30/5/22 29/6/22 |  1/7/22 |
| | Module : <u>I</u> Introduction to Operation Research | 12 | 23/2/22 | 15/3/22 | 23/2/22 | 15/3/22 |  1/7/22 |


Signature of Faculty 

HOD 


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TEACHING PLAN

| Module | Sub. Topics and Points to be discussed | Activities Proposed |
|--|--|--|
| <p style="text-align: center;">I</p> <p>operations Research</p> | <p>Introduction</p> <p>Decision making.</p> <p>Advantages of OR</p> <p>Limitations of OR</p> <p>Applications of OR</p> | <p>Discussion</p> <p>Problem solving.</p> <p>Debate</p> <p>group discussion</p> |
| <p style="text-align: center;">II</p> <p>Linear Programming problems</p> | <p>Introduction</p> <p>Mathematical formulation</p> <p>Canonical form</p> <p>std. forms</p> | <div style="text-align: right;">  Dr. NAVEEN MOHAN PRINCIPAL GEMS ARTS AND SCIENCE COLLEGE KADUNGAPURAM (PO), RAMAPURAM MALAPPURAM DT., KERALA-679 321 </div> |

TEACHING PLAN

Module

Sub. Topics and Points
to be discussed

Activities Proposed


Simplex method
Artificial variable
Big-M. Method
Two phase method
degeneracy.
duality
dual simplex
method

Discussion
Problem solving.
debates
group discussions

III


Transportation
Problem

Mathematical
formulation.
North West Corner
Rule.


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TEACHING PLAN

| Module | Sub. Topics and Points to be discussed | Activities Proposed |
|---|--|---|
| <p>less</p> <p style="text-align: center;"><u>W</u></p> | <p>least cost method</p> <p>VAM method</p> <p>loops</p> <p>Degeneracy.</p> <p>Transshipment Problems</p> | <p>Discussion</p> <p>Problems solving.</p> <p>Quiz</p> |
| <p>Assignment Problems</p> | <p>Mathematical formulation</p> <p>assignment location</p> <p>travelling salesman problem</p> | <p>Discussion</p> <p>Problems solving.</p> <p>debates</p> <p>Quiz</p> |


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TEACHING PLAN

Module

Sub. Topics and Points to be discussed

Activities Proposed

V

Network scheduling

Concept of network.

Discussions
problem solving

basic components

Quiz

PERT

CPM

minimal flow problems

Advantages of network.

sequencing problem


processing jobs
- through two
machines


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TEACHING PLAN

| Module | Sub. Topics and Points to be discussed | Activities Proposed |
|--------|--|--|
| | <p>n jobs through 3 machines</p> <p>Two jobs through m machines</p> | <p>Discussion Problem solving Quiz</p> |

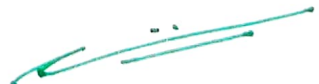

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ASSIGNMENTS / SEMINAR


| Module No. | Assignments | Seminars |
|------------|---|--|
| I | <p>15/3/2022</p> <p>Introduction to</p> <p>Operation Research</p> | <p style="text-align: center;">—</p> <ul style="list-style-type: none"> * Importance of O.R * Merits of OR * Demerits of OR |
| II | <p>17/6/2022</p> <p>Problem related</p> <p>LPP</p> | <p style="text-align: center;">—</p> <ul style="list-style-type: none"> * Simplex method * Big M method |


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ASSIGNMENTS / SEMINAR

| Module No. | Assignments | Seminars |
|---|---|--|
| <p style="text-align: center;"><u>III</u></p> | <p style="text-align: center;">24/6/22</p> <p style="text-align: center;">Problems related to T.P</p> | <p style="text-align: center;">—</p> <ul style="list-style-type: none"> * Vogel's approximation method * optimality |
| <p style="text-align: center;"><u>IV</u></p> | <p style="text-align: center;">4/7/2022</p> <p style="text-align: center;">Problems related to Assignment model</p> | <p style="text-align: center;">—</p> <ul style="list-style-type: none"> * Mathematical formulation * Assignment model <div style="text-align: right; margin-top: 20px;">  <p>Dr. NAVEEN MOHAN PRINCIPAL GEMS ARTS AND SCIENCE COLLEGE KADUNGAPURAM (PO), RAMAPURAM MALAPPURAM DT., KERALA-679 321</p> </div> |

