PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

BSc DEGREE EXAMINATION MAY 2025
(Sixth Semester)

Branch – MATHEMATICS WITH COMPUTER APPLICATIONS

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   In canonical form, the objective function is of ____type.
(i) minimization
(ii) maximization
(iii) maximization or minimization
(iv) none of these.

2   The necessary and sufficient condition for the existence of a feasible solution to the transportation is ___.
(i) Total supply = Total demand
(ii) Total supply ≠ Total demand
(iii) Total supply < Total demand
(iv) Total supply > Total demand.

3   In case, there is no saddle point in a game then the game is said to be ____.
(i) deterministic
(ii) fair
(iii) mixed strategy
(iv) multi strategy.

4   The formula $t_e = \frac{t_0 + 4t_m + t_p}{6}$ is formed on basis of _____ distribution.
(i) binomial
(ii) Poisson
(iii) normal
(iv) beta.

5   When there are more than one servers, customer behaviour in which he moves from one queue to another is known as ____.
(i) balking
(ii) jockeying
(iii) reneging
(iv) alternating.

SECTION - B (15 Marks)
Answer ALL Questions
ALL Questions Carry EQUAL Marks

(5 x 3 = 15).

6   a. Use graphical method to solve the following LPP: Minimize $z = 6000x + 4000y$ subject to $3x + y \geq 40$, $2x + 5y \geq 44$ and $x, y \geq 0$.

OR

b. Write the dual the following LPP: Minimize $z = x_2 + 3x_3$ subject to $2x_1 + x_2 \leq 3$, $x_1 + 2x_2 + 6x_3 \geq 5$, $-x_1 + x_2 + x_3 = 2$ and $x_1, x_2, x_3 \geq 0$.

7   a. Obtain the initial basic feasible solution of the following transportation problem by North-West corner method:

	To D	E	F	G	Capacity
A	11	13	17	14	250
B	16	18	14	10	300
C	21	24	13	10	400
Demand	200	225	275	250	

OR

b. Solve the following assignment problem:

		Machine A	B	C	D
Job	I	5	8	3	2
	II	10	7	5	8
	III	4	10	12	10
	IV	8	6	9	4

Cont...

8   a. Determine the optimum strategies and value of the following game:

	I	II	III	IV	V
I	-4	-2	-2	3	1
II	1	0 OR -1		0	0
III	-6	-5	-2	-4	4
IV	3	1	-6	0	-8

OR

b. Determine the optimum strategies and value of the following game:

Player B

Player A $\begin{pmatrix} 4 & 1 \\ 2 & 3 \end{pmatrix}$.

9   a. Draw a network diagram for the following data:

Activity	A	B	C	D	E
Immediate predecessors	None	A	A	A	B, C, D

OR

b. Distinguish between CPM and PERT.

10 a. What are the elements of a queuing system?

OR

b. Given average arrival rate = 25 per hour, average service time = 2 minutes, calculate i) average queue length ii) average waiting time in the queue.

SECTION -C (30 Marks)
Answer ALL questions
ALL questions carry EQUAL Marks   (5 x 6 = 30)

11 a. Solve the following LPP by graphically: Maximize $z = 4x_1 + 3x_2$ subject to $2x_1 + x_2 \le 1000$, $x_1 + x_2 \le 800$, $0 \le x_1 \le 400$, $0 \le x_2 \le 700$.

OR

b. Applying duality principle, to solve the following LPP: Maximize $z = 5x + 20y$ subject to $5x + 2y \le 20$, $x + 2y \le 8$, $x + 6y \le 12$, $x, y \ge 0$.

12 a. Solve the following transportation problem:

	A	B	C	D	Capacity
1	4	6	8	13	50
2	13	11	10	8	70
3	14	4	10	13	30
4	9	11	13	8	50
Demand	25	35	105	20	

OR

b. Solve the following travelling salesman problem:

	A	B	C	D	E
A	∞	16	18	13	20
B	21	∞	16	27	14
C	12	14	∞	15	21
D	11	18	19	∞	21
E	16	14	17	12	∞

13 a. Determine the range of value of p and q that will make the payoff element a_{22}, a saddle point for the game whose payoff matrix is given below:

$\begin{pmatrix} 2 & 4 & 7 \\ 10 & 7 & q \\ 4 & p & 8 \end{pmatrix}$

OR

b. Solve the following game by graphical method:

B

A	6	4	3
	2	4	8

14 a. Draw the network diagram and find the critical path and three types of floats for the following data:

Job(i, j)	1 – 2	1 – 3	2 – 4	3 – 4	3 – 5	4 – 5	4 – 6	5 – 6
Duration(days)	6	5	10	3	4	6	2	9

OR

b. A project consists of the following activities and time estimates:

Activity (i , j)	1-2	1-3	2-4	3-4	3-5	4-5
Least time (days)	2	9	5	2	8	6
Most likely time (days)	5	12	14	5	17	6
Greatest time (days)	14	15	17	8	20	12

i) Draw the network diagram
ii) Calculate expected duration and variances of each activity
iii) What is the probability that the project will be completed within 30 days?

15 a. Workers come to tool store room to receive tools for accomplishing a project assigned to them. The average time between two arrivals is 60 seconds and the arrivals are assumed to be Poisson distribution. The average service time is 40 seconds. Determine i) average queue length ii) average length of non-empty queue iii) average number of workers in the system iv) mean waiting time of a worker in the queue.

OR

b. Trains arrive at the yard every 15 minutes and the service time is 33 minutes. If the line capacity of the yard is limited to 4 trains, find i) the probability that the yard is empty ii) average number of trains in the system.

Z-Z-Z   END