

# **D.K.M.COLLEGE FOR WOMEN (AUTONOMOUS), VELLORE-1.**

## **OPERATIONS RESEARCH**

### **UNIT-1                  DECISION THEORY**

#### **SECTION -A**

1. Define Essential Elements in Decision Model?
2. Explain steps in Decision theory approach.
3. A firm manufactures 3 types of product the fixed and variables cost are given below.

Product	Fixed cost(₹)	Variable cost(₹)
A	25,000	12
B	35,000	9
C	53,000	7

The likely demand (units) of the product is given below.

Poor demand	₹ 3,000
Moderate demand	₹ 7,000
High demand	₹ 11,000

If the sale price of each type of product is ₹ 25 then prepare the payoff matrix.

4. Explain Types of decision making environment.
5. Explain types of decision making under uncertainty.
6. The marketing department of the company workout the payoff in terms of year. This is represented as follows.

Strategies	State of Nature		
	N <sub>1</sub>	N <sub>2</sub>	N <sub>3</sub>
S <sub>1</sub>	7, 00,000	3, 00,000	1, 50,000
S <sub>2</sub>	8, 00, 000	4, 50,000	0
S <sub>3</sub>	3, 00,000	3, 00,000	3, 00,000

Which strategy should be chosen on the basis of

- (i) Maximin criterion
- (ii) Maximax criterion

(iii) Minimax criterion

(iv) Laplace criterion

7. Explain steps of calculating EMV.

8. Mr. X quiet often files from town A to town B he can use airport, Bees which cost ₹ 25 but if he takes it there is a 0.08 chance that he will miss the flight of stay in a total cost ₹ 270 with 0-96 chance of being on time. For ₹ 350 he can use taxi which make's 99% chance of being on time. If he catches the plane he makes a profit of ₹ 10000 otherwise he will lose it. Which mode of transport must Mr. X choose answer based on EMV.

9. The probability distribution as follows.

State	:	Fair	Good	Great
Probability	:	0.2	0.5	0.3

Each state of economy are as follows

Alternatives	State of Economy		
	Fair	Good	Great
W	₹1000	₹3000	₹6000
X	₹500	₹4500	₹6800
Y	₹0	₹ 5000	₹8000
Z	₹4000	₹6000	₹ 8500

## SECTION-B

1. The daily demand of roses are as follows

Dozens of roses	7	8	9	10
Probability	0.1	0.2	0.4	0.3

The purchase cost is ₹10 per dozen and selling cost is ₹ 30 all unsold roses are donated to hospital. How many dozens of roses should be purchased to maximize its profit?

2. The cost price of cherries is ₹ 50 per case and sales them for ₹ 80 per case any case remaining is sold for ₹20 per case the next day. The following as the recorded of the sales.

Cases sold	15	16	17	18
Number of days	12	24	48	36
Probability	0.1	0.2	0.4	0.3

Find how many cases to be sold to maximize the profit.

3. The probability demand for Lorries for hiring per day

No. of Lorries demanded	0	1	2	3	4
Probability	0.1	0.2	0.3	0.2	0.2

Lorries have a fixed cost of ₹ 90 daily hire charges ₹200 the company owns 4 lorries what is its daily expected and currently aver no lorries should it buy.

4. The cost of an item ₹ 25 selling price is ₹30 and disposed off at ₹20 if not sold within a week

Weekly sales	3	< 4	5	6	7	> 8
Probability	0	0.1	0.2	0.4	0.3	0

Find optimum number of items purchased per week.

## UNIT-II

## PROJECT MANAGEMENT

### SECTION-A

1. Explain Basic Difference between PERT and CPM .
2. Explain steps for PERT and CPM techniques.
3. Explain components of PERT and CPM method.
4. Define Rules for Network Constructions.
5. Draw the Network diagram for the followings

Activity	A	B	C	D	E	F	G	H	I	J
Predecessor	-	A	B	B	B	C	C	F,G	D, E,H	I

6. Draw network diagram using the date  
1-2, 1-3, 2-3, 2-5, 3-6, 3-4, 4-5, 4-6, 5-6, 6-7.
7. Draw the network diagram

Activity	A	B	C	D	E	F	G	H
Predecessor	-	A	A	B	B, C	E	D, F	G

8. Explain Critical Path Analysis.
9. Explain how to calculate time estimates.
10. Explain Activity float.
11. Explain probability in PERT Analysis.

