PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

BSc DEGREE EXAMINATION MAY 2018
(Sixth Semester)

Branch – **MATHEMATICS WITH COMPUTER APPLICATIONS**

OPERATIONS RESEARCH

Time : Three Hours Maximum : 75 Marks

SECTION-A (20 Marks)

Answer **ALL** questions
ALL questions carry **EQUAL** marks (10 x 2 = 20)

1 Define an optimum solution of a problem.

2 Write the standard primal and dual problem.

3 Write a necessary and sufficient condition for the existence of a feasible solution to the general transportation problem.

4 Define loops in transportation tables.

5 Define two person zero sum games.

6 Define saddle point in a game.

7 Write the types of errors in logical sequencing while drawing a network diagram.

8 Define a critical path.

9 What are the basic elements of a queuing system?

10 In (M|M|1) : (∞ | FIFO) model, write the value of E(n).

SECTION - B (25 Marks)

Answer **ALL** Questions
ALL Questions Carry **EQUAL** Marks (5 x 5 = 25)

11 a Solve the following LPP by graphical method . minimize $Z = 20x_1 + 40x_2$ subject to the constraints:
$36x_1 + 6x_2 \geq 108$; $3x_1 + 12x_2 \geq 36$; $20x_1 + 10x_2 \geq 100$ and $x_1, x_2 \geq 0$.

OR

b Obtain the dual problem of the following primal problem:
Minimize $z = x_1 - 3x_2 - 2x_3$ subject to the constraints :$3x_1 - x_2 + 2x_3 < 7$; $2x_1 - 4x_2 > 12$; $-4x_1 + 3x_2 + 8x_3 = 10$; $x_1, x_2 > 0$ and x_3 is unrestricted.

12 a Obtain an IBFS to the following transportation problem using the North – West corner rule

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

OR

b Solve the following assignment problem

	M_1	M_2	M_3	M_4
J_1	5	7	11	6
J_2	8	5	9	6
J_3	4	7	10	7
J_4	10	4	8	3

How should the jobs be assigned to the various machines so that the total cost is minimized?

13 a Determine which of the following two-person zero-sum games are strictly determinable and fair. Give optimum strategies for each player in the case of strictly determinable games:

(a) Player A $\begin{matrix} \text{Player B} \\ \end{matrix}$ $\begin{bmatrix} 5 & 0 \\ 0 & 2 \end{bmatrix}$ (b) A $\begin{matrix} \text{B} \\ \end{matrix}$ $\begin{bmatrix} 0 & 2 \\ -1 & 4 \end{bmatrix}$

OR

b For the game with the following payoff matrix, determine the optimum strategies and the value of the game : $\begin{matrix} & P_2 \\ P_1 & \end{matrix}\begin{bmatrix} 5 & 1 \\ 3 & 4 \end{bmatrix}$.

14 a Write the rules of network construction.

OR

b A project consists of eight activities with the following relevant information.

Activity	Immediate Predecessor	Estimated duration (days)		
		Optimistic	Most likely	Pessimistic
A	-	1	1	7
B	-	1	4	7
C	-	2	2	8
D	A	1	1	1
E	B	2	5	14
F	C	2	5	8
G	D, E	3	6	15
H	F, G	1	2	3

Draw the PERT network and find out the expected project completion time.

15 a Write about distribution of arrivals (Pure Birth process).

OR

b A road transport company has one reservation clerk on duty at a time. He handles information of bus schedules and makes reservations. Customers arrive at a rate of 8 per hour and the clerk can service 12 customers on an average per hour. After stating your assumptions, answer the following: What is the average number of customers waiting for the service of the clerk.

SECTION - C (30 Marks)

Answer any **THREE** Questions

ALL Questions Carry **EQUAL** Marks (3 x 10 = 30)

16 Use duality to solve the following LPP:

Maximize $Z = 2x_1 + x_2$ subject to the constraints :

$x_1 + 2x_2 < 10$, $x_1 + x_2 < 6$,

$x_1 - x_2 < 2$, $x_1 - 2x_2 < 1$, $x_1, x_2 > 0$.

17 Solve the following transportation problem by using Modi method.

				Available units
6	1	9	3	70
11	5	2	8	55
10	12	4	7	90
85	35	50	45	

required unit

18 Obtain the optimal strategies for both-persons and the value of the game for zero-sum two-person game whose payoff matrix is as follows:

$$\begin{bmatrix} 1 & -3 \\ 3 & 5 \\ -1 & 6 \\ 4 & 1 \\ 2 & 2 \\ -5 & 0 \end{bmatrix}$$

19 A project consists of a series of tasks labeled A, B, ..., H, I with the following relationships (W < X, Y means X, and Y cannot start until W is completed; X, Y < W means W cannot start until both X and Y are completed). With this notation construct the network diagram having the following constraints: A < D,E; B, D < F; C < G ; B, G < H; F, G < I. Find also the minimum time of completion of the project, when the time (in days) of completion of each task is as follows:

Task :	A	B	C	D	E	F	G	H	I
Time :	23	8	20	16	24	18	19	4	10

20 A supermarket has two girls serving at the counters. The customers arrive in a Poisson fashion at the rate of 12 per hour. The service time for each customer is exponential with mean 6 minutes. Find (i) the probability that an arriving customer has to wait for service, (ii) the average number of customers in the system, and (iii) the average time spent by a customer in the super-market.

Z-Z-Z END