ASSIGNMENTS / SEMINAR

| Module No. | Assignments | Seminars |
|---|---|--|
| <p style="text-align: center;"><u>V</u></p> | <p>11/7/2022</p> <p>Network problems</p> <p>4/7/2022</p> <p>Sequencing Problems</p> | <p style="text-align: center;">—</p> <p>* PERT and CPM</p> <p>* Sequencing models</p> <div style="text-align: right; margin-top: 200px;">  Dr. NAVTEN MOHAN PRINCIPAL SANSKRIT ARTS AND SCIENCE COLLEGE MADUNGA PURAM (PO), RAMAPURAM MALAPPURAM DT., KERALA-679 321 </div> |

IMPORTANT DATES RELATED TO THE SUBJECT

Date of Commencement of the Semester : 11/02/2022
Date of First Class in the Subject : 23/2/2022
Date of Last Class in the Subject : 2/7/2022
Date of Closing the Semester : 30/7/2022
Total Hours Engaged in the Class : 70 hrs
Date of First Achievement Test : 29/3/2022
Date of Second Achievement Test : 17/4/2022
Date of Third Achievement Test : 31/5/2022
Date of First Assignment : 15/3/2022
Date of Second Assignment : 17/6/2022
Date of Model Exam : 13/7/2022
Date of University Exam : 3/8/2022

Signature of Faculty

Date 4/8/2022

Signature of HOD

Date 4/8/22

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AVERAGE PERFORMANCE ANALYSIS IN INTERNAL TESTS

| Test/Date | No. of Students | | | Pass % | Remarks with dated sign | |
|-------------------------|-----------------|--------|------------------|--------|-------------------------------|-------------------------------|
| | Appeared | Absent | Passed Mark >50% | | Faculty | HOD |
| 29/3/2022 | 42 | 0 | 42 | 100 | <i>[Signature]</i> 29/3/22 | <i>[Signature]</i> 4/8/22 |
| 17/4/2022 | 42 | 0 | 42 | 100 | <i>[Signature]</i> 17/4/22 | <i>[Signature]</i> 4/8/22 |
| 31/5/2022 | 42 | 0 | 42 | 100 | <i>[Signature]</i> 31/5/22 | <i>[Signature]</i> 4/8/22 |
| 13/7/22 | 42 | 0 | 42 | 100 | <i>[Signature]</i> 13/7/22 | <i>[Signature]</i> 4/8/22 |
| Assign Semester I | 42 | 0 | 42 | 100 | <i>[Signature]</i> 30/6/22 | <i>[Signature]</i> 30/6/22 |
| Seminar I | - | - | - | - | - | - |

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DETAILS OF REMEDIAL CLASSES
(For each module)

| MODULE | 1 | 2 | 3 | 4 | 5 |
|----------------------------------|---|---|--|--|---|
| Topic Taught | Previous question paper | Previous question paper | Previous question paper | Previous question paper | Previous question paper |
| Date and Venue of Class | 18/7/22 Online | 19/7/22 Online | 20/7/22 Online | 21/7/22 Online | 22/7/22 Online |
| No. of Students Attended | 42 | 42 | 42 | 42 | 42 |
| Approval of HOD |  |  |  |  |  |
| Sign of Faculty Date: 22/7/22 |  | | Verification Sign HOD Date: 4/8/22   | | |

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ACTIVITIES CONDUCTED IN THE SEMESTER

| Sl No. | Brief Description of Activity | Date | No. of Students Attended | Sign Faculty | Sign HOD | Remarks |
|--------|-------------------------------|---------|--------------------------|--------------|----------|---------|
| 1 | Internal exam 1 | 29/3/22 | 42 | | | |
| 2 | Internal exam 2 | 17/4/22 | 42 | | | |
| 3 | Internal exam 3 | 31/5/22 | 42 | | | |
| 4 | Model exam | 13/7/22 | 42 | | | |
| 5 | Assignment 1 | 15/3/22 | 42 | | | |
| 6 | Assignment 2 | 17/6/22 | 42 | | | |
| 7 | question paper discussion 1 | 18/7/22 | 42 | | | |
| 8 | question paper discussion 2 | 19/7/22 | 42 | | | |
| 9 | question paper discussion 3 | 20/7/22 | 42 | | | |
| 10 | question paper discussion 4 | 21/7/22 | 42 | | | |
| 11 | question paper discussion 5 | 22/7/22 | 42 | | | |
| 12 | viva set 1 | 23/7/22 | 20 | | | |
| 13 | viva set 2 | 24/7/22 | 22 | | | |

