ROLL NO. _____

Code: AE62/AC62/AT62

Subject: OPERATIONS RESEARCH & ENGG. MANAGEMENT

AMIETE – ET/CS/IT (Current Scheme)

Time: 3 Hours **JUNE 2016** **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: (2×10)

a. Which of the following statement is not true?

(A) Operations Research is a scientific knowledge based approach for determining best possible utilization of the available resources

(B) Operations Research involves model building for representing an operation or a process with the purpose of improving its performance

(C) Operations Research is applied decision theory

(D) None of these

b. Given any basic feasible solution to a linear programming problem. If for this solution there is some column a_j not in the basis for which $z_j - c_j < 0$ and $y_{ij} \le 0$, i = 1,2,3…,m, then

(A) The given basic feasible solution is the optimal solution of the linear programming problem

(B) The constraints of the linear programming problem are inconsistent

(C) The given basic feasible solution is degenerate

(D) There exist feasible solutions in which m+1 variables can be different from zero, with the value of the objective function being arbitrarily large

c. A Radiology lab has one CT scan machine. Patients arrive at the centre according to Poisson process at the average of 10 per 8-hour day. The time spent on the performing CT scan of the patients is exponentially distributed with mean of 30 minutes. For what percentage of time, the machine is expected to be idle?

(A) 37.5% **(B)** 43%

(C) 28% **(D)** 19%

d. Which of the following is a valid objective function for a linear programming problem?

(A) Max 5xy **(B)** Max $5x^2 + 6y$

(C) Min (x + y)/z **(D)** Min 4x + 3y + (2/3)z

e. Which of the following method is used to obtain the initial basic feasible solution for a transportation problem?

(A) North West Corner Method **(B)** Least Cost Method

(C) Vogel's Approximation Method **(D)** All of these

f. In PERT, the optimistic time of an activity refers to

(A) Activity duration when execution goes extremely well.
(B) Activity duration when execution is done under normal conditions.
(C) Activity duration when execution goes extremely poorly.
(D) Expected duration.

g. In a Two-person zero sum game

(A) The value of game is always zero.
(B) Both the players gain.
(C) A gain by one player signifies an equal loss to the other.
(D) Both the players lose.

h. Which one is not a component of a Time Series?

(A) Trend **(B)** Seasonality
(C) Cyclic Variation **(D)** Cost Variation.

i. The father of 'scientific management' is

(A) F.W. Taylor **(B)** F.A. Gilbreth
(C) M.L. Cooke **(D)** H. Emerson

j. According to ----------, employees love work as play or rest.

(A) X theory **(B)** Y theory
(C) Z theory **(D)** None of these

PART A
Answer any THREE Questions. Each question carries 16 marks.

Q.2 a. Explain different phases in an O.R. study. Explain the role of computers in this field. **(6)**

b. A company makes two kinds of fertilizers, called Hi-phosphate and Lo-phosphate. Three basic raw materials are used in manufacturing these fertilizers in this manner: **(10)**

Raw Material	Tons of raw material required to manufacture one ton		Maximum amount of raw material available per month
	Hi-Phosphate	Lo-Phosphate	
1	2	1	1500
2	1	1	1200
3	1	0	500
Selling price per ton of fertilizer	Rs.15/-	Rs10/-	

How much of each fertilizer should the company manufacture to maximize its gross monthly sales revenue? Formulate this as a linear programming problem and solve it using Simplex method.

Q.3 a. Describe the various methods to find the initial basic feasible solution to a transportation problem. **(6)**

b. Use Vogel's approximation method to find the initial basic feasible solution of the following transportation problem: **(10)**

Warehouses	*A*	*B*	*C*	*D*	*E*	*F*	*Availability*
X	1	2	1	4	5	2	600
Y	3	3	2	1	4	3	500
Z	4	2	5	9	6	2	750
Re*quirements*	200	400	300	200	400	370	

Q.4 a. Write the dual of the following linear programming problem

Maximize : $Z = 4x_1 + 2x_2 - x_3$

Subject to $4x_1 + 7x_2 - x_3 \leq 7$

$2x_2 + 8x_3 \geq 7$

$x_1, x_2, x_3 \geq 0$ **(4)**

b. Give the economic interpretation of duality. **(4)**

c. Four jobs are to be processed and four machines are available. Any machine can process any job with the associated cost (in rupees) as follows:

Jobs

		A	***B***	***C***	***D***
	1	18	26	17	11
	2	13	28	14	26
Machines	3	38	19	18	15
	4	19	26	24	10

What is the minimum cost that may be expected if optimum assignments made? **(8)**

Q.5 a. Consider the following project:

Activity	**Time estimates in weeks**			**Predecessors**
	Optimistic	Most likely	Pessimistic	
A	3	6	9	None
B	2	5	8	None
C	2	4	6	A
D	2	3	10	B
E	1	3	11	B
F	4	6	8	C, D
G	1	5	15	E

(i) Draw the project network.
(ii) Find the expected duration and variance of each activity.
(iii) What is the expected project length and critical path of the network?

(3+4+3)

b. Differentiate between PERT and CPM. **(6)**

Q.6 a. Two firms are competing for business under the condition so that one firm's gain is another's loss. Firm A's payoff matrix is given below:

		Firm B		
		No ad	*Med ad*	*Heavy ad*
Firm A	*No ad*	2	4	5
	Med ad	1 0	7	9
	Heavy ad	4	6	8

Suggest optimum strategies for the two firms and the net outcome thereof. **(6)**

b. A departmental store has a single cashier. During the rush hours, customers arrive at the rate of 20 customers per hour. The average number of customers that can be processed by the cashier is 24 per hour. Assume that the arrivals and processing are Poisson. What is the **(10)**

(i) Probability that the cashier is idle?

(ii) Average no of customers in the system?

(iii) Average no of customers in the queue?

(iv) Average time a customer spends in the system?

PART B
Answer any TWO questions. Each question carries 16 marks.

Q.7 a. Explain the classic three-fold concept for management as proposed by Harbison and Myers. **(6)**

b. Classify organizations by the nature of authority. Explain one of them. **(6)**

c. What are different functions of Management? **(4)**

Q.8 a. How do forecasting and decision tree techniques help in planning and decision making in an organization? **(8)**

b. What is layout planning? Based on the firm's flow strategy, how many basic types of layout are possible? How do you design for a process layout? **(8)**

Q.9 a. Define leadership and motivation. Explain Herzberg's two-factor model of motivation. **(8)**

b. What is product development? Define product life cycle. **(4)**

c. Define marketing and marketing management. **(4)**