ROLL NO. _____

Code: AE62/AC62/AT62 Subject: OPERATIONS RESEARCH & ENGG. MANAGEMENT

AMIETE – ET/CS/IT (Current Scheme)

Time: 3 Hours **DECEMBER 2015** **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 transportation problem is called balanced if:

(A) $\sum_i a_i = \sum_j b_j$ **(B)** $\sum_i a_i < \sum_j b_j$

(C) $\sum_i a_i > \sum_j b_j$ **(D)** $\sum_i a_i \neq \sum_j b_j$

b. Which of the following is not a queue structure?

(A) FIFO **(B)** LIFO

(C) SIRO **(D)** FIRO

c. McGregor's two theories for motivation are:

(A) Theory A and Theory B **(B)** Theory A and Theory X

(C) Theory X and Theory Y **(D)** Theory Y and Theory B

d. If t_m, t_p and t_o are most likely time, pessimistic time and optimistic time of an activity respectively, then the expected time t_e is calculated as:

(A) $\frac{t_p + 4t_m + t_0}{6}$ **(B)** $\frac{t_m + 4t_o + t_p}{6}$

(C) $\frac{t_p + 6t_o + t_m}{4}$ **(D)** $\frac{t_p + 6t_m + t_0}{4}$

e. CPM is

(A) Correct project management **(B)** Critical path method

(C) Critical project management **(D)** Correct path method

f. The number of basic feasible solutions of a LPP with n-variables and m-equations are:

(A) C (m, n) **(B)** C (n, m)

(C) C (m + n, m) **(D)** C (m + n, n)

g. Slack variable is added to

(A) A constraint of ≤ type **(B)** A constraint of ≥ type

(C) An equation **(D)** None of these

h. An assignment problem is said to be balanced if:
(A) Rows = Columns **(B)** Rows < Columns
(C) Rows > Columns **(D)** None of these

i. Time series analysis is used in:
(A) Game Theory **(B)** Motivation Theory
(C) Queuing Theory **(D)** Forecasting

j. Maslow's need hierarchy theory is related to
(A) Leadership **(B)** Organization
(C) Motivation **(D)** Decision Making

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

Q.2 a. State the different phases in an operations research study. **(6)**

b. Rolls of paper having a fixed length and width of 180 cm. are being manufactured by a paper mill. These rolls have to be cut to satisfy the following demand: **(10)**

Width:	80 cm.	45 cm.	27 cm.
No. of Rolls:	200	120	130

Obtain the linear programming formulation of the problem to determine the cutting pattern, so that the demand is satisfied and wastage of paper is a minimum.

Q.3 a. Give the standard form of a linear programming problem. **(4)**

b. Solve the following LPP using Simplex method: **(12)**

$$\text{Min } Z = x_1 - 3x_2 + 2x_3$$
$$\text{Subject to: } 3x_1 - x_2 + 2x_3 \leq 7$$
$$-2x_1 + 4x_2 \leq 12$$
$$-4x_1 + 3x_2 + 8x_3 \leq 10$$
$$x_1, x_2, x_3 \geq 0.$$

Q.4 Find the initial basic feasible solution for the following transportation problem using Vogel's approximation method. Further optimize the solution by MODI's method to minimize the total cost of transpiration. **(6+10)**

Origins / Destinations	D_1	D_2	D_3	D_4	D_5	D_6	Available
O_1	1	2	1	4	5	2	30
O_2	3	3	2	1	4	3	50
O_3	4	2	5	9	6	2	75
O_4	3	1	7	3	4	6	20
Requirements	20	40	30	10	50	25	

Q.5 a. Distinguish between total float and free float. **(4)**

b. A project consists of eight activities with the following time estimates: **(12)**

Activity	Time	Activity	Time
1 – 2	4	5 – 6	4
1 – 3	1	5 – 7	8
2 – 4	1	6 – 8	1
3 – 4	1	7 – 8	2
3 – 5	6	8 – 10	5
4 – 9	5	9 – 10	7

(i) Construct PERT network.
(ii) Compute T_E, T_L for each event.
(iii) Find the critical path.

Q.6 a. Define saddle point in a two-player zero-sum game. Find out the saddle point for the given pay-off matrix: **(6)**

$$A=\begin{bmatrix} 3 & 4 & 1 & -2 \\ 2 & 5 & 2 & 4 \\ -5 & 2 & 1 & 0 \end{bmatrix}$$

b. Customers arrive at one person barber shop according to Poisson process with a mean inter-arrival time of 20 minutes. Customers spend on an average of 15 minutes in the barber's chair. **(2×5)**
(i) What is the probability that a new arrival need not to wait for the barber to be free?
(ii) What is the expected number of customers in the barber shop?
(iii) How much time can a customer expect to wait for his turn?
(iv) How much time can a customer expect to append in the shop?
(v) Management will put in another chair and hire another barber when a customer's average time in the shop exceeds 1.25 hours. How much must the average rate of arrivals increase to warrant a second barber?

PART B

Answer any TWO Questions. Each question carries 16 marks.

Q.7 a. Define management. What are the managerial functions? **(8)**

b. Draw and explain line and staff organization. State its advantages and disadvantages also. **(8)**

Q.8 a. Define the various steps involved in the process of decision making. **(8)**

b. What is forecasting? Explain the time series technique for forecasting. **(8)**

Q.9 a. What are the different methods for marketing communications? **(8)**

b. Compare and contrast the Maslow and Herzberg theories of motivation. **(8)**