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C 4353

(Pages : 4)

Name.....

Reg. No.....

**SECOND SEMESTER (CBCSS—UG) DEGREE EXAMINATION
APRIL 2021**

B.C.A.

BCA 2C 04—OPERATIONS RESEARCH

Time : Two Hours

Maximum : 60 Marks

Section A (Short Answer Type Questions)

Answer at least eight questions.

Each question carries 3 marks.

All questions can be attended.

Overall Ceiling 24.

1. Write any two applications of OR ?
2. What do you mean by an objective function of an LPP ?
3. What are the basic assumptions of a LPP ?
4. What do you mean by an artificial variable ?
5. What do you mean by basic feasible solution of a Transportation problem ?
6. What are Assignment problems ?
7. Define Travelling salesman problem.
8. What do you mean by Degeneracy in a TP ?
9. What is network analysis ?
10. What is meant by a Critical path ? Why should we know which activities are critical ?
11. What is dummy activity ?
12. Distinguish between 'Slack' and 'float'.

(8 × 3 = 24 marks)

Section B (Short Essay Type Questions)

Answer at least five questions.

Each question carries 5 marks.

All questions can be attended.

Overall Ceiling 25.

13. What are the limitations of OR ?

Turn over

14. Solve Graphically :

$$\text{Maximizes} = 3x_1 + 5x_2$$

$$\text{subjected to } x_1 + 2x_2 \leq 2000 ;$$

$$x_1 + x_2 \leq 1500 ;$$

$$x_2 \leq 600 ;$$

$$x_1, x_2 \geq 0.$$

15. A manufacturer of furniture makes two products, chairs and tables. Processing of these products is done on two machines A and B. A chair requires 2 hours on machine A and 6 hours on machine B. A table requires 5 hours on machine A and no time on machine B. There are 16 hours of time per day available on machine A and 30 hours on machine B. Profit gained by the manufacturer from a chair is Re. 1 and from a table is Rs. 5 respectively. Formulate the problem into a LPP in order to maximise the total profit ?

16. Find the initial solution of the following TP by using Lowest cost entry method :

| | D ₁ | D ₂ | D ₃ | Supply |
|----------------|----------------|----------------|----------------|--------|
| O ₁ | 2 | 7 | 4 | 5 |
| O ₂ | 3 | 3 | 1 | 8 |
| O ₃ | 5 | 4 | 7 | 7 |
| O ₄ | 1 | 6 | 2 | 14 |
| Demand | 7 | 9 | 18 | |

17. Find the optimal solution to the following Assignment problem showing the cost for assigning workers to jobs :

| | x | y | z |
|---------|----|----|----|
| Workers | 18 | 17 | 16 |
| | 15 | 13 | 14 |
| | 19 | 20 | 21 |

18. Draw a network diagram to the following set of activities :

| Activities | Preceding activities |
|------------|----------------------|
| A | ----- |
| B | ----- |
| C | A |
| D | A |
| E | B and C |
| F | B and C |
| G | B and C |
| H | D and E |
| I | F |
| J | F |
| K | G |
| L | H and I |
| M | H and I |
| N | J, K and L |

19. Distinguish between PERT and CPM.

(5 × 5 = 25 marks)

Section C

Answer any **one** question.

The question carries 11 marks.

