

1C8110

Roll No.

Total No. of Pages: **4****1C8110****M.C.A. I-Sem. (Main / Back) Exam., 2026**
MCA-101 Mathematical Foundations in Computer Science**Time: 3 Hours****Maximum Marks: 70**
Min. Passing Marks: 28*Instructions to Candidates:**Attempt all Ten questions from Part A. All five questions from Part B and three questions out of five questions from Part C.**Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.**Use of following supporting material is permitted during examination. (As mentioned in form No. 205)*1. NIL2. NIL**PART – A****[10×2=20]****(Word limit 25)**Q.1 If A is a 3×3 matrix of rank 2, and $B = A^T$, what is the rank of B?

Q.2 State the principle of inclusion and exclusion.

Q.3 A bag contains 4 red and 6 blue balls. Two balls are drawn at random. Find the probability that one is red and one is blue.

Q.4 Define conditional probability.

Q.5 Define Tautology with example.

- Q.6 What do you mean by functionally complete set of connectives?
- Q.7 Define absolute error and relative error.
- Q.8 What is a floating-point representation?
- Q.9 Write the adjacency matrix of a graph with edges $((A, B), (B, C), (C, A))$.
- Q.10 Draw graph which is Eulerian but not Hamiltonian.

[5×4=20]

PART - B

(Word limit 100)

- Q.1 Determine whether the relation $R = \{(1, 1), (2, 2), (1, 2)\}$ on set $\{1, 2\}$ is reflexive, symmetric, and transitive.
- Q.2 A manufacturing firm produces steel pipes in three plants with daily production volume of 500, 1000 and 2000 units respectively. According to past experience it is known that the fractions of defective output produced by the three plants are respectively 0.005, 0.008 and 0.010. If a pipe is selected from a day's total production and found to be defective. Find out what is the probability that it came from the first plant?
- Q.3 Construct a truth table for the following statements and check whether it is a tautology or contradiction:
- (i) $(p \wedge q) \vee (q \wedge r) \vee (r \wedge p) \Leftrightarrow (p \vee q) \wedge (q \vee r) \wedge (r \vee p)$
- (ii) $(p \wedge q) \rightarrow (p \vee q)$
- Q.4 Convert $(0.5625)_{10}$ to its corresponding binary fraction.
- Q.5 Draw the graph represented by the adjacency matrix $A = \begin{bmatrix} 0 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & 1 & 0 \end{bmatrix}$ and determine whether the graph is Eulerian.

PART - C

[3×10=30]

(Attempt any three questions)

Q.1 Solve the following system of linear equations:

$$27x + 6y - z = 85$$

$$6x + 15y + 2z = 72$$

$$x + y + 54z = 110$$

Q.2 Find mean, variance and standard deviation for the following data:

Class	0-20	20-40	40-60	60-80	80-100	100-120
Frequencies	2	5	8	6	3	2

Q.3 (a) Find the disjunctive normal form of $P \rightarrow ((P \rightarrow Q) \wedge \sim (\sim P \vee \sim P))$.

(b) Show that the following proposition is tautology:

$$(P \rightarrow Q) \leftrightarrow (\sim P \vee Q)$$

Q.4 (a) If the true value is 125.68 and the computed value is 124.92, find the percentage relative error.

(b) Perform the following floating-point multiplication (use 4 significant digits):

$$(2.315 \times 10^3) \times (4.201 \times 10^{-2})$$

Normalize and round the result to 4 significant digits.

Q.5 Write a short note on any two -

(i) Isomorphic graph

(ii) Multi graph and Planar graph

(iii) Spanning Trees

