Enrollment No..................................

Faculty of Engineering

End Sem (Even) Examination May-2022

EN3ES15 Operation Research

Programme: B.Tech.   Branch/Specialisation: CSBS

Duration: 3 Hrs.   **Maximum Marks: 60**

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d.

Q.1   i.   Operations research is based upon collected information, knowledge **1** and advanced study of various factors impacting a particular operation. This leads to more informed _____.
(a) Management Processes   (b) Decision Making
(c) Procedures   (d) All of these

ii.   Operations research was known as an ability to win a war without **1** really going in to _____.
(a) Battlefield (b) Fighting   (c) The opponent   (d) All of these

iii.   If at the optimum in LPP a dual variable corresponding to a **1** particular primal constraint is zero, then it means that-
(a) RHS of the primal constraint can be altered w/o affecting the optimum solution
(b) Changing the RHS of the primal constraint will disturb the LPP
(c) The objective function is unbounded
(d) The problem is degenerate

iv.   Consider the following LPP – **1**
Maximize $3a + 2b$
ST $a <= 4$,
    $b <= 6$ and
    $3a + b <= 18$.
    $a >= 0$ and $b >= 0$
(a) The LPP has UNIQUE OPTIMAL Solution
(b) The LPP is infeasible
(c) The LPP is unbounded
(d) The LPP has Multiple optimal solutions

P.T.O.

OR   iii.   Solve following transportation problem by- **7**
(a) NW Corner method   (b) Row Minima method
State whether the solution is optimal or not in both cases? Why?

		Destinations
		1	2	3	4	Supply
Sources	1	5	6	9	7	6000
	2	7	8	2	4	5000
	3	6	3	5	3	4000
Demand		5000	4000	2000	4000	

Q.5   i.   Differentiate between PERT and CPM with suitable examples. **4**

ii.   What do you understand by crashing? When and where it is used, **6** explain with suitable example. What is Indirect and Direct Costs in Project explain in detail.

OR   iii.   Deduce the relationship for EOQ. What are functions of inventory **6** model?

Q.6   Attempt any two:

i.   What do you understand by Kendall notation, where it is used **5**

ii.   If Arrival Rate of cars at service station is 3 per hr, Service Rate is **5** 15 min per car. The capacity can handle 1 car at a time.
Find:
(a) Average queue length   (b) Average no. of cars in system
(c) Waiting time in system   (d) Waiting time in Queue
(e) Percent utilization

iii.   Explain Monte- Carlo simulation detail by an example. **5**

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v. Which of the following statements in NOT correct? **1**
   (a) Assignment model is special case of a LPP
   (b) In queuing models, Poisson arrivals & Exponential services are assumed
   (c) In Transportation problems, the non-square matrix is made square by adding dummy row or dummy column
   (d) In LPP, dual of dual is primal

vi. In marking assignments, which of the following should be preferred? **1**
   (a) Only row having single zero
   (b) Only column having single zero
   (c) Only row/column having single zero
   (d) Column having more than one zero

vii. The objective of network analysis is to_____. **1**
   (a) Minimize total project duration
   (b) Minimize total project cost
   (c) Minimize production delays, interruption and conflicts
   (d) Maximize total project duration

viii. Select Correct Statement: **1**
   (a) EOQ is that quantity at which price paid by the buyer is minimum
   (b) If annual demand doubles with all other parameters remaining constant, the Economic Order Quantity is doubled
   (c) Total ordering cost equals holding cost
   (d) Stock out cost is never permitted

ix. Service mechanism in a queuing system is characterized by _____. **1**
   (a) Customers behaviour
   (b) Servers behaviour
   (c) No. of customers
   (d) No. of Servers

x. Simulation technique cannot be used for solving problems of- **1**
   (a) Inventory Control   (b) Queuing
   (c) Maintenance Problem   (d) None of these

Q.2   i. List at least five various tools of operations research. **2**

ii. Define: **3**
   (a) Infeasibility   (b) Unboundedness

iii. Explain seven stages of Operations Research. **5**

OR   iv. A manufacturer produces 2 products "A" & "B". For which 2 Resources are required "R$_1$ & R2". **5**
A requires 1 unit of R$_1$ & 3 units R$_2$; B requires 1 unit of R$_1$ & 2 units of R$_2$; Selling A gives Profit of Rs. 6/- and Selling B gives Profit of Rs. 5/-. Formulate the LPP to maximize profit.