20. Solve the following LPP by using Two-phase simplex method :

$$\text{Maximize } Z = 5x_1 + 8x_2$$

$$\text{subjected to : } 3x_1 + 2x_2 \geq 3$$

$$x_1 + 4x_2 \geq 4$$

$$x_1 + x_2 \leq 5$$

$$x_1, x_2 \geq 0.$$

Turn over

21. Solve the following minimal assignment problems :

| | I | II | III | IV | V |
|---|---|----|-----|----|---|
| A | 1 | 3 | 2 | 3 | 6 |
| B | 2 | 4 | 3 | 1 | 5 |
| C | 5 | 6 | 3 | 4 | 6 |
| D | 3 | 1 | 4 | 2 | 2 |
| E | 1 | 5 | 6 | 5 | 4 |

(1 × 11 = 11 marks)

29/3/2022

INTERNAL EXAM - 1

S₂ BCA - Operations Research

29/3/2022 (Online)

One hour - 15 marks

ANSWER ALL QUESTIONS

1) Solve graphically

$$\text{Maximize } Z = 60x_1 + 40x_2$$

$$\text{subject to } 2x_1 + x_2 \leq 60$$

$$x_1 \leq 25$$

$$x_2 \leq 35$$

$$x_1, x_2 \geq 0$$

2) Explain (a) constraint (b) feasible region (c) linear programming

3) Explain the canonical form and standard form of L.P.P

3x5 = 15 marks

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method

(10 marks)

2) Explain (a) slack variable

17/4

STUDENTS ATTENDANCE AND PERFORMANCE RECORD

| Sl No. | Name of the Student | Month Total | Attendance/Month | | | | | Continuous Evaluation | | | | |
|--------|---------------------|-------------|------------------|------|-----|-----|------|-----------------------|----|-------|------------|---------|
| | | | 14 | 22 | 18 | 3 | 10 | Exam | | | Assignment | Seminar |
| | | | Feb | Mar | Apr | May | June | T1 | T2 | Model | | |
| 1 | Mohd. Shafeeq | 9.5 | 18 | 17.5 | 3 | 8.5 | 3 | 3 | 2 | 3 | 3 | |
| 2 | Mohd. Ashiq | 13.5 | 14 | 13.5 | 3 | 8.5 | 3 | 3 | 3 | 3 | 3 | |
| 3 | Mohd. Mishaal | 12 | 11.5 | 13.5 | 3 | 3.5 | 3 | 3 | 2 | 2 | 3 | |
| 4 | Mohd. Noorul Ameen | 11 | 21.5 | 16.5 | 3 | 10 | 3 | 3 | 3 | 3 | 3 | |
| 5 | Bilal Subod | 10 | 18 | 16 | 3 | 6.5 | 3 | 3 | 3 | 2 | 3 | |
| 6 | Arshad | 12.5 | 18.5 | 17 | 3 | 7.5 | 3 | 3 | 2 | 3 | 3 | |
| 8 | Mohd. Sabique | 12.5 | 18.5 | 4.5 | 3 | 7.5 | 3 | 3 | 3 | 3 | 3 | |
| 9 | Mohd. Fais | 10.5 | 19.5 | 17.5 | 3 | 9 | 3 | 3 | 3 | 3 | 3 | |
| 10 | Mohd. Shaamil | 7.5 | 21.2 | 17 | 3 | 4.5 | 3 | 3 | 3 | 2 | 3 | |
| 11 | Mohd. Hisham | 11 | 21.5 | 11.5 | 3 | 8 | 3 | 3 | 2 | 2 | 3 | |
| 12 | Banla Parveen | 13 | 16 | 18 | 3 | 8.5 | 3 | 3 | 3 | 3 | 3 | |
| 13 | Febin Falaah | 4.5 | 9.5 | 11 | 3 | 4.5 | 3 | 3 | 2 | 2 | 3 | |
| 14 | Subailah E | 11 | 18 | 18 | 3 | 8 | 3 | 3 | 3 | 3 | 3 | |
| 15 | Muud Krishna | 11 | 17.5 | 14 | 3 | 4.5 | 3 | 3 | 3 | 2 | 3 | |
| 16 | Fardin Mohd. | 10.5 | 17.5 | 17 | 3 | 9.5 | 3 | 3 | 3 | 3 | 3 | |
| 17 | Mohd. Shibili | 14 | 20 | 13.5 | 3 | 7.5 | 3 | 3 | 2 | 3 | 3 | |
| 18 | Ajuna | 13 | 20 | 17.5 | 3 | 10 | 3 | 3 | 3 | 3 | 3 | |
| 19 | Sahle Sherin | 14 | 17.5 | 17.5 | 3 | 9.5 | 3 | 3 | 3 | 3 | 3 | |
| 20 | Mohd. Shafi | 7.5 | 18.5 | 14.5 | 3 | 7 | 3 | 3 | 2 | 3 | 3 | |
| 21 | Mohd Risuan | 10 | 13 | 15.5 | 3 | 6 | 3 | 3 | 2 | 3 | 3 | |
| 22 | Mohd Mashahir | 10.5 | 20 | 16.5 | 3 | 9 | 3 | 3 | 2 | 3 | 3 | |
| 23 | Shibin Syed. | 13.5 | 19 | 14.5 | 3 | 8.5 | 3 | 3 | 2 | 3 | 3 | |