### PART-B

- Construct the Network diagram and the Critical path, earliest starts time, latest finishing time, and Float values.

Activities: 1-2 1-3 2-3 2-5 3-4 3-6 4-5 4-6 5-6 6-7  
Duration : 15 15 3 5 8 12 1 14 3 14

- Draw the network and find the critical path

A<D, E B, D<E C<G B<H F,G<I

- Time estimate of project is as follows.

Activities : 1-2 1-3 1-4 2-5 3-5 4-6 5-6  
Estimated to : 1 1 2 1 2 2 3  
Duration tm : 1 4 2 1 5 5 6  
(in weeks) tp : 7 7 8 1 14 8 15

- Draw a project network.
- Find the expected duration and variance for each Activity.
- What is the expected project length?
- Calculate the variance and standard derivation of the project length.
- What is the probability that the project will be completed?
  - At least 4 week earlier than expected time?
  - No more than 4 weeks later than expected time?
- If the project due date is 19 weeks. What is the probability of not meeting the due date?

- The project is represented as

Task : A B C D E F G H I  
to : 5 18 26 16 15 6 7 7 3  
tp : 10 22 40 20 25 12 12 9 5  
tm : 8 20 33 18 20 9 10 8 4

- Expected task time and their variances.
- The earliest and latest expected time to reach each event.
- The critical path.
- The probability of an event occurring at the proposed completion date.  
((i.e.) expected completion). If the original contract of completing the project is 41.5 weeks.
- The duration of the project that will have 95% chance of being completed.

## UNIT-III

### DETERMINISTIC INVENTORY CONTROL MODEL

#### SECTION-A

1. Explain the functional classification of inventory.
2. Explain the advantages of carrying inventory.
3. Explain the types of inventory system.
4. The production department for a company requires 3,600kg of new materials for manufacturing a particular item per year. It has been estimated that the cost of planning on order is ₹36 and the cost of carrying inventory is 25% of the investment in the investment in the inventories. The price is ₹ 10/kg. The purchase manager wishes to determine an ordering policy for raw material.
5. Explain the economic lot size model with different rate of demand in different cycle.
6. Explain the EOQ model with constant demand and variable order cycle time with shortages are allowed.
7. Explain the EOQ model with constant demand and fixed reorder cycle time (shortages are allowed).
8. Explain the EOQ model with constant demand and finite Replenishment rate (shortages are allowed).
9. Explain the model with instantaneous demand with no setup cost and discrete supply units.
10. Explain the model with instantaneous demand with no setup and continuous supply units.
11. Explain the probability inventory model with instantaneous demand with no setup cost.
12. An aircraft company uses at an approximately constant rate of 5,000kg/year. The reveals cost ₹ 20/kg and the company personal estimates that cost ₹ 200 to place an order and the carrying cost of inventory is 10% of year.
  - (i) How frequently should reveals be placed and what quantity should be order for
  - (ii) If the actual cost are ₹ 500 to place on order and 15% for carrying cost the optimal policy would changed. Flow much the company tossing per year, because of imperfect cost information.
13. A manufacturing company purchases 9,000 parts of a machine for its annual requirements, ordering 1 month's requirement at a time. Each part of costs ₹ 20. The ordering cost per order is ₹ 15 and the carrying charges are 15% of the average inventory per year. You have been asked to suggest a more economical purchasing policy for the company. What advice would you offer and how much would it same the company per year.