Q.3   i. What is condition for Alternate Optimum in LPP? **2**

ii. Solve following LPP by Simplex Method to Maximize: **8**
$Z=12x_1+16x_2$
ST: $10x_1+20x_2 \leq 120$
    $8x_1+8x_2 \leq 80$
    $x_1, x_2 \geq 0$
Confirm the results by Graphical Method.

OR   iii. What do you understand by duality? Explain in detail. **8**
Write dual of following LPP Problem.
$x_1 + x_2 \leq 5;$
$3x_1 + 2x_2 \leq 12$
$x_1, x_2 \geq 0$

Q.4   i. What do you understand by degeneracy in Assignment Problems? How do we solve degeneracy? **3**

ii. Solve the following Assignment Problem. Name the model used for solving this type of problem. Assign Jobs to Man for minimum cost. The cost in hundreds of rupees is given in matrix for each man corresponding to each job. **7**

	Printing	Typing	Shorthand	Filing
M1	5	9	3	6
M2	8	7	8	2
M3	6	10	12	7
M4	3	10	8	6

Marking Scheme
EN3ES15 Operation Research

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(b) Decision Making

ii. Operations research was known as an ability to win a war without really going in to _____. **1**
(d) All of these

iii. If at the optimum in LPP a dual variable corresponding to a particular primal constraint is zero, then it means that- **1**
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iv. Consider the following LPP – **1**
Maximize 3a + 2b
ST a <= 4,
   b <= 6 and
   3a + b < =18.
   a >= 0 and b >=0
(a) The LPP has UNIQUE OPTIMAL Solution

v. Which of the following statements in NOT correct? **1**
(c) In Transportation problems, the non-square matrix is made square by adding dummy row or dummy column

vi. In marking assignments, which of the following should be preferred? **1**
(c) Only row/column having single zero

vii. The objective of network analysis is to_____. **1**
(a) Minimize total project duration

viii. Select Correct Statement: **1**
(c) Total ordering cost equals holding cost

ix. Service mechanism in a queuing system is characterized by _____. **1**
(b) Servers behaviour

x. Simulation technique cannot be used for solving problems of- **1**
(d) None of these

Q.2 i. Any five tools of operations research **2**
ii. (a) Infeasibility   1.5 marks **3**
   (b) Unboundedness   1.5 marks

iii.	Name of stages	2 marks	**5**
	Explanation	3 marks	
OR iv.	As per solution and explanation		**5**

Q.3 i.	Condition for Alternate Optimum in LPP		**2**
ii.	As per solution and explanation		**8**
OR iii.	As per solution and explanation		**8**

Q.4 i.	Degeneracy in Assignment Problems	1 mark	**3**
	Steps to solve degeneracy	2 marks	
ii.	As per solution and explanation	6 marks	**7**
	Name the model used	1 mark	
OR iii.	(a) NW Corner method	3 marks	**7**
	(b) Row Minima method	3 marks	
	State whether the solution is optimal or not	1 mark	

Q.5 i.	Any four differences	(1 mark * 4)	4 marks	**4**
ii.	Crashing		2 marks	**6**
	Uses		1 mark	
	Example		1 mark	
	Indirect and Direct		2 marks	
OR iii.	Derivation		4 marks	**6**
	Functions		2 marks	

Q.6	Attempt any two:		
i.	Definition	3 marks	**5**
	Example	1 mark	
	Usage	1 mark	
ii.	(a) Average queue length	1 mark	**5**
	(b) Average no. of cars in system	1 mark	
	(c) Waiting time in system	1 mark	
	(d) Waiting time in Queue	1 mark	
	(e) Percent utilization	1 mark	
iii.	Definition	3 marks	**5**
	Example	2 marks	