

Shri Mata Vaishno Devi University

School of Mechanical Engineering

Minor I Examination 2018 (Jan.)

Operations Research

Marks: 20

B.Tech: Mech.

Credits: 4

Code: EMEL

Semester: 4th

Time: 1 Hr.

1. What do understand by the term Operations Research? State the advantages of Operations Research with respect to Manufacturing Industry. (4 marks)
2. Write in Brief about the following : (4*1.5 = 6)
- (a) Economic Ordered Quantity.
 - (b) Lead Time.
 - (c) Optimal and Optimum Solution
 - (d) Dummy Variables
3. There are five Batsmen in IPL Cricket Team who could play at any position from Number 1 to Number 5. The Captain of the team and the coach want to maximize the score based on Average scores of these players at five positions. Based on the data available as shown in the below matrix, suggest the optimal batting order. (5marks)

Order Player	No. 1	No.2	No.3	No.4	No.5
A	54	47	37	41	36
B	37	31	40	28	34
C	51	52	32	34	21
D	29	42	39	45	47
E	26	29	31	23	26

4. A Metal Cutting Industry wants to purchase three different types of Metal Cutting machines and five manufacturers have come forward to supply one or all the three machines. However, the Industry's policy is not to accept more than one machine from any one of the manufacturers. The data relating to the price (in Thousands of Dollars) quoted by the different manufacturers are as given in table below. Find the optimum assignment policy such that cost is minimized. (5 Marks)

Manufacturers	Machines		
	M1	M2	M3
A	30	31	27
B	28	29	26
C	29	30	28
D	28	31	27
E	31	29	29

Shri Mata Vaishno Devi University
School of Mechanical Engineering
2018 Examination

Minor-II

Subject: Operations Research

Time: 1 Hr.

Credits: 4

Semester: IVTH

Max. Marks: 20

Course Code:

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1. Discuss the significance of the term Inventory Control in a Manufacturing Industry. Give at least 5 situations where principle of Inventory is followed. (4 Marks)
 2. An Automotive Co. manufactures gears @ 120, 000 units per year. The annual requirement is 75,000 units. Each unit of gear costs Rs. 125. The cost of putting through each order is computed @ Rs. 75. Inventory carrying charges are Rs. 50 per unit per year. What could be the manufacturing batch quantity for the company and, the cycle time. (5 Marks)
 3. What are the various assumptions in a Waiting Line Model analysis? Give few examples of Waiting Line Model that you see in day to day life. (4 Marks)
 4. Attempt the following questions (3*1 = 3 Marks)
 - (a) Which among the following is not a type of Inventory.
(i) Raw Materials (ii) Sold Materials
(iii) WIP (iv) Maintenance Equipment
 - (b) In Inventory Management, ABC stands for
 - (c) Which among the following is not a component of Carrying Cost of Inventory.
(i) Taxes Payable (ii) Obsolesce
(iii) Spoilage (iv) Goodwill Cost
 5. Write in brief about the following terms: (2*2 = 4 Marks)
 - (a) Impact of Que Length.
 - (b) Utilization Factor.

SHRI MATA VAISHNO DEVI UNIVERSITY, KATRA

School of Mechanical Engineering

B.Tech. (Mechanical Engineering) Major Examination (Even) 2017-18

Entry No: [REDACTED] Total Number of Pages:[2]

Date: Apr-May 2018 Total Number of Questions: [8]

Course Title: Operations Research

Course Code: MEL 2133

Time Allowed: 3.0 Hours **Max Marks: [50]**

Instructions / NOTE

- i. Attempt All Questions.
 - ii. Support your answer with neat freehand sketches/diagrams, wherever appropriate.
 - iii. Assume any missing data to suit the case / derivation / answer.