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STUDENTS ATTENDANCE AND PERFORMANCE RECORD

| Sl. No. | Name of the Student | Month Total | Attendance/Month | | | | | Continuous Evaluation | | | | |
|---------|----------------------|----------------|------------------|------|-------|-----|------|-----------------------|----|-------|------------|---------|
| | | | 14 | 22 | 18 | 3 | 10 | Exam | | | Assignment | Seminar |
| | | | Feb | Mar | April | May | June | T1 | T2 | Model | | |
| 24 | Mohd. Yaseen | | 13.5 | 19.5 | 16.5 | 3 | 7.5 | 3 | 3 | 2 | 3 | 2 |
| 25 | Mohd. Ameen | | 10 | 19 | 11.5 | 3 | 6.5 | 3 | 3 | 2 | 3 | 2 |
| 26 | Mohd. Shajal | | 13.5 | 20 | 17.5 | 3 | 7.5 | 3 | 3 | 3 | 3 | 3 |
| 27 | Shahin Abdulla | | 12.5 | 19.5 | 13.5 | 3 | 6 | 3 | 3 | 3 | 2 | 3 |
| 28 | freekumar | | | | | | | 3 | 3 | 3 | 3 | 3 |
| 29 | Salman. A | | 12 | 16 | 13 | 3 | 5 | 3 | 3 | 2 | 3 | 2 |
| 30 | Mahloofa | | 12 | 18 | 17.5 | 3 | 7.5 | 3 | 3 | 2 | 3 | 3 |
| 31 | Mohammed K | | 11 | 17.5 | 15 | 3 | 6 | 3 | 3 | 2 | 3 | 3 |
| 32 | Shiyana. | | 13 | 18 | 16.5 | 3 | 8 | 3 | 3 | 3 | 3 | 3 |
| 33 | Adarsh. K | | 12 | 20.5 | 18 | 3 | 10 | 3 | 3 | 3 | 3 | 3 |
| 34 | Mohd. Shamil | | 11 | 19.5 | 17.5 | 3 | 9.5 | 3 | 3 | 3 | 3 | 3 |
| 35 | Mohd. Afvan | | 11 | 18 | 14 | 3 | 7.5 | 3 | 3 | 2 | 2 | 3 |
| 36 | Fidha. P. K | | 13.5 | 15.5 | 18 | 3 | 10 | 3 | 3 | 2 | 3 | 3 |
| 37 | Jyotish Kumar | | 11 | 14 | 13 | 3 | 6.5 | 3 | 3 | 2 | 3 | 3 |
| 38 | Ashwin | | 10.5 | 16 | 16.5 | 3 | 6 | 3 | 3 | 2 | 2 | 3 |
| 39 | Ashhad Mohd. | | 10 | 13 | 15.5 | 3 | 7.5 | 3 | 3 | 2 | 3 | 3 |
| 40 | Jilsha Mol | | 12.5 | 18 | 18 | 3 | 9.5 | 3 | 3 | 3 | 3 | 3 |
| 41 | Ranoes Khedher | | 13 | 21 | 17.5 | 3 | 9.5 | 3 | 3 | 3 | 3 | 3 |
| 42 | Harshid K.C. | | 10.5 | 19 | 17 | 3 | 7.5 | 3 | 3 | 3 | 3 | 3 |

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(Pages : 3)

Name.....

