MEASI
Institute *of* Management

APPLIED OPERATIONS RESEARCH-434C2A
QUESTION BANK
PART- A (ONE MARKS QUESTIONS)

UNIT-I

1. What is operation research?
2. Mention the Techniques of operation Research?
3. Narrate the Phases/ Process/Methodology of Operation Research?
4. Write the limitation of Operation Research?
5. State the Assumption of Operation Research?

UNIT-II

1. Define Linear Programming Problem (LPP)?
2. Write the Requirement/ Formulation/ Components of LPP?
3. What is Basic variable
4. What do you mean by Slack variable
5. Define Surplus variable
6. What is Artificial variable
7. What is Entering variable
8. What is Leaving variable
9. Define Pivot Element/ Equation
10. Write the Merits and Demerits of LPP?
11. Define Decision Variable
12. What is Objectives Function
13. What do you mean by Constraints/ Restrictions
14. What is Feasible solution
15. Define Feasible Region
16. What is Optimal solution
17. Define Duality?
18. Write the relationship of the primal and dual problems?

UNIT-III

1. Mention the Application of Assignment Problems?
2. What is unbalanced Problem?
3. What is a Transshipment problem?
4. What is traveling Salesman problem?
5. What is a forbidden assignment problem/ Prohibited or Restricted Assignment problem?

UNIT-IV

1. Define Project?

2. What is an Event and activity?

3 What is Dummy Activity?

4 What is Arrow Diagram and AON Diagram?

5. What is Looping and Dangling?

6 What is Slack and total float?

7. Define free float, Independent and Interference float?

8. What is critical path?

9. What is Critical activities / Bottle Neck activities?

10. What is Gannt Chart?

11. What is crashing? Mention its purpose?

12 Define Cost slope/ Define Slope in Crashing?

13. Define Crash and Normal Time?

14. Mention the objectives of Network Analysis?

15. What is replacement?

16.What are the situations which make the replacement of items necessary?

17. Distinguish between Individual replacement and Group replacement Policy?
18. Define simulation?
19. What is sequencing problems?
20. What is Queuing theory ?
21. What is Queue Discipline?
22. Define traffic intensity or utilization factor?
23. What is meant by inventory?
24. What are the main objectives/functions of an inventory model?
25. Distinguish between deterministic model and probabilistic model?
26. What is inventory control?

UNIT-V

1. Define a game?
2. What is Game theory?
3. What is meant by Minimax, Maximin?
4. What is Pure Strategy?
5. What is Mixed Strategy?
6. What is Optimal strategy?
7. Define Saddle Point?
8. Define Dominance Rule/ Property?
9. Define Zero sum Game?
10. What is Stochastic and deterministic model ?
11. Write down the steps involved in Simulation Process?
12. What do you mean by integer programming problem?
13. Where is Branch and Bound method used?

14. What is Dynamic Programming Problem ?
15. What is Goal Programming ?

PART- B (FIVE MARKS QUESTIONS)

UNIT-1

1. Discuss the character/ Features/ Nature of OR?
2. Discuss the classification/ Types of OR?
3. Narrate the Techniques/ Mathematical Models of OR?
4. Explain Scope/ Uses/ Application/ Areas / Role of OR in Industrial Management?
5. Explain the phases/ Methodology of OR/ How operation Research Works?
6. Explain the Importance/ Necessity of OR?
7. Explain the Limitation of OR?
8. Explain the History/ Background/Origin & Development of OR?

UNIT-II

1. Explain the components/ Requirement/ Formulation of LPP?
2. State the General / Standard/ Mathematical form of LPP?
3. List the Basic Assumption of LPP?
4. Explain the Advantages and Limitations of LPP?
5. Explain the Application of LPP?

UNIT-III

1. Write the difference between Assignment problem and Transportation problem?
2. Give a LPP Formulation /Mathematical Expression of Transportation problem?

UNIT-IV

1. Explain the Phases in Project Management?

2. Distinguish between PERT & CPM?

3. Discuss the rules/ Guidelines for Project Network Construction?

4. What is Replacement? Describe some important replacement Situation and Policies?

5. Explain the General Assumption of Sequencing Problem?

6. Explain the Special features/ Characteristic/ Components/ Elements/ Process/ Structure/ Queuing System or Waiting Line System?

