

**B.E DEGREE EXAMINATIONS: APRIL/MAY 2014**

(Regulation 2009)

Fifth Semester

**GSS108: OPERATIONS RESEARCH**

(Common to MECH/TXT)

*(Usage of normal tables permitted)*

Time: Three Hours

Maximum Marks: 100

Answer all the Questions:-

**PART A (10 x 1 = 10 Marks)**

1. Productivity is defined as
  - a) Production per unit time
  - b) Time per production
  - c) Production on a large scale
  - d) none of the above
2. If there is no solution to an LP, then the problem suffers from
  - a) optimal solution
  - b) infeasible solution
  - c) degenerate solution
  - d) bounded solution
3. Penalty method is otherwise called as ----- method
  - a) Northwest corner
  - b) least cost
  - c) Vogel's approximation method
  - d) northeast corner
4. Hungarian algorithm is associated with
  - a) linear programming
  - b) non linear programming
  - c) dynamic programming
  - d) assignment modeling
5. Event is otherwise called as an
  - a) Node
  - b) activity
  - c) project
  - d) none of the above
6. Floyd's algorithm is associated with
  - a) minimal spanning tree
  - b) shortest route
  - c) maximal flow
  - d) integer programming
7. Out datedness of a machine is otherwise named as
  - a) malfunctioning
  - b) overloading
  - c) obsolescence
  - d) breakdown
8. The total elapsed time is called as
  - a) flow time
  - b) lateness
  - c) completion time
  - d) makespan
9. When operating characteristics of a queuing system vary with time, it is said to be in

- a) Transient state
  - b) Steady state
  - c) Unsteady state
  - d) Proportional state
10. R in kendall's notation (P/Q/R :X/Y/Z) denotes
- a) Service distribution
  - b) arrival date distribution
  - c) Number of servers
  - d) Service discipline

**PART B (10 x 2 = 20 Marks)**

11. What is a solution space?
12. State the 'Minimax' principle.
13. When a transportation model is said to be balanced?
14. Mention few applications of assignment models.
15. State Fulkerson's rule of networking.
16. Mention any 2 algorithms for shortest route algorithms.
17. List assumptions underlying sequencing models.
18. Give an example of group replacement.
19. Give an expression for minimum cost service rate.
20. When do waiting line problems arise?

**PART C (5 x 14 = 70 Marks)**

21. a) Use the two-phase simplex method to maximize  $z = 5x_1 - 4x_2 + 3x_3$   
 Subject to  $2x_1 + x_2 - 6x_3 = 20; 6x_1 + 5x_2 + 10x_3 \leq 76; 8x_1 - 3x_2 + 6x_3 \leq 50; x_1, x_2, x_3 \geq 0$

**(OR)**

21. b) Minimize  $z = x_1 - 3x_2 + 3x_3$   
 Subject to  $3x_1 - x_2 + 2x_3 \leq 7; 2x_1 + 4x_2 \geq -12; -4x_1 + 3x_2 + 8x_3 \leq 10; x_1, x_2, x_3 \geq 0$

22. a) The following transportation problem involves 3 sources and 4 destinations. Each cell entry represent the cost of transportation per unit. Find the initial basic feasible solution using least cost method and vogel's approximation method.

	Destination 1	Destination 2	Destination 3	Destination 4	SUPPLY
Source 1	3	1	7	4	300
Source 2	2	6	5	9	400
Source 3	8	3	3	2	500
DEMAND	250	350	400	200	1200

(OR)

22. b) A machine tool company decides to make four subassemblies through 4 contractors. Each contractor is to receive only one sub assembly. The cost of each sub assembly is determined by the bids submitted by each contractor and is shown in hundreds of rupees. Assign the different sub assemblies to contractors so as to minimize the total cost.

Sub assemblies	Contractors			
	1	2	3	4
1	15	13	14	17
2	11	12	15	13
3	13	12	10	11
4	15	17	14	16

23. a) The time estimates in weeks for the activities of PERT network are given.

Activity	1-2	1-3	1-4	2-5	3-5	4-6	5-6
To	1	1	2	1	2	2	3
Tm	1	4	2	1	5	5	6
Tp	7	7	8	1	14	8	5

- i) Draw the project network and identify the paths through it. (4)  
 ii) Determine the expected project length. (3)  
 iii) Calculate the standard deviation and variance of the project. (4)  
 iv) What is the probability that project will be completed 4 weeks earlier than expected time? (3)

(OR)

23. b) Write short notes on (7)  
 (i) Maximal flow algorithm (7)  
 (ii) Minimal spanning tree

24. a) A firm is considering replacement of an equipment whose first cost is Rs. 4000 and the scrap value is negligible at the end of any year. Based on experience it has been found that the maintenance cost is zero during the first year and it is Rs. 1000 for the second year. It increases by Rs.300 every year thereafter. When should the equipment be replaced if  $i=0\%$ ?

(OR)

24. b) A machine operator has to perform two operations turning and threading on a number of different jobs. The time required to perform those operations in minutes for each job is given. Determine the order in which the jobs should be processed in order to minimize the total time required to turn all the jobs and idle times.

job	1	2	3	4	5	6
Turning time	3	12	5	2	9	11
Threading time	8	10	9	6	3	1

25. a) A self service store employs one cashier at its counter. Nine customers arrive on an average every 5 minutes while the cashier can serve 10 customers in 5 minutes. Assuming poisson distribution for arrival rate and exponential distribution for service rate find

- (i) Average number of customers in the system (4)  
 (ii) Average number of customers in the queue (3)  
 (iii) Average time a customer spends in the system (4)  
 (iv) Average time a customer waits before being served (3)

(OR)

25. b) The arrival rate of customers at a banking counter follows Poisson distribution with a mean of 45 per hour. The service rate of the counter clerk also follows poisson distribution with a mean of 60 per hour.

- (i) What is the probability of having 0 customers in the system ( $p_0$ )?  
 (ii) What are the average number of customers waiting in the system ( $L_s$ )?  
 (iii) What is the expected waiting time of a customer in the queue and system?  
 (iv) What is utilization factor?

\*\*\*\*\*