

(FOR THE CANDIDATES ADMITTED

23UMS616

DURING THE ACADEMIC YEAR 2025 ONLY)

REG.NO.:

N.G.M. COLLEGE (AUTONOMOUS): POLLACHI

END-OF-SEMESTER EXAMINATIONS: MAY-2026

B.Sc.- MATHEMATICS

MAXIMUM MARKS: 75

SEMESTER: VI

TIME: 3 HOURS

PART-III
RESOURCE MANAGEMENT TECHNIQUE

SECTION – A

(10 X 1 = 10 MARKS)

ANSWER THE FOLLOWING QUESTIONS.S

MULTIPLE CHOICE QUESTIONS.

(K1)

- 1) The size of the Pay-off matrix of a game can be reduced by using the principal of
(A) dominance (B) rotation reduction
(C) game transpose (D) all of the above
- 2) If A_i , B_i and C_i denote the processing times of i^{th} job on three machines A , B and C respectively, then a n-job three machine problem can be reduced to an n-job and two machine problem, provided that:
(A) $\text{Min}.A_i \geq \text{Max}.B_i$ and/or $\text{Min}.C_i \leq \text{Max}.B_i$
(B) $\text{Min}. A_i \geq \text{Max}.B_i$ and/or $\text{Min}.C_i \geq \text{Max}.B_i$
(C) $\text{Min}. A_i \leq \text{Max}.B_i$ and/or $\text{Min}.C_i \geq \text{Max}.B_i$
(D) $\text{Min}. A_i \leq \text{Max}.B_i$ and/or $\text{Min}.C_i \leq \text{Max}.B_i$
- 3) Queue can form only when
(A) arrivals exceed service capacity
(B) arrivals equals service capacity
(C) service facility is capable to serve all the arrivals at a time
(D) there are more than one service facilities
- 4) Which costs can vary with order quantity?
(A) unit cost only (B) holding cost only
(C) re-order cost only (D)all of these
- 5) The activity which can be delayed without affecting the execution of the immediate succeeding activity is determined by
(A) Total float (B) free float
(C) independent float (D) interfering float

ANSWER THE FOLLOWING IN ONE OR TWO SENTENCES.

- 6) Define player in game.
- 7) What is “no passing” rule in a sequencing algorithm?
- 8) Define transient state.
- 9) Write the two categories of deterministic inventory problem with shortages.
- 10) Define critical path.

(CONTD.....2)

SECTION – B

(5 X 5 = 25 MARKS)

ANSWER EITHER (a) OR (b) IN EACH OF THE FOLLOWING QUESTIONS. (K3)

- 11) (a) Explain some basic terms in game theory.

(OR)

- (b) 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 $\begin{bmatrix} 5 & 0 \\ 0 & 2 \end{bmatrix}$ (b) A $\begin{bmatrix} 0 & 2 \\ -1 & 4 \end{bmatrix}$

- 12) (a) Using graphical method, calculate the minimum time needed to process job 1 and 2 on five machines A, B, C, D and E, i.e., for each machine find the job which should be done first. Also calculate the total time needed to complete both jobs.

		Machines					
$Job\ 1$	Sequence	:	A	B	C	D	E
	Time(hours)	:	6	8	4	12	4
$Job\ 2$	Sequence	:	B	C	A	D	E
	Time(hours)	:	10	8	6	4	12

(OR)

- (b) Determine the Optimal Sequence Algorithm for processing n jobs through k machines.

- 13) (a) List the operating characteristics of a queueing system.

(OR)

- (b) A T.V. repairman finds that the timespent on his jobs has an Exponential distribution with mean 30 minutes. If he repairs sets in the order in which they came in, and if the arrival of sets is approximately Poisson with an average rate of 10 per 8-hour day, what is repairman's expected idle time each day? How many jobs are ahead of the average set just brought in?

- 14) (a) A contractor has to supply 10,000 bearings per day to an automobile manufacture. He finds that, when he starts a production run, he can produce 25,000 bearings per day. The cost of holding a bearing in stock for one year is Rs.2 and the set-up cost of a production run is Rs.1800. How frequently should the production run be made?

(OR)

- (b) The demand for a certain item is 16 units per period. Unsatisfied demand causes a shortage cost of Rs.0.75 per unit per short period. The cost of initiating purchasing action is Rs.15.00 per purchase and the holding cost is 15% of average inventory valuation per period. Item cost is Rs.8.00 per unit. (Assume that shortages are being back ordered at the above mentioned cost). Find the minimum cost purchase quantity.

- 15) (a) Construct the network diagram comprising activities B, C,, Q and N such that the following constraints are satisfied:

$$B < E, F; C < G, L; E, G < H; L, H < I; L < M; H < N; H < J; I, J < P; P < Q.$$

The notation $X < Y$ means that the activity X must be finished before Y can begin.