1. A manufacturer of Leather products makes 3 types of Products A, B and C which are processed on 3 Machines M₁, M₂ and M₃. Product A requires 2 hours on Machine M₁ and 3 hours on Machine M₃. Product B requires 3 hours on Machine M₁, 2 hours on Machine M₂ and 2 hours on Machine M₃. Product C requires 5 hours on Machine M₂ and 4 hours on Machine M₃. There are 8 hours of time available daily on Machine M₁, 10 hours of time available daily on Machine M₂ and 15 hours of time available daily on Machine M₃. The profit gained from Product A is 3 Dollars per unit, Product B is 5 Dollars per unit and Product C is 4 Dollars per unit. Formulate the given data as a LPP. (7 Marks)
 2. A Pharmaceutical company is producing a single product and is selling it through 5 agencies located in different cities. All of a sudden, there is a demand of this product in another 5 cities where there is no agency of the company. The company is faced with the problem of deciding on how to assign the existing agencies to deliver the product to needy cities in such a way that the travelling distance is minimized. The distance (in km) between surplus and deficit cities is given in the table below. Suggest the optimal assignment. (6 Marks)

	A	B	C	D	E
1	85	75	65	125	75
2	90	78	66	132	78
3	75	66	57	114	69
4	80	72	60	120	72
5	76	64	56	112	68

3. Discuss the relevance of Replacement Analysis, in an Industrial organization. What are the various strategies used for this purpose? Give an example to support your answer. (4 Marks)

4. A manufacturing company purchases 9000 parts of a machine for its annual requirements, ordering one month usage at a time. Each part costs Rs. 20. The ordering cost per order is Rs. 15 and carrying charges are 15% of the average inventory per year. Determine: (i) EOQ
(ii) Total Annual Cost (iii) Net saving per year. (6 Marks)

5. The data collected in running a machine 'X', the cost of which is Rs. 60000 are given below:

Year:	1	2	3	4	5
Resale Value (Rs.)	42000	30000	20400	14400	9650
Cost of Spares (Rs.)	4000	4270	4880	5700	6800
Cost of Labour (Rs.)	14000	16000	18000	21000	25000

Suggest the period after which, the machine 'X' should be replaced. Also assign the reason for its replacement.

(6 Marks)

6. Suggest the Optimal solution of the given Linear Programming Problem using Simplex procedure

$$\text{Maximize } Z = 2X_1 + 3X_2 + 4X_3$$

Subject to,

$$3X_1 + X_2 + 6X_3 \leq 600$$

$$2X_1 + 4X_2 + 2X_3 \geq 480$$

$$2X_1 + 3X_2 + 3X_3 = 540$$

$$X_1, X_2, X_3 \geq 0$$

(10 Marks)

7. A Road Transport Company has one reservation clerk on duty at a time. The company serves on a FCFS policy. Customers arrive at a rate of 8 per hour and the clerk can serve 12 customers on an average per hour. Determine:

- (a) Utilization Factor
- (b) Average waiting time in the system
- (c) Average No. of Customers Waiting in Queue.
- (d) Queue Length
- (e) Probability that No. of Customers are more than 2 in the system. (5 = 5 Marks)

8. Write in brief about the following:

(3*2 = 6 Marks)

- (a) Degeneracy in LPP.
- (b) Probabilistic Techniques in Operations Research.
- (c) Reorder Level Inventory

Course Outcomes

After Successful Completion of this Course, students shall be able to;

- (1) To get a basic understanding about various aspects of Operations Research in Engineering and their applications in an Industrial Environment. More precisely, how a Mechanical / Industrial Engineer has to channelize the resources/activities within the Industry.
- (2) Implement concepts like linear programming, Assignment problems, Inventory Management, etc. for getting optimal allocation of resources in manufacturing systems.
- (3) Thoroughly understanding the fundamental concept of stochastic model and practically solving a stochastic model.
- (4) Act as Effective Decision Makers under uncertainty.

