

Code: AE62/AC62/AT62

Subject: OPERATIONS RESEARCH &amp; ENGG. MANAGEMENT

AMIETE – ET/CS/IT

Time: 3 Hours

June 2018

Max. Marks: 100

**PLEASE WRITE YOUR ROLL NO. AT THE SPACE PROVIDED ON EACH PAGE IMMEDIATELY AFTER RECEIVING THE QUESTION PAPER.**

**NOTE: There are 9 Questions in all.**

- Question 1 is compulsory and carries 20 marks. Answer to Q.1 must be written in the space provided for it in the answer book supplied and nowhere else.
- The answer sheet for the Q.1 will be collected by the invigilator after 45 minutes of the commencement of the examination.
- Out of the remaining EIGHT Questions, answer any FIVE Questions. Selecting THREE questions from part A and TWO questions from part B.
- Any required data not explicitly given, may be suitably assumed and stated.

**Q.1 Choose the correct or the best alternative in the following: (2 x 10)**

- a. O.R. Society of India is founded in the year
 

(A) 1965	(B) 1970
(C) 1959	(D) 1972
  
- b. A Constraint in an LP model restricts
 

(A) Value of objective function	(B) Value of a decision variable
(C) Use of available resources	(D) All of these
  
- c. The number at the intersection of key row and key column is known as
 

(A) Column number	(B) Row number
(C) Key number	(D) Cross number
  
- d. If the primal has an unbounded solution, then the dual has
 

(A) Optimal solution	(B) No solution
(C) Bound solution	(D) None of the above
  
- e. The opportunity cost of a row in a transportation problem is obtained by:
 

(A) Deducting the smallest element in the row from all other elements of the row
(B) Adding the smallest element in the row to all other elements of the row
(C) Deducting the smallest element in the row from the next highest element of the row
(D) Deducting the smallest element in the row from the highest element in that row

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- f. The assignment matrix is always a  
 (A) Rectangular matrix (B) Square matrix  
 (C) Identity matrix (D) None of the above
- g. The games with saddle points are:  
 (A) Probabilistic in nature (B) Normative in nature  
 (C) Stochastic in nature (D) Deterministic in nature
- h. When engineer enters management. What is the most likely problem he finds difficult to acquire?  
 (A) Learning to trust other  
 (B) Learning how to work through others  
 (C) Learning how to take satisfaction in the work of others  
 (D) All of the above
- i. In project management O & M stands for:  
 (A) Operation and Manpower (B) Operation and Maintenance  
 (C) Operation and Management (D) Operation and Mission
- j. What describes how to determine the number of service units that minimize both customer's waiting time and cost of service?  
 (A) Queuing theory (B) Network model  
 (C) Sampling theory (D) Simulation

**PART A (Operations Research)**

**Answer any three questions. Each question carries 16 marks.**

- Q.2** a. Define Operations Research. What do you mean by scientific method in Operation Research? Describe in brief. (5)
- b. Use the graphical method to solve the following LPP: (5)
- $$\max z = 2x_1 + 3x_2$$
- s.t.  $x_1 + x_2 \leq 30, x_1 - x_2 \geq 0,$   
 $x_2 \geq 3, 0 \leq x_2 \leq 12, 0 \leq x_1 \leq 20,$   
 $x_1, x_2 \geq 0.$
- c. A company has two plants, each of which produces and supplies two products: A and B. The plants can each work up to 16 hours a day. In plant 1, it takes three hours to prepare and pack 1000 gallons of A and one hour to prepare and pack one quintal of B. In plant 2, it takes two hours to prepare and pack 1000 gallons of A and 1.5 hours to prepare and pack a quintal of B. In plant 1, it costs Rs. 15000 to prepare and pack 1000 gallons of A and 28000 to prepare and pack a quintal of B, whereas these costs are Rs. 18000 and Rs 28000, respectively in plant 2. The company is obliged to produce daily at least 10 thousand gallons of A and 8 quintal of B. Formulate this problem as an LP model to find out as to how the company should organize its production so that the required amounts of the products be obtained at minimum cost. (6)

