



Register Number:.....

B.E/B.TECH DEGREE EXAMINATIONS: JUNE 2015

(Regulation 2009)

Fifth Semester

GSS108: OPERATIONS RESEARCH

(Common to MECH/TXT)

Time: Three Hours

Maximum Marks: 100

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. Graphical method is used to solve
 - a) two variable problems
 - b) three variable problems
 - c) four variable problems
 - d) six variable problems
2. In the objective function of the first phase of a simplex problem using two phase method, the coefficient of the artificial variable is taken as (M is a very big number)
 - a) 1
 - b) - 1
 - c) M
 - d) - M
3. If m= number of rows and n= number of columns of an initial solution table of a transportation problem and if there are (m+n-1) number of allocations in the initial solution table, then:
 - a) the problem is a balanced problem
 - b) the problem is an unbalanced problem
 - c) the problem is one with degeneracy
 - d) the problem is one without degeneracy
4. For using flood technique,
 - a) the number of row and columns are to be equal
 - b) the number of row and columns need not be equal
 - c) the number of row should be greater than the number of columns
 - d) the number of columns should be greater than the number of row
5. An activity that does not consume resources is called as
 - a) economical activity
 - b) dummy activity
 - c) non critical activity
 - d) ordinary activity
6. A spanning tree (network) will
 - a) not have a loop
 - b) will have a loop
 - c) may or may not have a loop
 - d) have only one loop
7. In the replacement model for items that deteriorate with time, considering time value of money,

cash flows during a year are assumed to take place during

- a) the beginning of the year
 - b) the end of the year
 - c) the middle of the year
 - d) the 3rd month of the year
8. In sequencing, elapse time is the time taken to
- a) process all the jobs
 - b) process all the jobs through the machines in any order
 - c) process all the jobs through the machines in the specified order
 - d) process all the jobs through the machines in the specified order using an optimal sequence
9. The queuing discipline applicable to the service provided by a lift in a building is:
- a) FCFS
 - b) SIRO
 - c) LCFS
 - d) SBP
10. The calling population is generally considered to be infinite if its size is
- a) greater than 40
 - b) greater than 20
 - c) greater than 25
 - d) greater than 50

PART B (10 x 2 = 20 Marks)

- 11. Define the term linear programming (LP).
- 12. What is meant by “bound solution” in a graphical solution linear programming problem?
- 13. What is degeneracy in transportation model?
- 14. What is compulsory allocation in an assignment model? State the procedure adopted to make such an allocation?
- 15. What is an economical network?
- 16. What is a box network (schedule graph)?
- 17. What is discount rate?
- 18. State the conditions to be satisfied to convert n jobs \times 3 machine sequencing problem to a n jobs \times 2 machine sequencing problem.
- 19. Define queuing discipline.
- 20. How are queuing models represented using Kendall’s notations?

PART C (5 x 14 = 70 Marks)

- 21. a) A chemical company has two bottling plants situated at two cities A and B. Each plant produces 3 types of chemicals: type – I, type – II, type – III. The number of bottles produced per day is as follows:

CHEMICAL TYPE	PLANT AT CITIES	
	A	B
I	1500	1500
II	3000	1000

III	2000	5000
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A market survey indicates that there will be a demand of 20,000 bottles of type – I chemical, 40,000 bottles of type – II chemical, and 44,000 bottles of type – III chemical. The operating costs per day of the plant A and B are Rs. 600 and Rs. 400 respectively. For how many days each plant should run in the month of May so as to have a minimum production cost, while still meeting the market demand. Obtain the solution by graphical method.

(OR)

b) Solve by Simplex Method

$$\begin{aligned} \text{Max } Z &= x_1 - x_2 + 3x_3 \text{ (Objective function)} \\ \text{Subjected to } & 2x_1 + x_2 + x_3 \leq 10 \quad - (1) \\ & 2x_1 - x_3 \leq 2 \quad - (2) \\ & 2x_1 - 2x_2 + 3x_3 \geq 0 \quad - (3) \\ & x_1, x_2, x_3 \geq 0. \end{aligned}$$

22. a) Solve the following transportation problem.

