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B.E/B.Tech. (FT) DEGREE END SEMESTER EXAMINATION NOV/DEC 2011

INDUSTRIAL ENGINEERING BRANCH

V SEMESTER

IE9302 – OPERATIONS RESEARCH – II

Answer All Questions

PART 'A' (10 x 2 = 20 Mark)

1. What is 'p' system and 'Q' system?
2. What are the costs considered for ordering cost?
3. What is normal lead time and maximum lead time?
4. List advantages of buffer stock
5. Write the general form of Kendall's notation
6. Name the assumptions considered in the queuing model
7. List some of the criteria considered for making decision under uncertainty
8. What is value of the game?
9. What is group replacement?
10. How the present value of the money is calculated in replacement

PART 'B' (5 x 16 = 80 Mark)

11 a) Consider the production consumption inventory model with backorders. The data are demand per year is 10000 units, production rate per year is 16000, ordering cost is Rs.350/order, holding cost is Rs. 3.6/unit/year and shortage cost is Rs.100/unit/year. Find the batch quantity Q and the total cost. Find the time in a cycle, where there is production and consumption, consumption of existing inventory, and the buildup of backorder. (8)

b) A car company works for 200 days in a year and has the capacity to produce 5 units of certain type of car per day. Their total sale for the 200 working days in a year is 400 units at the rate of 2 per day. The annual inventory holding cost is 1.667 per unit per year and the set up cost of Rs. 3.125 per run. Find the following parameters. (8)

- i. The optimum lot size
- ii. The optimum number of production runs
- iii. The optimum number of days in a production run
- iv. The optimum number of days in an inventory cycle
- v. The optimum inventory level
- vi. The optimum reorder level give a lead time of 5 days
- vii. Optimum inventory holding cost
- viii. Optimum order cost.

12a) i) For the data given below perform the ABC analysis

(6)

Item	1	2	3	4	5	6	7	8	9	10	11	12
No. of units	700	2400	150	60	3800	4000	6000	300	30	2900	1150	410
Unit price	5	3	10	22	1.5	0.5	0.2	3.5	8	0.4	1.1	6.2

ii) The demand for an item during the order period is known to be normally distributed with mean 600 units and standard deviation 50 units. (5)

- When it has 800 units of safety stock, find the service level it can offer
- When it has no safety stock find the service level
- For 99% service level, find the safety stock.

iii) For a TV dealer the cost of holding a TV in stock for a week is Rs.30. The shortage cost per unit is Rs.70. The probability distribution of the week demand is given by the following probability distribution. (5)

Weekly sales	0	1	2	3	4	5	6
Probability	0.05	0.10	0.20	0.25	0.2	0.15	0.05

How many units per week should the dealer order?

OR

12 b) Consider a two-item inventory problem with the data given in the below table

	Item 1	Item 2
Annual demand	10,000	15,000
Ordering cost	Rs.200/order	Rs. 250/ order
Carrying cost	Rs.4/unit/year	Rs. 5/unit/year
Item cost	Rs.10/unit	Rs.20/unit

- Find the economic order quantity for each product separately.
- Owing to a liquidity problem, the company requires that the average yearly investment in the inventory for the two products taken together be less than or equal to Rs.15000. Is the answer found in part (i) consistent with this added constraint.

13 a) i) There is a toll arrangement in a newly opened flyover in Bangalore. There is an assistant at the toll gate to collect the fee. To the toll gate the mean arrival rate is 0.75 vehicles per minute. The mean service rate of billing and collecting money is 1 vehicle per

minute. If an arrival is described by poisson and service time is described by exponential calculate all the five steady state operational characteristics (P_0, L_q, L_s, W_q, W_s).

ii) Let the manager in the toll appoint an additional person to assist the existing single lonely assistant. Such an arrangement definitely will increase the number of units served in a given time interval. Let the new service rate, after appointing the second service personnel into our single channel system, is 1.25 vehicles per minute. Compare the five steady state characteristics (P_0, L_q, L_s, W_q, W_s).

OR

13 b) Patient visit a dentist at the rate of 8/hour (poisson) and the service time are 11/ hour (exponentially distributed). Find the expected waiting time in the system. If the dentist wished to have a finite queue length model, find N for which time in the system is less than 15 minutes.

14 a) An organization has 3 alternative projects A,B and C under consideration. Which one it should choose based on decision tree approach. The data are given below for all the three projects.

Project A: For project A, a capital investment of Rs.60, 000 is required. If the project is completed on time, then the organization will receive reward of Rs.1, 00,000 as revenue. If not completed on time, a penalty of Rs.5000 per day will deducted from assured reward of 1, 00,000 with a maximum penalty of Rs. 15,000. The following table gives the probabilities of delay.

0 day	0.75
1 day	0.10
2 days	0.10
3 or more days	0.05

Project B: Project B needs initial investments of Rs. 75,000. After completion the company will get a reward of Rs. 75,000. If the said project is completed in 2 days the organization will get a follow up project that will require an expenditure of Rs.20, 000 and revenue reward of Rs. 50,000 with 70% chance and Rs.75000 with 30% chance. If more than 2 days are required for the first project, the follow up project will not be available. They have equal chance of completing the project in two days.

Project C: Project C needs an initial investment of Rs.1, 00,000. A chance of success for this project is 70% the associated revenue reward will be 1, 80,000. If the project fails then no revenue will be received. Suggest suitable optimum decision for the said investor.

OR

14 b) i) Obtain the optimal strategies for both players and value of the game for two-person zero sum game whose pay-off matrix is as follows: (6)

	B1	B2
A1	-6	7
A2	4	-5
A3	-1	-2
A4	-2	5
A5	7	-6

ii) A businessman has three alternatives open to him, each of which can be followed by any of the four possible events. The conditional pay-offs for each action are given below.

	A	B	C	D
S ₁	8	0	-10	6
S ₂	-4	12	18	-2
S ₃	14	6	0	8

(10)

- A) If he adopts maximin criterion, which action should he choose
 B) If the criterion of choice is minimax regret, what action should be chosen
 C) If he uses EMV as his decision criterion, what action should be chosen
 (assuming that all the events have equal probability of occurrences)

15 a) A manufacturer is offered two machines A and B. A is priced at RS 5000 and running costs are estimated at Rs 800 for each year of the first five years, increasing by Rs.200 per year in the 6th subsequent years. Machine B, which has the same capacity as A, costs Rs 2,500 but will have running costs of Rs1200 per year for six years increasing by Rs.200 per year thereafter. If money is worth 10% per year, which machine should be purchased? (Assume that machines will eventually be sold for scrap at negligible price.)

OR

15 b) An electronic equipment contains 1000 resistors. When any resistors fail, it is replaced. The cost of replacing a resistor individually is Rs 8. If all the resistors are replaced at the same time, the cost per resistors is Rs.2. The percentage of surviving at the end of month is given below.

Month	0	1	2	3	4	5	6
% surviving	100	96	89	68	37	13	0

- i) Replace the resistors individually when they fail (individual replacement policy)
 ii) Replace all the resistors simultaneously at fixed intervals and replace the individual resistors as and when they fail in service during the fixed interval.

Find out the optimal replacement policy? If group replacement policy, then find at what equal intervals should all the resistors be replaced?