Reg. No.....

SECOND SEMESTER (CBCSS-UG) DEGREE EXAMINATION, APRIL 2022

B.C.A.

BCA 2C 04—OPERATIONS RESEARCH

(2021 Admissions)

Time : Two Hours

Maximum Marks : 60

Section A (Short Answer Type Questions)

Answer at least **eight** questions.

Each question carries 3 marks.

All questions can be attended.

Overall Ceiling 24.

1. What is Operations Research ?
2. What is the role of OR in decision-making ?
3. Write the Mathematical model of a LPP.
4. What do you mean by feasible region in a LPP ? What will be the shape of the feasible region ?
5. What are slack and surplus variables ?
6. What do you mean by dual of a LPP ?
7. Name the three methods for obtaining initial feasible solution of a Transportation problem.
8. What are Unbalanced transportation problems ?
9. Cite any two areas where assignment technique is applied.
10. Write any two applications of Network techniques.
11. Define an Activity and an event.
12. Draw the network diagram to the following activities :

Activity (i, j) Time Duration

| | | |
|-----|-----|---|
| 1—2 | ... | 2 |
| 1—3 | ... | 4 |
| 1—4 | ... | 3 |
| 2—5 | ... | 1 |
| 3—5 | ... | 6 |
| 4—6 | ... | 5 |
| 5—6 | ... | 7 |

(8 × 3 = 24 marks)

Turn over

Section B (Essay Type Questions)

Answer at least **five** questions.

Each question carries 5 marks.

All questions can be attended.

Overall Ceiling 25.

13. What are the advantages of OR ?
 14. Solve graphically the following LPP :

$$\text{Maximize } Z = 60x_1 + 40x_2$$

subject to the constraints $2x_1 + x_2 \leq 60$; $x_1 \leq 25$; $x_2 \leq 35$; $x_1, x_2 \geq 0$.

15. A company sells two types of fertilizers, one is liquid and the other is dry. The liquid fertilizer contains 2 units of chemical A and 4 units of chemical B per jar and the dry fertilizer contains 3 units of the chemicals A and B. The liquid fertilizer sells for Rs. 3 per jar and the dry fertilizer sells for Rs. 4. A farmer requires at least 90 units of chemical A and at least 120 units of chemical B. Formulate the problem into a LPP.
 16. Find the initial solution of the following TP by using North-West corner rule :

| | D ₁ | D ₂ | D ₃ | D ₄ | Supply |
|----------------|----------------|----------------|----------------|----------------|--------|
| O ₁ | 190 | 300 | 500 | 100 | 70 |
| O ₂ | 700 | 300 | 400 | 600 | 90 |
| O ₃ | 400 | 100 | 600 | 200 | 180 |
| Demand | 50 | 80 | 70 | 140 | |

17. What do you mean by an Assignment problem ? Write the differences between Assignment problems and Transportation problems.
 18. Draw a network for a simple project of erection of shed works for a shed. The various elements of project areas shown below :

| Activity node | Description | Pre-requisites |
|---------------|------------------------|----------------|
| A | Erect site workshop | — |
| B | Fence site | — |
| C | Bend reinforcement | A |
| D | Dig foundation | B |
| E | Fabricate steel work | A |
| F | Install concrete plant | B |
| G | Place reinforcement | C, D |
| H | Concrete foundation | G, F |
| I | Paint steel work | E |
| J | Erect steel work | H, I |
| K | Give finishing touch | J |

19. Six jobs go first over machine I and then over machine II. The order of completion of jobs has no significance. The following table gives the machine times in hours for six jobs and the two machines. Find the sequence of jobs that minimises the total elapsed time to complete the jobs. Find the minimum time :

| | | | | | | | |
|--------------------|---|---|---|---|---|---|---|
| Job number | : | 1 | 2 | 3 | 4 | 5 | 6 |
| Time on machine I | : | 5 | 9 | 4 | 7 | 8 | 6 |
| Time on machine II | : | 7 | 4 | 8 | 3 | 9 | 5 |

(5 × 5 = 25 marks)

Section C (Essay Type Question)

Answer any one question.