Cell entries represent the unit cost of shipping.

	I	II	III	IV	V
A	12	4	9	5	9
B	8	1	6	6	7
C	1	12	4	7	7
D	10	15	6	9	1

The availability at sources I, II, III, IV, V are 40, 20, 50, 30, 40 respectively. The requirement at destinations at A, B, C, D are 55, 45, 30, 50 respectively.

- Find the optimal solution using MODI method.
- Is the solution unique in the problem? If not, determine the alternate solutions to the problem.

(OR)

b) There are 5 jobs and 5 machines. The associated cost of allocating a job to the machines is given in the table.

		Machines				
		M1	M2	M3	M4	M5
Jobs	J1	11	17	8	16	20
	J2	9	7	12	6	15
	J3	13	16	15	12	16
	J4	21	24	17	28	26
	J5	14	10	12	11	15

It is required to assign one job to each of the 5 machine. Determine the optimal assignment of jobs so that the total cost to process all the jobs is minimized.

23. a) The maintenance of a machine consists of ten jobs. The precedence relationship of these jobs have been listed with the help of their node numbers.

Job	1-2	2-3	2-4	3-5	3-6	4-6	4-7	5-8	6-8	7-8
Duration (DAYS)	2	3	5	4	1	6	2	8	7	4

- (i) Draw an arrow diagram for the project and calculate ES, EF, LS, LF, TS and FS
- (ii) If job 2-3 takes 6 days instead of 3 days, how will it affect the completion date of the project?

(OR)

- b) The normal cost and duration, crash cost and duration of activities of a project are given in table. If the overhead cost is Rs. 45/day, determine the optimal cost schedule for the project by drawing the project duration Vs total cost.

Activity	Normal		Crash	
	Cost	Duration	Cost	Duration
1-2	360	3	440	1
2-3	240	4	320	2
2-4	100	7	140	3
3-4	80	5	140	2

24. a) Small battery operated trucks are used in an industry for material handling purpose. The operating cost (battery / distilled water), maintenance cost

(repairs, replacement of parts such as tyres etc.,) and resale value for six years are given in table for one of these trucks. Determine when the truck is to be replaced by a new one if the initial cost of the truck is Rs. 75,000.

Year of service	Annual operating cost (Rs.)	Annual maintenance cost (Rs.)	Resale value
1	10,000	6,000	45,000
2	12,000	7,500	40,000
3	15,000	12,500	20,000
4	19,000	17,000	10,000
5	27,000	20,000	10,000
6	33,000	21,000	5,000

(OR)

- b) There are six jobs, each of which must go through two machines A and B in the order AB. Processing time in hours is given in table.

Job	Processing time	
	Machine A	Machine B
1	3	2
2	6	5
3	4	6
4	7	3
5	5	2
6	8	8

Determine the sequence for the six jobs which will minimize the elapse time and idle time.

25. a) In a medium scale industry, a tool and cutter grinder operator finds that the time spent on each tool has an exponential distribution with mean 25 minutes. If he grinds tools in the order in which they come in and arrival of tools for grinding is approximately Poisson with an average rate of 11 per 8 hours day, what is the operator's expected idle time each day. How many jobs are ahead of the average tool just brought in?

(OR)

- b) Arrivals at a telephone booth are considered to be Poisson, with an average time of 10 minutes between one arrival and the next. The length of the phone

cell is assumed to be distributed exponentially with a mean of 3 minutes.

- (i) What is the probability that a person arriving at the booth will have to wait?
- (ii) What is the average length of the queues that form from time to time?
- (iii) The telephone department will install a second booth when convinced that an arrival would expect waiting for at least 3 minutes for the phone. By how much should the flow of arrival increase in order to justify a second booth?