(OR)

- (b) Explain the distinction between PERT and CPM.

(CONTD.....3)

SECTION – C

(5 X 8 = 40 MARKS)

ANSWER EITHER (a) OR (b) IN EACH OF THE FOLLOWING QUESTIONS. (K4 (Or) K5)

16)(a) Prove that for any 2x2 two-person zero-sum game without any saddle point having the payoff

matrix for player A

 $B_1 \quad B_2$

$$\begin{matrix} A_1 \\ A_2 \end{matrix} \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix},$$

the optimum mixed strategies $S_A = \begin{bmatrix} A_1 \\ A_2 \end{bmatrix} \begin{bmatrix} p_1 \\ p_2 \end{bmatrix}$ and $S_B = \begin{bmatrix} B_1 \\ B_2 \end{bmatrix} \begin{bmatrix} q_1 \\ q_2 \end{bmatrix}$, are determined by

$$\frac{p_1}{p_2} = \frac{a_{22} - a_{21}}{a_{11} - a_{12}}, \quad \frac{q_1}{q_2} = \frac{a_{22} - a_{12}}{a_{11} - a_{21}}$$

where $p_1 + p_2 = 1$ and $q_1 + q_2 = 1$. The value v of the game to A is given by

$$v = \frac{a_{11}a_{22} - a_{21}a_{12}}{a_{11} + a_{22} - (a_{12} + a_{21})}.$$

(OR)

(b) Solve the following game:

Player B

 $I \quad II \quad III \quad IV$

$$\text{Player A} \quad \begin{matrix} I \\ II \\ III \\ IV \end{matrix} \begin{bmatrix} 3 & 2 & 4 & 0 \\ 3 & 4 & 2 & 4 \\ 4 & 2 & 4 & 0 \\ 0 & 4 & 0 & 8 \end{bmatrix}$$

17)(a) In a factory, there are six jobs to perform, each of which should go through two machines A and B, in the order A, B. The processing timings (in hours) for the jobs are given here. You are required to determine the sequence for performing the jobs that would minimize the total elapsed time, T. What is the value of T?

Job	:	J_1	J_2	J_3	J_4	J_5	J_6
Machine A	:	1	3	8	5	6	3
Machine B	:	5	6	3	2	2	10

(OR)

(b) Determine the optimal sequence of jobs that minimizes the total elapsed time based on the following information processing time on machines is given in hours and passing is not allowed:

Job	:	A	B	C	D	E	F	G
Machine M_1	:	3	8	7	4	9	8	7
Machine M_2	:	4	3	2	5	1	4	3
Machine M_3	:	6	7	5	11	5	6	12

18) a) A bank has two tellers working on savings accounts. The first teller handles withdrawals only. The second teller handles deposits only. It has been found that the service time distribution for both deposits and withdrawals is exponential with mean service time 3 minutes per customer. Depositors are found to arrive in Poisson fashion throughout the day with mean arrival rate of 16 per hour. Withdrawers also arrive in Poisson fashion with mean arrival rate of 14 per hour. What would be the effect on the average waiting time for depositors and withdrawers if each teller could handle both withdrawals and deposits? What could be the effect if this could be accomplished by increasing the mean service time to 3.5 minutes?

(OR)

(CONTD.....4)

(b) A car servicing station has 3 stalls where service can be offered simultaneously. The cars wait in such a way that when a stall becomes vacant, the car at the head of the line pulls up to it. The station can accommodate at most four cars waiting (seven in the station) at one time. The arrival pattern is Poisson with a mean of car per minute during the peak hours. The service time is exponential with mean 6 minutes. Find the average number of cars in the service station during peak hours, the average waiting time and the average number of cars per hour that cannot enter the station because of full capacity.

19) a) Explain the factors affecting inventory control.

(OR)

(b) Find the optimum order quantity for a period for which the price breaks are as follows:

Quantity	Purchasing cost per unit (Rs.)
$0 \leq Q_1 < 100$	20
$100 \leq Q_2 < 200$	18
$200 \leq Q_3$	16

The monthly demand for the product is 400 units. The storage cost is 20% of the unit cost of the product and the cost of ordering is Rs. 25.00 per month.

20) (a) A small project consists of seven activities for which the relevant data are given below:

Activity	Preceding activities	Activity duration (days)
A	-	4
B	-	7
C	-	6
D	A,B	5
E	A,B	7
F	C,D,E	6
G	C,D,E	5

(i). Draw the network and find the project completion time.

(ii). Calculate total float for each of the activities and highlight the critical path.

(iii). Draw the time scaled diagram.

(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

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

(ii). What duration will have 95% confidence for project completion?

(iii). If the average duration for activity F increases to 14 days, what will be its effect on the expected project completion time which will have 95% confidence?

(For standard normal $Z=1.645$, area under the standard normal curve from 0 to Z is 0.45).