

# C.U.SHAH UNIVERSITY

## Summer Examination-2018

Subject Name : Operation Research

Subject Code : 4TE07ORE1

Branch: B.Tech (Mechanical)

Semester : 7

Date : 04/04/2018

Time : 10:30 To 01:30

Marks : 70

Instructions:

- (1) Use of Programmable calculator & any other electronic instrument is prohibited.
  - (2) Instructions written on main answer book are strictly to be obeyed.
  - (3) Draw neat diagrams and figures (if necessary) at right places.
  - (4) Assume suitable data if needed.
- 

Q-1

Attempt the following questions:

(14)

- a) Operations Research has the characteristics that it is done by a team of -----  
1.Scientists 2.Mathematicians 3.Academics 4.All of the above
- b) Operations Research (OR) , which is a very powerful tool for -----  
1.Research 2.Decision – Making 3.Operations 4.None of the above
- c) Which of the following is the first step in starting the research process?  
1. Searching sources of information to locate problem. 2. Survey of related literature  
3. Identification of problem 4. Searching for solutions to the problem
- d) Who coined the term Operations Research?  
1.J.F. McCloskey 2.F.N. Trefethen 3.P.F. Adams 4.Both A and B
- e) The term Operations Research was coined in the year -----  
1.1950 2.1940 3.1978 4.1960
- f) In a transportation problem, items are allocated from sources to destinations  
1. At a maximum cost 2. At a minimum cost 3. At a minimum profit  
4. At a minimum revenue
- g) This innovative science of Operations Research was discovered during -----  
1.Civil War 2.World War I 3.World War II 4.Industrial Revolution
- h) Operations Research was known as an ability to win a war without really going in to a -----  
1.Battle field 2.Fighting 3.War 4.Both A and B
- i) An assignment problem is a special form of transportation problem where all supply and demand values equal..... 1.0 2.1 3.2 4.3
- j) Who defined Operations Research as scientific method of providing executive departments with a quantitative basis for decisions regarding the operations under their control?  
1.Morse and Kimball (1946) 2.P.M.S. Blackett (1948) 3.E.L. Arnoff and M.J. Netzorg  
4.None of the above
- k) Who defined Operations Research as scientific approach to problem solving for executive management? 1.E.L. Arnoff 2.P.M.S. Blackett 3.H.M. Wagner 4.None of the above
- l) EOQ is a (an) \_\_\_\_\_ inventory system. 1. Periodic 2. Continuous 3. Optimal  
4. Economic
- m) Who defined Operations Research as an aid for the executive in marketing his decisions by providing him with the quantitative information based on the scientific method of analysis ?  
1.C. Kitte 2.H.M. Wagner 3.E.L. Arnoff 4.None of the above
- n) Replacement theory is the process by which various cost consequences are studied so that



\_\_\_\_\_ replacement decision can be taken.  
 1.Best 2.Good 3.Correct 4.Optimal

**Attempt any four questions from Q-2 to Q-8**

**Q-2 Attempt all questions**

- (a) A particular item has a demand of 9000 units/year. The cost of one procurement is Rs. 100 and the holding cost per unit is Rs. 2.40 per year. The replacement is instantaneous and no shortages are allowed. Determine: 07
- The economic lot size
  - The number of orders per year
  - The time between orders
  - The total cost per year if the cost of one unit is Rs. 1.
- (b) Time and cost data of the activities of a R & D project is given below: 07  
 The overhead cost is Rs 160 per day. Crash the project to achieve optimum duration and optimum cost.

Activity	Normal		Crash	
	Time (Days)	Cost (Rs)	Time (Days)	Cost (Rs)
1-2	3	350	2	400
2-3	6	1440	4	1620
2-4	9	2160	8	2220
2-5	7	1300	5	1600
3-5	8	500	7	600
4-5	5	1600	3	1770
5-6	8	450	7	750
		7800		

**Q-3 Attempt all questions**

- (a) Use Charnes big – M method to 07  
 Maximize  $Z = 3X_1 + 2X_2$   
 Subject to constraints  $2X_1 + X_2 \leq 1$ ,  
 $3X_1 + 4X_2 \geq 4$ ,  
 $X_1, X_2 \geq 0$
- (b) A company has 3 factories manufacturing the same product and 5 sales agencies in different parts of the country. Production costs differ from factory to factory and the sales prices from agency to agency. The shipping cost per unit product from each factory to each agency is known. Given the following data, find the production and distribution schedules most profitable to the company. 07