7. Discuss the Application of Queuing theory?

8. List and explain the Parameters / Elements/ Components of Kendall Notation?

9. List and explain the terminology in Queuing Theory?

10. Explain Various Inventory Costs?

11. Explain the assumptions made while deriving EOQ Formula?

12. Explain various inventory Models and inventory control Techniques?

UNIT-V

1. List and Explain the Terminologies in Game Theory?

2. Discuss the Limitation and Application of Game Theory?

3. Discuss Dominance Property and its role?

4 Explain Minimax and Maximim Principle?

5. Explain Monte-Carlo technique?

PART- C (TEN MARKS QUESTIONS)

1.Solve LPP by Simplex Method

Maximize $z = 3x_1 + 2x_2 + 5x_3$

Subject to

$x_1 + 4x_2 \leq 420$

$3x_1 + 2x_3 \leq 460$

$x_1 + 2x_2 + x_3 \leq 430$ where $x_1, x_2, x_3 \geq 0$.

2.Solve LPP by Simplex Method

Maximize $z = 4x + 3y$

s.t

$2x + 3y \leq 150$

$3x + 2y \leq 150$

$x + y \leq 100$ where $x, y \geq 0$.

3. Solve LPP by Simplex Method

Maximize $z = x_1 + 2x_2 + x_3$

Subject to

$2x_1 + x_2 - x_3 \leq 2$

$-2x_1 + x_2 - 5x_3 \geq -6$

$4x_1 + x_2 + x_3 \leq 6$ where $x_1, x_2, x_3 \geq 0$.

4. Solve LPP by Simplex Method

Maximize $z = 3x_1 + 5x_2 + 4x_3$

Subject to

$2x_1 + 3x_2 \leq 8$

$-2x_1 - 5x_3 \geq -10$

$3x_1 + 2x_2 + 4x_3 \leq 15$ where $x_1, x_2, x_3 \geq 0$

5. Solve LPP by Big M Method

Minimize $z = 5x_1 + 6x_2$

s.t

$2x_1 + 5x_2 \geq 1500$

$3x_1 + x_2 \geq 1200$ where $x_1, x_2 \geq 0$.

6. Solve LPP by Big M Method

Minimize $z = 12x + 20y$

s.t

$6x + 8y \geq 100$

$7x + 12y \geq 120$ where $x_1, x_2 \geq 0$.

7. Solve LPP by Big M Method

Minimize $z = 60x_1 + 80x_2$

s.t

$20x_1 + 30x_2 \geq 900$

$40x_1 + 30x_2 \geq 1200$ where $x_1, x_2 \geq 0$.

8.A firm has four plants A, B, C, D with the supply of 15, 35, 12, 19 units as per day. This firm has four warehouses W1, W2, W3, W4 with daily demand of 21,26,17,17 units respectively. The per unit transportation costs are given in the following table

Plants	Warehouses			
	W1	W2	W3	W4
A	3	3	5	4
B	5	1	3	3
C	6	4	4	3
D	4	1	4	2

Determine the optimal transportation cost.

9. A company has to transport its product from 3 plants to 4 distribution centers. The availability and requirement of unit of product, with unit transportation costs are given below. Find the optimal transportation cost

Plant	Distribution Centers				
	D1	D2	D3	D4	Available
1	6	2	8	9	80
2	12	6	16	12	80
3	4	6	18	4	120
Requirement	40	50	130	60	

10. A firm has three plants A, B, C with the supply 6,1,10 units as per day. This firm has four dealers D, E, F, G with daily demand of 7,5,3,2 units respectively. The per unit transportation costs are given in the following table

Plants	Dealers			
	I	II	III	IV
A	2	3	11	7
B	1	0	6	1
C	5	8	15	9

Determine the test for optimality and find out optimal transportation cost.

11.A job has to be processed in three machines in the order of Machine A, Machine B and Machine C. The time required to perform these operations (in minutes) for each job is known. Determine the order in which job should be processed in order to minimize the total time required to turn out all the jobs.

Jobs	1	2	3	4	5	6	7	8
Machine A	4	6	7	4	5	3	6	2
Machine B	8	10	7	8	11	8	9	13
Machine C	5	6	2	3	4	9	15	11

12. A factory has to complete 5 jobs and each job has to be processed on 3 machines. The time required to perform these operations (in minutes) for each job is known. Determine the order in which job should be processed in order to minimize the total time required to turn out all the jobs.

