ROLL NO. _____

Code: AE62/AC62/AT62
Subject: OPERATIONS RESEARCH & ENGINEERING MANAGEMENT

AMIETE – ET/CS/IT (Current Scheme)

Time: 3 Hours **JUNE 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. Consider the following LPP: Maximize Z=5x+6y Subject to 4x+2y≤420, x+2y≤ 120, x, y≥ 0. Which of the following points (x, y) is feasible?
(A) (50, 40) **(B)** (30, 50)
(C) (80, 20) **(D)** All above points are feasible.

b. As for maximization in assignment problem, the objective is to maximize the _____
(A) Profit **(B)** Optimization
(C) Cost **(D)** None of these

c. Which of the following is not correct?
(A) Break-even models are the examples of stochastic models.
(B) OR replaces management by personality.
(C) OR is concerned with optimization.
(D) OR is a bunch of mathematical techniques.

d. For a two persons game with A and B, the minimizing and maximizing players, the optimum strategies are:
(A) Minimax for A and Maximin for B
(B) Maximax for A and Minimax for B
(C) Minimin for A and Maximin for B
(D) Maximin for A and Minimax for B.

e. For a "Poisson exponential, single server and infinite population" queuing model, which of the following statement is not correct:
(A) The system has a single service facility
(B) The arrivals occur in a Poisson fashion
(C) The service rate is according to exponential distribution
(D) The source population is a small sized finite population.

f. Which of the following is correct?
(A) CPM is event oriented
(B) CPM is deterministic is nature
(C) Events making the start of activities are called head events
(D) It is not possible for a network to have more than one critical path.

g. At any iteration of the simplex method, if there is at least one basis variable in the basis at zero level and all $(z_j - c_j) \geq 0$, the current solution is
(A) Infeasible **(B)** Unbounded
(C) Non-degenerative **(D)** Degenerative

h. If you are an engineer wanting to become a manager, what will you do?
(A) Develop new talents **(B)** Acquire new values
(C) Broaden your point of view **(D)** All of these

i. In which type of organization, the structure can lead to a "dual boss" phenomenon?
(A) Functional organization **(B)** Matrix organization
(C) Process organization **(D)** Product organization

j. A quantitative technique where samples of populations are statistically determined to be used for a number of processes, such as quality control and marketing research is:
(A) Sampling theory **(B)** Linear programming
(C) Statistical decision theory **(D)** Simulation

PART A

Answer any THREE questions. Each carries 16 marks.

Q.2 a. Explain briefly the applications of OR. **(6)**

b. Use the graphical method to solve the following LPP: **(5)**

$$\text{Max } z = 6x_1 + x_2$$
$$s.t. \quad 2x_1 + x_2 \geq 3$$
$$x_2 - x_1 \geq 0$$
$$x_1, x_2 \geq 0$$

c. A firm manufactures headache pills in two sizes A and B. Size A contains 2 grains of aspirin, 5 grains of bicarbonate and 1 gain of codeine. Size B contains 1 grain of aspirin, 8 grains of bicarbonate and 6 grains of codeine. It is found by users that it requires at least 12 grains of aspirin, 74 grains of bicarbonate and 24 grains of codeine for providing immediate effect. It is required to determine the least number of pills a patient should take to get immediate relief. Formulate the problem as an LPP. **(5)**

Q.3 a. Find the dual of the following primal problem: **(6)**

$$\text{Max } z = 2x_1 + x_2$$
$$s.t. \quad x_1 + 5x_2 \leq 10$$
$$x_1 + 3x_2 \geq 6$$
$$2x_1 + 2x_2 \leq 8$$
$$x_2 \geq 0 \text{ and } x_1 \text{ unrestricted.}$$

b. Use the duality to solve the following LPP: **(10)**

$$\text{Min } z = 15x_1 + 10x_2$$
$$s.t. \quad 3x_1 + 5x_2 \geq 5$$
$$5x_1 + 2x_2 \geq 3$$
$$x_1, x_2 \geq 0$$

Q.4 a. Find the starting solution in the following transportation problem by (i) Least-Cost Method and (ii) Vogel's Approximation Method. Also obtain the optimum solution by using the best starting solution: **(8)**

	D_1	D_2	D_3	D_4	Supply
S_1	3	7	6	4	5
S_2	2	4	3	2	2
S_3	4	3	8	5	3
Demand	3	3	2	2	

b. Write the procedures to solve the assignment problem. **(8)**

Q.5 a. Define: (i) Activity, (ii) Critical Path and (iii) Total float. **(6)**

b. A project consists of eight activities with the following relevant information: **(10)**

Activity	Predecessor activity	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?

Q.6 a. In a railway marshalling yard, goods trains arrive at a rate of 30 trains per day. Assuming that the inter-arrival time follows an exponential distribution and the service time distribution is also exponential with an average 36 minutes. Calculate the following: **(8)**
(i) the mean queue size (line length) and
(ii) the probability that the queue size exceeds 10.
If the input trains increases to an average 33 per day, what will be the change in (i) and (ii)?

b. For the game with the following payoff matrix, determine the optimum strategies and the value of the game: **(8)**

$$\begin{array}{c} \\ P_1 \end{array} \begin{array}{c} \begin{array}{cc} P_2 & \end{array} \\ \begin{pmatrix} 5 & 1 \\ 3 & 4 \end{pmatrix}. \end{array}$$

PART B

Answer any TWO questions. Each carries 16 marks.

Q.7 a. What are functions of management? Describe each one in brief. **(8)**

b. Draw and explain staff or functional authority organizational structure. **(8)**

Q.8 a. The demand for an item is observed for 15 months and are recorded below: **(8)**

Month	Demand	Month	Demand
1	280	9	309
2	288	10	315
3	266	11	320
4	295	12	332
5	302	13	310
6	310	14	308
7	303	15	320
8	328		

Calculate (i) 3-monthly and (ii) 4-monthly moving averages. What is the forecast for month 16 for each one?

b. What do you mean by strategy formulation? What are the steps of strategy formulation process? Describe each one in brief. **(8)**

Q.9 a. Define product management. What are the dimensions of a product? Describe in brief. **(8)**

b. What is leadership? How to improve leadership skills? **(8)**