Code No. : 31054 E   **Sub. Code : EECO 43**

B.Com. (CBCS) DEGREE EXAMINATION,
NOVEMBER 2025.

Fourth Semester

Commerce

Elective – OPERATION RESEARCH

(For those who joined in July 2023 onwards)

Time : Three hours   Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer :

1. Operations Research has originated during:

    (a) The Industrial Revolution

    (b) World War II

    (c) The Cold War

    (d) The Renaissance

2. Which of the following is an application of Linear Programming?
   (a) Resource allocation
   (b) Weather forecasting
   (c) Social media marketing
   (d) Music composition

3. In the North-West Corner Method, how is the first allocation determined?
   (a) By selecting the cell with the lowest cost
   (b) By selecting the cell in the top-left corner
   (c) By selecting the cell with the highest cost
   (d) By selecting any random cell

4. The Hungarian Method is used to solve:
   (a) Transportation Problem
   (b) Assignment Problem
   (c) Linear Programming Problem
   (d) Network Flow Problem -

5. What is the primary objective of Game Theory?
   (a) To analyze competitive situations
   (b) To solve linear programming problems
   (c) To optimize supply chain management
   (d) To simulate real-world scenarios

6. Which method is used to solve a 2x2 game without a saddle point?
   (a) Graphical Method
   (b) Algebraic Method
   (c) Simplex Method
   (d) Stepping Stone Method

7. ABC analysis in inventory management is based on:
   (a) The size of the items
   (b) The value of the items
   (c) The weight of the items
   (d) The color of the items

8. Which of the following is a key feature of JIT?
   (a) High inventory levels
   (b) Long lead times
   (c) Continuous improvement (Kaizen)
   (d) Frequent stockouts

9. In PERT, the three-time estimates used are:
   (a) Optimistic, Pessimistic, and Most Likely
   (b) Early Start, Late Start, and Float
   (c) Optimistic, Realistic, and Critical
   (d) Start, Finish, and Delay

10. The slack of an activity on the critical path is:
   (a) Zero
   (b) Equal to the activity duration
   (c) Equal to the project duration
   (d) Equal to the float of the previous activity

PART B — (5 × 5 = 25 marks)

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 250 words.

11. (a) Describe the different phases involved in solving an Operations Research problem.

Or

(b) Solve the following linear programming problem using graphical method:

Maximize $Z = 30x + 50y$

Subject to the constraints

$2x + 3y \leq 18$

$3x + 2y \leq 18$

x and $y \geq 0$

12. (a) Discuss the assumptions made in the formulation of a Transportation Problem.

Or

(b) A company needs to transport goods from three warehouses (WI, W2, W3) to three markets (Ml, M2, M3). The supply available at each warehouse and the demand required at each market is given below:

Supply and Demand Table

	M1	M2	M3	Supply
W1	2	3	1	30
W2	4	2	5	40
W3	3	1	2	50
Demand	20	50	50	Total = 120

Each cell in the table represents the transportation cost per unit from a warehouse to a market. Solve this problem using the North-West Corner Method.

13. (a) Analyze the limitations of Game Theory in modeling real-world scenarios.

Or

(b) Explain the concept of the minimax criterion in Game Theory.

14. (a) A company sells 10,000 units of a product annually. The ordering cost per order is Rs. 500, and the holding cost per unit per year is Rs. 2. Find the Economic Order Quantity (EOQ).

Or

(b) Discuss the advantages of implementing a Just-in-Time (JIT) inventory system.

15. (a) A project consists of the following activities with their respective durations (in days) and dependencies:

Activity	Predecessor	Duration (days)
A	–	4
B	A	5
C	A	6
D	A	3
E	B, C	4
F	D, E	7

(i) Draw the network diagram for the given project.

(ii) Determine the critical path and total project duration using CPM.

Or

(b) Define the Critical Path Method (CPM) and explain its purpose in project management.

PART C — (5 × 8 = 40 marks)

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 600 words.

16. (a) Solve the following linear programming problem using simplex method:

Maximize $Z = 40x + 30y$

Subject to

$2x + y \le 40$

$x + 2y \le 50$

x and $y \ge 0$

Or

(b) Solve the following linear programming problem using graphical method:

Cost Minimization : $Z = 5x + 8y$

Constraints

(i) Machine Hours Constraint: $2x + 3y \le 50$

(ii) Material Constraint: $4x + 2y \le 80$

(iii) Non-negativity Constraints: x and $y \ge 0$

17. (a) Differentiate between balanced and unbalanced Transportation Problems and explain how to handle unbalanced problems.

Or

(b) A company has three factories (Fl, F2, F3) and three warehouses (Wi, W2, W3). The supply available at each factory and the demand required at each warehouse are given below. The cost of transporting one unit from each factory to each warehouse is also provided. Solve this problem using:

(i) North-West Corner Method.

(ii) Least cost cell method

(iii) Vogel's Approximation Method (VAM)

Factories/Warehouses	W1	W2	W3	Supply
F1	19	30	50	7
F2	70	30	40	10
F3	40	8	70	15
Demand	5	8	19	32

18. (a) A small retail store sells a product with the following characteristics:

· Demand per day: Randomly follows the distribution:

o 10 units (30% chance)

o 20 units (50% chance)

o 30 units (20% chance)

· Lead time for restocking: 2 days (fixed).

· Initial inventory: 50 units

· Reorder policy: If inventory $\leq$ 30 units at the end of the day. order 50 more units (arrives after 2 days).

Simulate the inventory for 7 days and determine:

(i) Total lost sales (if demand exceeds available stock).

(ii) Average inventory level.

Or

(b) Discuss the different types of simulation models

19. (a) Compare and contrast Just-in-Time (JIT) and Material Requirement Planning (MRP)

Or

(b) A retailer sells a product with an average daily demand of 50 units and a standard deviation of demand of 10 units per day. The lead time for new stock is 5 days. The retailer wants a 95% service level, meaning they should not run out of stock 95% of the time. The Z-score for 95% service level is 1.65. Determine the Reorder Point (ROP) considering demand variability.

20. (a) A construction project consists of the following activities along with their respective time estimates (in weeks):

Activity	Predecessors	Optimistic (a)	Most likely (m)	Pessimistic (b)
A	–	2	4	6
B	A	3	5	9
C	A	1	4	7
D	B	2	6	10
E	C	3	5	8
F	D, E	4	7	11

(i) Calculate the expected time (TE) for each activity using the PERT formula:

$$TE = a + 4m + b/6$$

(ii) Construct the network diagram.

(iii) Determine the critical path and project completion time.

Or

(b) Compare and contrast CPM and PERT in terms of their focus, assumptions, and applications.

_____