Time in Minutes

Jobs	M/C_1	M/C_2	M/C_3
1	13	7	3
2	14	5	10
3	9	6	5
4	12	4	12
5	8	2	4

13. Find the sequencing that minimize total elapsed time required to complete the jobs

JOBS	MACHINE		
	A	B	C
1	9	2	3
2	7	7	7
3	6	4	5
4	9	5	4
5	5	3	8

14. A job has to be processed in two machines in the order of Machine 1, Machine 2 and Machine 3. The time required to perform these operations (in minutes) for each

job is known. Determine the order in which job should be processed in order to minimize the total time required to turn out all the jobs

Jobs	A	B	C	D	E	F	G
Machine 1	4	9	8	5	10	9	8
Machine 2	5	4	3	6	2	5	4
Machine 3	7	8	6	12	6	7	13

15. A manufacturer is offered 2 machines A and B. A is priced at Rs 5000 with running cost at Rs 800 for each of first five years increasing by Rs200 per year in the sixth and subsequent years. B is priced at Rs 2500 but will have running cost of Rs1200 first five years increasing by Rs200 per year in the sixth and subsequent years. If money worth is 10% per year, which machine should the customer purchase from the manufacturer?

16.A company purchase a machine for Rs10,000. The operating cost of the machine is expected to be more or less the same during its life. The maintenance cost of machine is Rs2000 during the first year of operation. It increases by Rs800 from second to fourth year of operation. During its fifth year of operation, it is Rs6000 and then increase by Rs1000 every year. The interest rate is 12% and determine the economic life of machine.

17. A computer contains 20,000. When any resistor fails, it is replaced. The cost of replacing a resistor individually is Rs 1 only. If all the resistor are replaced at the same time, the cost per resistor would be reduced to 0.40 paise. The present surviving says

s(t) at the end of month t and p(t), the probabilities of failure during the month t are given below. What is the optimal replacement plan?

t	0	1	2	3	4	5	6
s(t)	100	96	90	65	35	20	0
p(t)	_	0.04	0.06	0.25	0.30	0.15	0.20

18. Draw the network for the project. Determine critical path, project duration and total float, free float independent float

Activity	0-1	1-2	1-3	2-4	2-5	3-4	3-6	4-7	5-7	6-7
Duration(days)	3	8	12	6	3	3	8	5	3	8

19.Draw a network diagram using CPM for a project involving the following activities and determine critical path as well as project duration

Activity	A	B	C	D	E	F	G	H	I	J	K	L
Immediate Predecessors	_	_	_	(B,C)	A	C	E	E	(D,F,H)	E	(I,J)	G
Duration (Weeks)	9	4	7	8	7	5	10	8	6	9	10	2

20. A project is comprising of following activities. The time estimates are given below

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	15

(a)Determine expected duration, standard deviation, variance and range.

(b) Draw a network and estimate project duration along with critical path

(c) If the project duration is 19 weeks, what is the probability of completing the project.

(d) If the project duration is 13 weeks, when the project completes?

(e) Find out the expected duration of task which have 95% confidence of completion.

21. A project is comprising of following activities. The time estimates are given below

Activity	Predecessor	Optimistic time	Most likely time	Pessimistic time
A	-	2	4	6
B	A	8	12	16
C	A	14	16	30
D	B	4	10	16
E	(B,C)	6	12	18
F	E	6	8	22
G	D	18	18	30
H	(F,G)	8	14	32

Draw a network and project will require complete in 75 days

22. A company use rod at a rate of 5000kg per year and rod costing is Rs2.00 per kg. Its cost Rs 20 to place an order and carrying cost of inventory is 10% per year. How frequently should the order for rods be placed and how much?

23.The Mahavir Paints ltd would like to improve its inventory management policies for its supply of paints used for automobiles. The annual demand for such paints is 50,000 litres and the paints which cost is Rs20 per litre is used at constant rate. Annual carrying cost are estimated at 15% of the value of paint and ordering cost is Rs 80.

(a) How much paints should be ordered each time?

(b) How often should paint be ordered?

(c) What is the total annual cost?

24.An Automobile Repair Shop is able to install new silencer at the rate of 3 per hour. The service rate follows an exponential distribution. The customer seeking their service at the repair shop on the average of 2 per hour. The customer are served on FIFO service.Determine

(a)Average number of customers in the system

(b) Average Queue length

(c)Average waiting time of customer in the system

(d) Average waiting time in the queue.

(e) Probability of zero units in the system

(f) Probability of 2 customer in the system

25. A company management and labour union are negotiating a new three years settlement. Each party has four strategy. Determine the value of the game.

Union Strategy	Company Strategy			
	1	II	III	IV
A	20	15	12	35
B	25	14	8	10
C	40	2	10	5
D	-5	4	11	0