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**Q.3** a. What do you mean by BFS to an LPP? By using simplex method find a BFS to the following LPP, which is also optimal (8)

$$\begin{aligned} \max z &= x_1 + x_2 + 3x_3 \\ \text{s.t. } 3x_1 + 2x_2 + x_3 &\leq 3, \\ 2x_1 + x_2 + 2x_3 &\leq 5, \\ x_1, x_2, x_3 &\geq 0. \end{aligned}$$

b. Let the LPP be

$$\begin{aligned} \text{Max } z &= -x_1 + 3x_2 \\ \text{s.t. } x_1 + 2x_2 &\geq 2, \quad 3x_1 + x_2 \leq 3, \quad x_1 \leq 4, \\ x_1, x_2 &\geq 0 \end{aligned}$$

with the optimal table is

	$c_j$		-1	3	0	0	0	0	$M$
$C_B$	$Y_B$	$X_B$	$Y_1$	$Y_2$	$Y_3$	$Y_4$	$Y_5$	$Y_6$	
3	$Y_2$	3	3	1	0	1	0	0	
0	$Y_3$	4	5	0	1	2	0	-1	
0	$Y_5$	4	1	0	0	0	1	0	
$z = 9$	$z_j - c_j$		10	0	0	3	0		$M$

Then find the effect of (i) when constraint first will be deleted (ii) when constraint second will be deleted. (8)

**Q.4** a. A manufacturer wants to ship 22 loads of his product as shown below. The matrix gives the kilometers from sources of supply to the destinations. (8)

		<b>Destination</b>					
		$D_1$	$D_2$	$D_3$	$D_4$	$D_5$	Supply
<b>Source</b>	$S_1$	5	8	6	6	3	8
	$S_2$	4	7	7	6	5	5
	$S_3$	8	4	6	6	4	9
	Demand	4	4	5	4	8	

Shipping cost is Rs. 10 per load per km. What shipping schedule should be used to minimize total transportation cost?

b. A department has five employees with five jobs to be performed. The time (in hours) each men will take to perform each job is given in the effectiveness matrix.

		<b>Employees</b>				
		I	II	III	IV	V
<b>Job</b>	A	10	5	13	15	16
	B	3	9	18	13	6
	C	10	7	2	2	2
	D	7	11	9	7	12
	E	7	9	10	4	12

How should the jobs be allocated one per employee, so as to minimize the total man-hours? (8)

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**Q.5** a. Write the procedures of forward pass method to calculate the earliest event time for critical path method. (5)

b. A project consists of eight activities with the following relevant information:

Activity	Predecessor	Estimated duration (days)		
		Optimistic	Most likely	Pessimistic
A	-	1	1	7
B	-	1	4	7
C	-	2	2	8
D	A	1	1	1
E	B	2	5	14
F	C	2	5	8
G	D, E	3	6	15
H	F, G	1	2	3

- I. Draw the PERT network and find out the expected project completion time.
- II. What duration will have 95% confidence for project completion? [Given that for standard normal variable  $Z$ ,  $P(0 \leq Z \leq 1.645) = 0.45$ ]. (11)

**Q.6** a. Solve the game whose payoff matrix is given below: (6)

		Player B			
		B <sub>1</sub>	B <sub>2</sub>	B <sub>3</sub>	B <sub>4</sub>
Player A	A <sub>1</sub>	3	2	4	0
	A <sub>2</sub>	3	4	2	4
	A <sub>3</sub>	4	2	4	0
	A <sub>4</sub>	0	4	0	8

b. What do you mean by single-server queuing model? Derive M/M/1: (N/FCFS) queuing model and also discuss its performance measure. (10)

**PART B (Engineering Management)**

**Answer any two questions. Each question carries 16 marks.**

**Q.7** a. Define Management. What are the objectives of management? (5)

b. What criteria would you suggest for evaluating the effectiveness of a management team? (5)

c. Explain the different management styles? (6)

**Q.8** a. Define leadership. Write the skills which are required for leadership. (8)

b. Explain the tools for decision making? (8)

**Q.9** a. Define scientific management. (6)

b. What do you mean by a committee? (5)

c. What are the functions of management? (5)