SHRI MATA VAISHNO DEVI UNIVERSITY, KATRA
School of Mechanical Engineering
B. Tech. (ME) Minor-I Examination (Even) 2019-20

Entry No: Date: 05/02/2019

Total Number of Pages: [01]
Total Number of Questions: [05]

Course Title: Operations Research
Course Code: MEL 2133

Time Allowed: 1.5 Hours

Max Marks: [20]

Instructions / NOTE (Faculty may include any other relevant instruction, if required)

- i. Attempt All Questions.
- ii. Support your answer with neat freehand sketches/diagrams, wherever appropriate.
- iii. Assume an appropriate data / information, wherever necessary / missing.

Section - A

Q1.	Operations Research is a scientific approach to problem solving for executive management. Comment on the statement highlighting the relevance of Operations Research in decision making.	[04]	CO1
Q2.	Mention the scope of Operations Research in an industrial scenario from Mechanical Engineering perspective.	[04]	CO1

Section - B

Q3.	A Gear manufacturing company has 4 Machinists available to whom jobs may be assigned for production work on daily basis. The time taken (in hours) by each Machinist to complete a specific Job is given in the matrix below. Suggest the optimal assignment of Jobs to the Machinists. Also suggest if there are any alternate solutions for this problem.	[06]	CO2																									
	<table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <th></th> <th>A</th> <th>B</th> <th>C</th> <th>D</th> </tr> <tr> <th>1</th> <td>2</td> <td>3</td> <td>4</td> <td>5</td> </tr> <tr> <th>2</th> <td>4</td> <td>5</td> <td>6</td> <td>7</td> </tr> <tr> <th>3</th> <td>7</td> <td>8</td> <td>9</td> <td>8</td> </tr> <tr> <th>4</th> <td>3</td> <td>5</td> <td>8</td> <td>4</td> </tr> </table>		A	B	C	D	1	2	3	4	5	2	4	5	6	7	3	7	8	9	8	4	3	5	8	4		
	A	B	C	D																								
1	2	3	4	5																								
2	4	5	6	7																								
3	7	8	9	8																								
4	3	5	8	4																								
Q4.	Write in brief about the following:																											
	(a) The Algorithm used to suggest Optimal Assignment is	[01]	CO2																									
	(b) variable is used to solve any non square matrix.	[01]	CO2																									
Q5.	A stockist has to supply 400 units of a product every Monday to his customers. He gets the product @ Rs. 50/- per unit from the manufacturer. The cost of ordering and transportation from the manufacturer is Rs. 75/- per order. The inventory carrying cost is 7.5 % per year of the cost of product. Determine the optimum manufacturing quantity and the total optimal cost if EOQ policy is followed.	[04]	CO2																									

Course Outcomes

Upon successful completion of this course, the student shall be able:

CO1	Basic understanding of the fundamental concept of deterministic models
CO2	Enabling candidates how to implement linear programming for getting optimal allocation of resources in manufacturing systems
CO3	understanding the fundamental concept of stochastic model and practically solving a stochastic model
CO4	Enabling candidates to implement critical path method for getting optimal solution of any manufacturing network and understanding the concepts of Inventory Management manufacturing systems
CO5	Realizing the situations under which, queuing theory is effective in handling practical real life problems in industries/societies

CO	Questions Mapping	Total Marks	Total Number of Students (to appear in Exam)
CO1	1,2	08	32
CO2	3,4,5	12	32

SHRI MATA VAISHNO DEVI UNIVERSITY, KATRA
School of Mechanical Engineering
B. Tech. (ME) Minor-~~I~~Examination (Even) 2019-20

Entry No: _____

Total Number of Pages: [01]

Date: 17/03/2019

Total Number of Questions: [05]

Course Title: Operations Research

Course Code: MEL 2133

Max Marks: [20]

Time Allowed: 1.5 Hours

Instructions / NOTE (Faculty may include any other relevant instruction, if required)

- i. Attempt All Questions.
- ii. Support your answer with neat freehand sketches/diagrams, wherever appropriate.
- iii. Assume an appropriate data / information, wherever necessary / missing.

