**18COE20**

**PSG COLLEGE OF ARTS & SCIENCE**
(AUTONOMOUS)

**BCOM DEGREE EXAMINATION MAY 2023**
(Fourth Semester)

Branch – **COMMERCE (e – COMMERCE)**

**OPERATIONS RESEARCH**

Time: Three Hours Maximum: 50 Marks

**SECTION-A (5 Marks)**
Answer **ALL** questions
**ALL** questions carry **EQUAL** marks (5 x 1 = 5)

1 How many types of models are studied in OR?
(i) Two types (ii) Three types
(iii) Five types (iv) Seven types

2 The solution to a transportation problem with m sources and n destinations is feasible, if the numbers of positive allocations are
(i) m + n (ii) mn
(iii) m + n - 1 (iv) m + n + 1

3 Replacement decision is very much common when
(i) Infant stage (ii) Old age
(iii) Youth (iv) All of the above

4 In general, sequencing problem will be solved by using
(i) Hungarian Method (ii) Simplex Method
(iii) Graphical Method (iv) Johnson and Bellman Method

5 The slack for an activity is equal to
(i) LF - LS (ii) EF - ES
(iii) LS - ES (iv) None of these

**SECTION - B (15 Marks)**
Answer **ALL** Questions
**ALL** Questions Carry **EQUAL** Marks (5 x 3 = 15)

6 a) What is OR? And explain the applications of OR.

OR

b) Explain the canonical and standard from of LPP.

7 a) Determine an IBFS to the transportation problem by using North- West corner method.

| | $D_1$ | $D_2$ | $D_3$ | $D_4$ | Available |
|---|---|---|---|---|---|
| $O_1$ | 6 | 4 | 1 | 5 | 14 |
| $O_2$ | 8 | 9 | 2 | 7 | 16 |
| $O_3$ | 4 | 3 | 6 | 2 | 5 |
| Requirement | 6 | 10 | 15 | 4 | |

OR

b) Describe the solving procedure of Vogel's approximation method.

**Cont...**

8 a) What is replacement? Explain some replacement situations.

OR

b) A fleet owner finds from his past records that the cost per year of running equipment whose purchase price is Rs. 6000 are as given below:

| Year | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| Running Cost (Rs.) | 1000 | 1200 | 1400 | 1800 | 2300 | 2800 | 3400 |
| Resale Value (Rs.) | 3000 | 1500 | 750 | 375 | 200 | 200 | 200 |

Determine at what stage is replacement is to be done.

9 a) Five jobs are performed first on machine X and then on machine Y. The time taken in hours by each job on each machine is given below.

| Job | A | B | C | D | E |
|---|---|---|---|---|---|
| Machine X (Hrs.) | 6 | 2 | 10 | 4 | 11 |
| Machine Y (Hrs.) | 3 | 7 | 8 | 9 | 5 |

Determine the optimal sequence of jobs that minimize the total elapsed time to complete the job.

OR

b) Explain the behaviour of the customer.

10 a) Discuss the rules of constructing the network diagram.

OR

b) Given the following information:

| Activity | 0-1 | 1-2 | 1-3 | 2-4 | 2-5 | 3-4 | 3-6 | 4-7 | 5-7 | 6-7 |
|---|---|---|---|---|---|---|---|---|---|---|
| Duration | 2 | 8 | 10 | 6 | 3 | 3 | 7 | 5 | 2 | 8 |

i) Draw the network diagram.
ii) Identify critical path and find the total project duration.

## SECTION -C (30 Marks)

Answer **ALL** questions
**ALL** questions carry **EQUAL** Marks (5 x 6 = 30)

11 a) Solve the LPP by using simplex method:

Maximize $Z = 4X_1 + 10X_2$
Subject to the constraints $2X_1 + X_2 \leq 50$
$2X_1 + 5X_2 \leq 100$
$2X_1 + 3X_2 \leq 90$ And $X_1, X_2 \geq 0$

OR

b) Solve the following LPP by using graphical method.

Maximum $Z = 5X_1 + 7X_2$
Subject to $3X_1 + 2X_2 \leq 12$
$2X_1 + 3X_2 \leq 13$ and $X_1, X_2 \geq 0$

12 a) Find the optimal solution for the assignment problem with the following cost matrix.

| | Area | W | X | Y | Z |
|---|---|---|---|---|---|
| Salesmen | A | 11 | 17 | 8 | 16 |
| | B | 9 | 7 | 12 | 6 |
| | C | 13 | 16 | 15 | 12 |
| | D | 14 | 10 | 12 | 11 |

OR

b) Solve the assignment problem and find the optimum time

| | | Machines | | | | |
|---|---|---|---|---|---|---|
| | | A | B | C | D | E |
| Jobs | I | 20 | 15 | 18 | 20 | 25 |
| | II | 18 | 20 | 12 | 14 | 15 |
| | III | 21 | 23 | 25 | 27 | 25 |
| | IV | 17 | 18 | 21 | 23 | 20 |
| | V | 18 | 18 | 16 | 19 | 20 |

13 a) The probability $P_n$ of failure just before age n are shown below. If individual replacement costs Rs. 1.25 and group replacement costs Rs.0.50 per item, find the optimum replacement policy.

| Number of year (n) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Probability of failure ($P_n$) | 0.10 | 0.03 | 0.05 | 0.07 | 0.10 | 0.15 | 0.20 | 0.15 | 0.11 | 0.04 |

OR

b) Let U=0.9 and initial price is Rs.5000, running cost varies as follows.

| Year(n) | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| Running cost | 400 | 500 | 700 | 1000 | 1300 | 1700 | 2100 |

What would be the optimum replacement year?

14 a) There are 5 jobs, each of which is to be processed through 3 machines A, B and C in the order ABC. Processing times in hours are given below:

| Job | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Machine A | 3 | 8 | 7 | 5 | 4 |
| Machine B | 4 | 5 | 1 | 2 | 3 |
| Machine C | 7 | 9 | 5 | 6 | 10 |

Determine the optimum sequence for the 5 jobs and the minimum total elapsed time.

OR

b) Explain the characteristics of a queuing system.

15 a) The following information is given:

| Activity | 1-2 | 2-3 | 2-4 | 3-5 | 4-6 | 5-6 | 5-7 | 6-7 |
|---|---|---|---|---|---|---|---|---|
| Optimistic Time (Weeks) | 3 | 3 | 2 | 4 | 4 | 0 | 3 | 2 |
| Most Likely Time (Weeks) | 3 | 6 | 4 | 6 | 6 | 0 | 4 | 5 |
| Pessimistic Time (Weeks) | 3 | 9 | 6 | 8 | 8 | 0 | 5 | 8 |

Draw the network diagram and determine the following,

i) Expected time and variance of each activity.

ii) Critical path and expected project length.

OR

b) Explain the follows terms.

(i) Network (ii) Activity (iii) Merge Event (iv) Burst Event

Z-Z-Z END