14. A contractor has to supply 10,000 bearing/day to an automobile manufacturer he finds that when he start production run he can produce 25,000 bearings/day the cost of holding a bearing in setup cost of production run is ₹ 1800. How frequently should production run be made?
15. A production is sold at the rate of  $n$  pieces/days and is manufacturing at a rate of 250 pieces/day. The setup cost of the machines are ₹ 1000 and storage cost are found to be ₹ 0.0015/pieces/day with labor charges of ₹ 3.20/pieces, material cost at ₹ 2.10/pieces and over head of ₹ 4.10/pieces. Find the minimum cost batch size if the interest charges are 8% (Assuming 300 working days in a year) compute the optimal no. of cycle in a year for the manufacturing of this product?
16. A commodity is to be supplied at a constant rate of 200 units/day. Supplying of any amount can be had at any required time but each ordering cost ₹ 50. Cost of holding the commodity inventory is ₹ 2/units/day. While the delay in the supply of the them induced a penalty of ₹ 10/units/day. Find the optimal policy ( $Q, t$ ). Where  $t$  is the reorder cycle period and  $Q$  is the inventory level after reordered. What could be the inventory level, after reorder what could be the best policy. If the penalty cost becomes infinite?
17. A commodity is to be supplied at a constant rate of 25 units/day. A penalty cost is being charged at a rate of ₹ 10/units/day. Late for missing the scheduled delivery date. The cost of carrying the commodity in inventory is ₹ 16/units/month. The production process in such month (30 days) a batch of items is started and is available for delivery any time after the end of the month. Find the optimum level of inventory at the beginning of each month.
18. A demand for an item in a company is 18000 units per year and the company can produce the item at a rate of 3000/month. The cost of 1 setup is ₹ 500 and the holding cost 1 unit/month is 15 paise. The shortage cost one unit is ₹ 240/year. Determine the optimum manufacturing quantity and number of shortages also determines the manufacturing time and the time between setups?
19. The probability distribution of monthly sales of a certain term is as follows
- |              |   |      |      |      |      |      |      |      |
|--------------|---|------|------|------|------|------|------|------|
| Monthly sale | : | 0    | 1    | 2    | 3    | 4    | 5    | 6    |
| Probability  | : | 0.01 | 0.06 | 0.25 | 0.35 | 0.20 | 0.03 | 0.10 |

The cost of unit carrying inventory is ₹ 30/unit/month and the cost of unit shortage is ₹10/month. Determine the optimum stock levels which minimize the total expected cost.

20. A banking company sells the cake by the kgw. It makes a profit ₹ 5/kg on every kg sold on the day it is baked. It dispose of all cakes not sold on the data, it's baked at 0 loss of ₹1.20/kg. If demand is known to be rectangular between 2000 and 3000kgs. Determine the optimum daily amount baked.
21. The amount of demand for an item is 3200units. The unit cost is ₹ 6 and inventory carrying charges 25% per annum. If the cost of one procurement is ₹ 150. Determine
- EOQ.
  - Number of order/year.
  - Time between two consecutive orders.
  - The optimal cost.

#### SECTION-B

1. Explain Wilson's lot size formula.
2. Explain the EOQ model with constant demand.
3. Explain the EOQ model with finite replenishment (supply) Rate.
4. Explain the probability inventory model with continuous demand, no setup cost, discrete replenishment units.
5. A dealer supplies you the following information with regard to a product dealt in by him. Annual demand 10000units. Ordering cost ₹ 10/order. Price ₹ 20/unit. Inventory carrying cost 20% of the value of inventory /year. The dealer is considering the possibility of the following some back orders (stock out) to occur; he has to estimate that the annual cost of back ordering will be 25% of the value of inventory.
  - (i) What should be the optimum no. of units of the products he should buy in the one lot?
  - (ii) What quantity of the product should be allowed to be back ordered if any?
  - (iii) What would be the maximum quantity of inventory at any time of the year?
  - (iv) Would you recommended to allow the back ordering. If so, what would be the annual cost saving by adopting the policy of back ordering?

**UNIT-IV**  
**QUEUEING THEORY**

**SECTION-A**

1. Explain the essential features of Queueing system.
2. Explain the properties of Poisson Queues.
3. Explain the Basic axiom of Poisson Queues.
4. A television repairmen finds that the time spend on his jobs has an exponential distribution with mean 30mins. If the repair sets in the order in which they come in. if the arrival of repairs sets follows a Poisson distribution approximately with an average rate of 10/8 hour day.
  - (i) What the repair man's expected idle time each day?
  - (ii) How many jobs are ahead of the average set just brought in?
5. In a railway marshalling yard goods trains arrive at a rate of 30 trains/day. Assuming the inter arrival time follows an exponential distribution and service time distribution is also exponential with an average of 36min.
  - (i) Probability that queue size exceeds 10.
  - (ii) If the input of train increases to an average of 3/day. What will be the change in (i) & (ii).
6. Consider a single server system with Poisson input exponential service time supposes the mean arrival rate in 3 calling units per hour. The expected service is 0.25 hour and the maximum permissible no calling units in the system is 2. Derive the steady state probability distribution of number of calling units in the system and then calculate the expected number in the system.