Section - A

Q1.	Discuss with the help of an example the relevance of Inventory Management in Operations Research.	[4]	CO3
Q2.	Explain in brief the following: (A) VED Analysis. (B) Significance of Utilization Factor	[2*2 =4]	CO3

Section - B

Q3.	A cast iron bracket has an annual demand of 9000 units. The cost of one procurement is Rs. 100/- and the holding cost is Rs. 2.40/- per year. The replacement is instantaneous and no shortages are allowed. Determine: (a) Economic Lot Size. (b) Number of orders per year. (c) Time between orders. (d) The company operates for 300 days per year. The procurement time is 10 days and safety stock is maintained at a level of 100 units. Find the reorder point, the maximum, minimum and average inventory. (e) Minimum total variable yearly cost. (f) Total cost per year.	[6]	CO3
Q4.	Write in brief about the following: (a) In inventory control system ABC stands for (b) policy is the ideal Queuing theory policy.	[01] [01]	CO3,4 CO5
Q5.	A fertilizer company distributes its products by trucks loaded as its only loading station. Both company's trucks and contractor's trucks are used for this purpose. It was found that at an average, every 5 minutes 1 truck arrives and the average loading time is 3 minutes. 40% of the trucks belong to the contractor. Assume suitable data and determine: (a) Probability that a truck has to wait. (b) Utilization factor. (c) Waiting time of a truck that waits. (d) Average number of trucks.	[04]	CO5

Course Outcomes

Upon successful completion of this course, the student shall be able:

CO1	Basic understanding of the fundamental concept of various Operations research models.		
CO2	Enabling candidates how to implement linear programming for getting optimal allocation of resources in manufacturing systems		
CO3	understanding the fundamental concept of stochastic model and practically solving a stochastic model		
CO4	Enabling candidates to implement critical path method for getting optimal solution of any manufacturing network and understanding the concepts of Inventory Management manufacturing systems		
CO5	Realizing the situations under which, queuing theory is effective in handling practical real life problems in industries/societies		
CO	Questions Mapping	Total Marks	Total Number of Students (to appear in Exam)
CO3	1,2	08	32
CO3,4,5	3,4,5	12	32

SHRI MATA VAISHNO DEVI UNIVERSITY, KATRA
School of Mechanical Engineering
B. Tech. (ME) MAJOR Examination (4th Sem.) 2019

Entry No:

Date: 05-05-2019

Total Number of Pages: [02]

Total Number of Questions: [08]

Course Title: Operations Research
Course Code: MEL 2133

Time Allowed: 3.0 Hours

Max Marks: [50]

Instructions / NOTE

- i. Attempt All Questions.
- ii. Assume an appropriate data / information, wherever necessary / missing.

