

Roll.No.

22UMACT6015

SHRIMATHI DEVKUNVAR NANALAL BHATT VAISHNAV COLLEGE FOR WOMEN
(AUTONOMOUS)

(Affiliated to the University of Madras and Re-accredited with 'A+' Grade by NAAC)
Chromepet, Chennai - 600 044.

B.Sc Mathematics- END SEMESTER EXAMINATIONS - NOVEMBER 2025
SEMESTER - VI

22UMACT6015 - Operations Research

Total Duration : 2 Hrs.30 Mins.

Total Marks : 60

Section B

Answer any **SIX** questions ($6 \times 5 = 30$ Marks)

1. A firm manufacture two types of products A and B and sells them at a profit of Rs.2 on type A and Rs.3 on type B. Each product is processed on two machines M_1 and M_2 . Type A requires 1 minute of processing time on M_1 and 2 minutes on M_2 . Type B requires 1 minute on M_1 and 1 minute on M_2 . Machine M_1 is available for not more than 6 hours 40 minutes, while machine M_2 is available for 10 hours during any working day. Formulate the problem as a LPP so as to maximize the profit.
2. Apply graphical method to solve the LPP: $Max Z = x_1 - 2x_2$
subject to the constraints
 $-x_1 + x_2 \leq 1,$
 $6x_1 + 4x_2 \geq 24,$
 $0 \leq x_1 \leq 5$ and
 $2 \leq x_2 \leq 4,$ where $x_1, x_2 \geq 0.$
3. Use Simplex Method to solve the LPP: $Max Z = 4x_1 + 10x_2$
subject to the constraints
 $2x_1 + x_2 \leq 50,$
 $2x_1 + 5x_2 \leq 100,$
 $2x_1 + 3x_2 \leq 90$ and $x_1, x_2 \geq 0.$
4. Find an Initial basic feasible solution for the following TP using Least Cost Method.

| | I | II | III | IV | Supply |
|--------|----|----|-----|----|--------|
| A | 1 | 2 | 1 | 4 | 30 |
| B | 3 | 3 | 2 | 1 | 50 |
| C | 4 | 2 | 5 | 9 | 20 |
| Demand | 20 | 40 | 30 | 10 | |

5. The processing times in hours for the jobs when allocated to the different machines are indicated below. Assign the machines for the jobs so that the total processing time is minimum.

| | M_1 | M_2 | M_3 | M_4 | M_5 |
|-------|-------|-------|-------|-------|-------|
| J_1 | 9 | 22 | 58 | 11 | 19 |
| J_2 | 43 | 78 | 72 | 50 | 63 |
| J_3 | 41 | 28 | 91 | 37 | 45 |
| J_4 | 74 | 42 | 27 | 49 | 39 |
| J_5 | 36 | 11 | 57 | 22 | 25 |

6. There are five jobs, each of which is to be processed through two machines M_1, M_2 in the order M_1M_2 . Processing hours are as follows:

| Job | 1 | 2 | 3 | 4 | 5 |
|-------|---|----|---|---|---|
| M_1 | 3 | 8 | 5 | 7 | 4 |
| M_2 | 4 | 10 | 6 | 5 | 8 |

Determine the optimum sequence for the five jobs, and minimum total elapsed time. Find also the idle time of machines M_1 and M_2 .

7. Find the sequence that minimizes the total elapsed time required to complete the following jobs on machines M_1, M_2 and M_3 in the order $M_1M_2M_3$.

| Job | A | B | C | D | E | F |
|-------|---|---|---|---|----|---|
| M_1 | 8 | 3 | 7 | 2 | 5 | 1 |
| M_2 | 3 | 4 | 5 | 2 | 1 | 6 |
| M_3 | 8 | 7 | 6 | 9 | 10 | 9 |

8. Calculate the critical path and project completion time for the following data:

| Activity | Duration (in weeks) |
|----------|---------------------|
| 1 – 2 | 8 |
| 1 – 3 | 7 |
| 1 – 5 | 12 |
| 2 – 3 | 4 |
| 2 – 4 | 10 |
| 3 – 4 | 3 |
| 3 – 5 | 5 |
| 3 – 6 | 10 |
| 4 – 6 | 7 |
| 5 – 6 | 4 |

Contd...

Section C

Answer any **THREE** questions ($3 \times 10 = 30$ Marks)

9. A company manufactures 2 types of printed circuits. The requirements of transistors, resistors and capacitors for each type of printed circuits along with other data are given below:

| | Circuit | | Stock Available |
|------------|---------|------|-----------------|
| | A | B | |
| Transistor | 15 | 10 | 180 |
| Resistor | 10 | 20 | 200 |
| Capacitor | 15 | 20 | 210 |
| Profit | Rs.5 | Rs.8 | |

10. Use Big – M method to solve the LPP: $\text{Min } Z = 4x_1 + 3x_2$
subject to the constraints
 $2x_1 + x_2 \geq 10$,
 $-3x_1 + 2x_2 \leq 6$,
 $x_1 + x_2 \geq 6$ and $x_1, x_2 \geq 0$.
11. Solve the following transportation problem using Vogel's Approximation Method.

| | I | II | III | IV | Supply |
|---------------|---|----|-----|----|--------|
| A | 1 | 2 | 3 | 4 | 6 |
| B | 4 | 3 | 2 | 0 | 8 |
| C | 0 | 2 | 2 | 1 | 10 |
| Demand | 4 | 6 | 8 | 6 | |

12. Solve the following sequencing problem of 4 jobs on 6 machines (Processing time in hrs) machines:

| Job | Machine | | | | | |
|----------|---------|-------|-------|-------|-------|-------|
| | M_1 | M_2 | M_3 | M_4 | M_5 | M_6 |
| A | 19 | 8 | 8 | 3 | 11 | 24 |
| B | 18 | 6 | 9 | 6 | 9 | 18 |
| C | 12 | 5 | 8 | 5 | 7 | 15 |
| D | 20 | 5 | 3 | 4 | 8 | 11 |

Contd...

13. Consider the following data:

| Activity | 1 – 2 | 1 – 3 | 1 – 4 | 2 – 4 | 2 – 5 | 3 – 5 | 4 – 5 |
|----------|-------|-------|-------|-------|-------|-------|-------|
| a | 2 | 3 | 4 | 8 | 6 | 2 | 2 |
| m | 4 | 4 | 5 | 9 | 8 | 3 | 5 |
| b | 5 | 6 | 6 | 11 | 12 | 4 | 7 |

- a) Draw the network diagram
- b) Find the critical path
- c) Determine the expected S.D of the completion time.