**SECTION-B**

1. Explain  $(M/M/1 : \infty/FCFS)$
2. Arrive at a telephone are considered to be Poisson with an average time of 10mins between one arrive and the next. The length of phone call is assumed to be distributing exponentially with mean 3 minutes.
  - (i) What is the probability that a person arriving at the booth will have to wait?
  - (ii) The telephone departments will instant a second booth which convinced that an arrival would expect waiting for at least 3min for a phone call. By how much should the flow of arrival increase in order to justify a second booth?
  - (iii) What is the average length of the queue that from time to time?



- (iv) What is the probability that it will take time more than 10mins altogether to wait for the phone and complete his call?
3. A super market has 2 girls ringing up sale at the counters. If the service time for each customers exponential with mean 4mins and if people arrive in a Poisson fashion at the rate of 10 an hour calculate.
- Probability of having to wait for service?
  - Expected percentage of idle time for each girl.
  - If a customer's has to wait what is the expected length of this waiting time?
4. Explain  $[M/M/1 : \infty/SRO]$ .
5. Explain  $[M/M/1 : N/FCFS]$ .
6. Explain  $[M/M/S : \infty/FCFS]$ .
7. Explain  $[M/M/S : N/FCFS]$ .

## UNIT-V

### REPLACEMENT AND MAINTAINANCE MODELS

#### SECTION-A

**6marks**

- 1) Explain Replacement and maintainance Models?
- 2) Afirm is considering replacement of machine whose cost price is Rs.12,200 and the scrap value is Rs.200. The running cost (maintainance and operating cost) of the machine are as follows.

Year	:	1	2	3	4	5	6	7	8
Running cost in Rs.	:	200	600	800	1200	1800	2000	3200	4000

when should the machine be replaced.

- 3) The data collected in running a machine the cost of which is Rs.60,000 are given below,

Year	:	1	2	3	4	5
Re-sale value	:	4200	30000	20400	14400	9650
Spare parts costs in Rs	:	4000	4270	4880	5700	6800
Cost of labour in Rs:		14000	16000	18000	21000	25000

Determine the optimum period for the replacement of machine.

- 4) The cost of machine is Rs.6100 its scrap value is Rs.100. The maintainance cost is given below,

Year	:	1	2	3	4	5	6	7	8
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R ( n ) : 100 200 400 600 900 1200 1600 2000

- 5) A track goner finds from his part reorder that the maintain cost (Year of a truck whose purchase cost is Rs.8000 are given below,

Year : 1 2 3 4 5 6 7 8

R ( n ) : 1000 1300 1700 2000 2900 3800 4800 6000

Resale cost : 4000 2000 1200 600 500 400 400 400

- 6) An equipement which cost Rs.15000 has to be replaced with a new equipement. The following data has been determined.

Year : 1 2 3 4 5 6 7 8

Resale value S : 1200 9500 7500 5100 4200 3900 2900 2000

Annual maintainance }  
Cost in Rs. : 600 800 1050 1400 2100 3500 5000 6800

Ignore the fine values of money and is infinite solution.

## SECTION - B

**15 marks**

- 1) Machine A cost Rs.45000 and the operating cost are estimated at Rs.1000 for the 1<sup>st</sup> year increasing by Rs.10000 year in the 2<sup>nd</sup> and subsequent year machine B cost Rs.30000 and operating costs are Rs.2000 for the 1<sup>st</sup> year increasing by Rs.4000 in the 2<sup>nd</sup> and subsequence year. If we now have a machine of type n should we replace it will B? It shown assume that both machine have no resale value and future costs are not discounted.
- 2) State and Prove “ MORALITY THEOREM ” .