Q1.	As a Mechanical Engineer, what do you understand by the term Operations Research? What are the areas where Operations Research finds applications? List some advantages of Operations Research.	[05]	CO1																														
Q2.	Write the algorithm for an assignment problem and also explain the difference between transportation model and assignment problem.	[05]	CO1																														
Q3.	For the given LPP suggest its Optimal solution using SIMPLEX procedure $Min \ Z = 5X_1 + 6X_2$ <i>Subject to,</i> $X_1 + X_2 \geq 2$ $4X_1 + X_2 \geq 4$ $X_1, X_2 \geq 0$	[10]	CO1																														
Q4.	At the interest rate of 10 %, suggest the optimal replacement policy for an automotive component purchased at a purchase price of USD 8,000. The other associated costs of this automotive component for different years is as per the data below: <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Year</th><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th></tr> </thead> <tbody> <tr> <td>Running/maintenance Cost (Rs.)</td><td>1300</td><td>1500</td><td>1700</td><td>1900</td><td>2100</td><td>2500</td><td>4000</td></tr> <tr> <td>Resale Value (Rs.)</td><td>4100</td><td>2700</td><td>2100</td><td>1600</td><td>1100</td><td>700</td><td>600</td></tr> </tbody> </table>	Year	1	2	3	4	5	6	7	Running/maintenance Cost (Rs.)	1300	1500	1700	1900	2100	2500	4000	Resale Value (Rs.)	4100	2700	2100	1600	1100	700	600	[06]	CO1						
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Resale Value (Rs.)	4100	2700	2100	1600	1100	700	600																										
Q5.	A Departmental Store with self service model has one cashier and the store is following Poisson arrival fashion and exponential service times. If there are 9 customers who arrive on an average every 5 minutes and the cashier has the capability to serve 10 in 5 minutes. Calculate: (a) Total number of customers in the system. (b) Probability of number of customers greater than 10 in the system. (c) Probability that a customer has to wait for more than 2 minutes in the queue.	[06]																															
Q6.	Write short notes on the following: (a) Limitations of Graphical Method in LPP. (b) Balking, Reneging and Jockeying. (c) Economic Ordered Quantity. (d) Types of Replacement Strategies.	[1.5*4 = 06]																															
Q7.	A Steel manufacturing company has 4 Machinists available to whom jobs may be assigned for production work on daily basis. 5 jobs are given and the expected profit in Dollars for each Machinist on each job is given in the matrix below. Suggest optimal assignment which maximizes profit. <table border="1" style="margin-left: auto; margin-right: auto; border-collapse: collapse;"> <tr> <td></td><td>A</td><td>B</td><td>C</td><td>D</td><td>E</td></tr> <tr> <td>1</td><td>6.20</td><td>7.80</td><td>5.00</td><td>10.10</td><td>8.20</td></tr> <tr> <td>2</td><td>7.10</td><td>8.40</td><td>6.10</td><td>7.30</td><td>5.90</td></tr> <tr> <td>3</td><td>8.70</td><td>9.20</td><td>11.10</td><td>7.10</td><td>8.10</td></tr> <tr> <td>4</td><td>4.80</td><td>6.40</td><td>8.70</td><td>7.70</td><td>8.00</td></tr> </table>		A	B	C	D	E	1	6.20	7.80	5.00	10.10	8.20	2	7.10	8.40	6.10	7.30	5.90	3	8.70	9.20	11.10	7.10	8.10	4	4.80	6.40	8.70	7.70	8.00	[06]	
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4	4.80	6.40	8.70	7.70	8.00																												

Q8. <p>The annual demand of a particular item by a maintenance company which operates for 300 days annually is 10,000 units. The maintenance consumables may be obtained either from an external company or a subsidiary company. Based on the data available, determine:</p> <ul style="list-style-type: none"> (a) What purchase quantity and from which source would you recommend the purchase. (b) What would be the minimum total cost? <p>The relevant data to procure the item is given below.</p>	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">Costs</th><th style="text-align: center;">From External Company (USD)</th><th style="text-align: center;">From Subsidiary Company (USD)</th></tr> </thead> <tbody> <tr> <td>Cost per Unit</td><td style="text-align: center;">12</td><td style="text-align: center;">13</td></tr> <tr> <td>Cost of placing an order</td><td style="text-align: center;">10</td><td style="text-align: center;">10</td></tr> <tr> <td>Cost of receiving an order</td><td style="text-align: center;">20</td><td style="text-align: center;">15</td></tr> <tr> <td>Storage and all carrying costs, including capital cost per unit per item</td><td style="text-align: center;">2</td><td style="text-align: center;">2</td></tr> </tbody> </table>	Costs	From External Company (USD)	From Subsidiary Company (USD)	Cost per Unit	12	13	Cost of placing an order	10	10	Cost of receiving an order	20	15	Storage and all carrying costs, including capital cost per unit per item	2	2	[06]
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Course Outcomes

Upon successful completion of this course, the student shall be able:

CO1	Basic understanding of the fundamental concept of deterministic models
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CO5	Realizing the situations under which, queuing theory is effective in handling practical real life problems in industries/societies

CO	Questions Mapping	Total Marks	Total Number of Students (to be appeared in Exam)
CO1	1,2	10	32
CO2	3	10	32
CO3	4, 6,7	18	32
CO4	8	6	32
CO5	5	6	32