The question carries 11 marks.

20. Solve the following LPP by using dual simplex method :

$$\text{Minimize } Z = 2x_1 + 2x_2$$

subject to the constraints :

$$2x_1 + 4x_2 \geq 1; x_1 + 2x_2 \geq 1; 2x_1 + x_2 \geq 1; x_1, x_2 \geq 0.$$

21. Solve the following Transportation problem :

| | D ₁ | D ₂ | D ₃ | D ₄ | D ₅ | Supply |
|----------------|----------------|----------------|----------------|----------------|----------------|--------|
| O ₁ | 3 | 4 | 6 | 8 | 9 | 20 |
| O ₂ | 2 | 10 | 1 | 5 | 8 | 30 |
| O ₃ | 7 | 11 | 20 | 40 | 3 | 15 |
| O ₄ | 2 | 1 | 9 | 14 | 16 | 13 |
| Demand | 40 | 6 | 8 | 18 | 6 | |

(1 × 11 = 11 marks)

FINAL RESULT ANALYSIS

Date of University Exam : 3/8/2022
Total No. of Students Appeared : 40
Date of Publication of Result : 25/7/2023

Analysis

No. of Students Scoring

| | |
|---------|----|
| > 90% - | 4 |
| > 80% - | 7 |
| > 70% - | 14 |
| > 60% - | 16 |
| > 50% - | 23 |

No. of Students Who failed - 4

Overall pass Percentage - 90%

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DETAILED ANALYSIS OF UNIVERSITY MARKS

| UNIVERSITY Reg.No. | NAME OF STUDENTS | BCA2C04 OPERATION RESEARCH | | | | | |
|-----------------------|----------------------------------|--------------------------------------|---|----------------------------|----------------------------|----------------------------|-----|
| | | O B T A I N E D | G P O A I D N E T | C R E D I T | C P O I N T | S T A T U S | % |
| GGAVBCA001 | BASILA PARVEEN VP | O | 10 | 3 | 30 | P | 100 |
| GGAVBCA002 | ARSHAD M K | A+ | 9 | 3 | 27 | P | 90 |
| GGAVBCA003 | DILBAR SUHOOD M | P | 4 | 3 | 12 | P | 40 |
| GGAVBCA004 | FEBIN FALAAH | F | 0 | 3 | 0 | F | 0 |
| GGAVBCA005 | MOHAMED SHAMIL | F | 0 | 3 | 0 | F | 0 |
| GGAVBCA006 | MOHAMMED ASHIQ A | B+ | 7 | 3 | 21 | P | 70 |
| GGAVBCA007 | MOHAMMED FAIS T M | C | 5 | 3 | 15 | P | 50 |
| GGAVBCA008 | MOHAMMED HISHAM | B+ | 7 | 3 | 21 | P | 70 |
| GGAVBCA009 | MOHAMMED NOORUL AMEEN | B | 6 | 3 | 18 | P | 60 |
| GGAVBCA010 | MOHAMMED SHAFEEQ MOOCHIKKADAN | P | 4 | 3 | 12 | P | 40 |
| GGAVBCA011 | MUHAMMED NISHAL K | F | 0 | 3 | 0 | F | 0 |
| GGAVBCA012 | MUHAMMED SABIQUE K | C | 5 | 3 | 15 | P | 50 |
| GGAVBCA013 | AIFUNA THESNI | O | 10 | 3 | 30 | P | 100 |
| GGAVBCA014 | SAHLA SHERIN A K | B | 6 | 3 | 18 | P | 60 |
| GGAVBCA015 | FARZIN MOHAMMED B | C | 5 | 3 | 15 | P | 50 |
| GGAVBCA016 | MOHAMMED RISVAN P | P | 4 | 3 | 12 | P | 40 |
| GGAVBCA017 | MOHAMMED SHAFI OP | C | 5 | 3 | 15 | P | 50 |
| GGAVBCA018 | MUHAMMAD SHIBLI C P | B+ | 7 | 3 | 21 | P | 70 |
| GGAVBCA019 | NIVED KRISHNA S N | F | 0 | 3 | 0 | F | 0 |

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