Factory	Production cost/unit (Rs)	Max. capacity (No. of units)
1	18	140
2	20	190
3	16	115

Factory 1	2	2	6	10	5	} Shipping cost (Rs)
Factory 2	10	8	9	4	7	
Factory 3	5	6	4	3	8	
Agency	1	2	3	4	5	
Demand	74	94	69	39	119	
Sales Price (Rs.)	35	37	36	39	34	

**Q-4 Attempt all questions**



- (a) A company manufacturing air coolers has plants at Bombay, Calcutta and Kanpur. Supplies are made to three showrooms situated at Ranchi, Delhi and Lucknow. Each manufacturing plant has capacity of 200 units per month. The monthly requirements of showrooms are 150, 300, and 150 numbers respectively. 07

Due to difference in raw material cost and transportation cost, the profit per unit is different for each showroom as given below:

	Ranchi	Delhi	Lucknow
Bombay	290	280	300
Calcutta	250	270	230
Kanpur	350	370	380

Decide the shipping schedule to maximize profit.

- (b) A newspaper boy buys papers for 5 paise each and sells them for 6 paise each. He cannot return unsold newspapers. Daily demand  $R$  for newspapers follows the distribution: 07

R	10	11	12	13	14	15	16
$P_R$	0.05	0.15	0.40	0.20	0.10	0.05	0.05

If each day's demand is independent of the previous day's, how many papers should he ordered each day?

### Q-5

#### Attempt all questions

- (a) A company has a team of four salesmen and there are four districts where the company wants to start its business. After taking in to account the capabilities of salesmen and the nature of districts, the company estimates that the profit per day in rupees for each salesman in each district is as given below: 07

		District			
		1	2	3	4
Salesman	A	16	10	14	11
	B	14	11	15	15
	C	15	15	13	12
	D	13	12	14	15

Find the assignment of salesmen to various districts which will yield maximum profit.

- (b) A person repairing radios finds that the time spent on the radio sets has been exponential distribution with mean 20 minutes. If the radios are repaired in the order in which they come in and their arrival is approximately Poisson with an average rate of 15 for 8 – hour day, what is the repairman's expected idle time each day? How many jobs are ahead of the average set just brought in? 07

### Q-6

#### Attempt all question

- (a) The cost of a new machine is Rs. 5000. The maintenance cost during the  $n$ th year is given by  $M_n = \text{Rs. } 500(n - 1)$ , where  $n = 1, 2, 3, \dots$ . If the discount rate per year is 0.05, after how many years will it be economical to replace the machine by a new one? 07
- (b) A research project consists of eleven activities identified by their beginning (i) and ending nodes (j) as under. Three time estimates have also been specified against each activity. 07

Activity (i - j)	Estimated duration (weeks)		
	Optimistic time (a)	Most likely time (m)	Pessimistic time (b)
1-2	6	7	8
1-3	4	5	12
1-4	2	10	12
2-5	3	7	11
3-6	10	20	48
3-7	6	9	18
4-6	3	3	9
5-8	3	3	9
6-9	8	18	40



7-8	2	6	10
8-9	2	5	14

- I) Calculate expected time of each activity  
 II) Construct the network diagram for the above project.  
 III) Enter the expected time of the activities computed under I) in to the network.

**Q-7**

**Attempt all questions**

- (a) 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 04 trains, find **07**  
 i) The probability that the yard is empty  
 ii) The average number of trains in the system
- (b) Maximize  $Z = X_1 + 2X_2 + 3X_3 - X_4$  **07**  
 Subject to,  
 $X_1 + 2X_2 + 3X_3 = 15$   
 $2X_1 + X_2 + 5X_3 = 20$   
 $X_1 + 2X_2 + X_3 + X_4 = 10$   
 $X_1, X_2, X_3, X_4 \geq 0$

**Q-8**

**Attempt all questions**

- (a) A company uses 75 numbers of an item per month. Each unit costs the company Rs 25/-. The cost of putting through each order and inventory carrying charges per month are computed at Rs 36 and 1.5% of the average inventory investment respectively. **07**  
 In what economic lots, should the item be purchased to minimize total cost?
- (b) A job production unit has four jobs A, B, C and D which can be manufactured on each of the four machines P, Q, R and S. The processing cost of each job on each machine is given in the table below: **07**

Jobs	Machine			
	P	Q	R	S
	Processing cost (Rs.)			
A	31	25	33	29
B	25	24	23	21
C	19	21	23	24
D	38	36	34	40

To achieve minimum processing cost, which job will you process on which machine?

