ROLL NO. _____

Code: AE113/AC113/AT113
Subject: OPERATIONS RESEARCH & ENGG. MANAGEMENT

AMIETE – ET/CS/IT (New Scheme)

Time: 3 Hours **December - 2017** **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. A constraint in an LP model restricts
(A) value of objective function **(B)** value of a decision variable
(C) use of the available resources **(D)** All of these

b. In the optimal simplex table, $c_j - z_j = 0$ value indicates
(A) unbounded solution **(B)** cycling
(C) alternative solution **(D)** infeasible solution

c. If dual of an LPP has an unbounded solution, then primal has
(A) no feasible solution **(B)** unbounded solution
(C) feasible solution **(D)** None of these

d. The solution to a transportation problem with m-rows and n-columns is feasible if number of positive allocations are
(A) $m+n$ **(B)** $m-n$
(C) $m+n-1$ **(D)** $m+n+1$

e. The objective of network analysis is to
(A) minimize total project duration
(B) minimize total project cost
(C) minimize production delays and interruption
(D) All of these

f. A calling population is considered to be infinite when
(A) all customers arrive at once
(B) arrivals are independent of each other
(C) arrivals are dependent upon each other
(D) All of these

g. The size of a pay-off matrix of a game can be reduced using the principle of
(A) game inversion **(B)** rotation reduction
(C) dominance **(D)** game transpose

h. Which one of the following is the primacy of fundamental functions of management?
(A) organizing **(B)** planning
(C) leading **(D)** controlling.

i. McGregor's Theory X places exclusive reliance upon
(A) external control of human behaviour
(B) self-direction
(C) self control
(D) None of these

j. The _____ is an association of two or more members to carry on as co-owners of a business for profit
(A) organization **(B)** cooperatives
(C) corporations **(D)** partnership

PART A

Answer any THREE Questions. Each question carries 16 marks.

Q.2 a. Explain different phases of operations research. **(9)**

b. An electric company produces two products X and Y. Products are produced and sold on weekly basis. The weekly production cannot exceed 25 for product X and 35 for product Y because of limited available facilities. The company employs total of 60 workers. Product X requires 2 man-weeks of labour, while X requires one man –week of labour. Profit margin on X is Rs. 60 and on Y it is Rs. 40. Formulate this as an LP problem and solve for maximum profit. **(7)**

Q.3 a. Use simplex method to solve: **(12)**

$$Max\, Z = 3x_1 + 5x_2 + 4x_3$$

$$Subject\ to: 2x_1 + 3x_2 \le 8$$

$$2x_2 + 5x_3 \le 10$$

$$3x_1 + 2x_2 + 4x_3 \le 15;\ x_1, x_2, x_3 \ge 0$$

b. Obtain the dual of the following LPP: **(4)**

$$Min\, Z = x_1 + 2x_2$$

$$Subject\ to: 2x_1 + 4x_2 \le 160,$$

$$x_1 - x_2 = 30$$

$$x_1 \ge 10;\ x_1, x_2 \ge 0$$

Q.4 a. Explain Vogel's approximation method to find the initial solution for the transportation problem. **(5)**

b. A marketing manager has five sales men and five sales districts. Considering the capabilities of the salesmen and nature of districts, the marketing manager estimates that the sales per month (in 100 rupees) for each salesman in each district would be as follows:

Salesmen	Districts A	B	C	D	E
1.	32	38	40	28	40
2.	40	24	28	21	36
3.	41	27	33	30	37
4.	22	38	41	36	36
5.	29	33	40	35	39

Find the assignment of salesmen to districts that will result in maximum sales. **(11)**

Q.5 The following table lists the jobs of a network along with their time estimates.

Job		Duration(days)		
i	j	Optimistic	Most likely	Pessimistic
1	2	3	6	15
1	6	2	5	14
2	3	6	12	30
2	4	2	5	8
3	5	5	11	17
4	5	3	6	15
6	7	3	9	27
5	8	1	4	7
7	8	4	19	28

(i) Draw the project network
(ii) Calculate the length and variance of the critical path
(iii) What is the approximate probability that the jobs on the critical path will be completed in (a) 41 days (b) 35 days
(iv) What is the probability that the project will not be completed within 45 days
(v) Find the due date which has 95% chance to meet **(16)**

Q.6 a. Solve the following game whose payoff matrix is given below: **(8)**

Player B

Player A						
	4	2	0	2	1	1
	4	3	1	3	2	2
	4	3	7	-5	1	2
	4	3	4	-1	2	2
	4	3	3	-2	2	2

b. A supermarket store employs one cashier at its counter. Nine customers arrive on an average every 5 minutes while the cashier can serve 10 customers in 5 minutes. Assuming Poisson distribution for arrival rate and exponential distribution for service time, find
(i) Average number of customers in the system.
(ii) The average queue length
(iii) Average time a customer spends in the system
(iv) Average time a customer waits before being served **(8)**

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

Q.7 a. Define management. What do you mean by engineering management? **(5)**

b. Explain the characteristics of Max Weber's model of "bureaucracy". **(6)**

c. Write a note on Maslow's theory. **(5)**

Q.8 a. What are the different areas to be established as a part of objectives of an organization according to Peter Drucker's point of view? **(8)**

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

Q.9 a. What are the functions of management? **(4)**

b. State and explain the characteristics of effective control system. **(6)**

c. What do you mean by a committee? Explain the reasons for using a committee. **(6)**