Roll No. ....

Total No. of Questions : 09] [Total No. of Pages : 02

MCA (Sem.-1st)
COMPUTER MATHEMATICAL FOUNDATION
SUBJECT CODE :MCA - 104 (N2)

Paper ID : [B0104]

[Note : Please fill subject code and paper ID on OMR]

Time : 03 Hours Maximum Marks : 60

Instruction to Candidates:

1) Attempt any one question from each Sections **A, B, C & D**.
2) Section-E is **Compulsory**.
3) Use of non-programmable **Scientific Calculator** is allowed.

Section - A

(1 × 10 = 10)

Q1) Show that set of real numbers in [0, 1] is uncountable set.

Q2) Let R be a relation on A. Prove that

(a) If R is reflexive, so is R^{-1}.

(b) R is symmetric if and only if $R = R^{-1}$.

(c) R is antisymmetric if and only if $R \cap R^{-1} \subseteq I_A$.

Section - B

(1 × 10 = 10)

Q3) If x and y denote any pair of real numbers for which $0 < x < y$, prove by mathematical induction $0 < x^n < y^n$ for all natural numbers n.

Q4) (a) Obtain disjunctive normal forms for the following

(i) $p \wedge (p \Rightarrow q)$.

(ii) $p \Rightarrow (p \Rightarrow q) [\vee \sim (\sim q \vee \sim p)]$.

(b) Define biconditional statement and tautologies with example.

Section - C

(1 × 10 = 10)

Q5) Find the ranks of A, B and A + B, where

$$A = \begin{bmatrix} 1 & 1 & -1 \\ 2 & -3 & 4 \\ 3 & -2 & 3 \end{bmatrix} \text{ and } B = \begin{bmatrix} -1 & -2 & -1 \\ 6 & 12 & 6 \\ 5 & 10 & 5 \end{bmatrix}$$

Q6) Solve the following equations by Gauss-Jordan method. $2x - y + 3z = 9$, $x + y + z = 6, x - y + z = 2$.

Section - D

(1 × 10 = 10)

Q7) (a) Show that the degree of a vertex of a simple graph G on 'n' vertices can not exceed $n-1$.

(b) A simple graph with 'n' vertices and k components cannot have more than $\dfrac{(n-k)(n-k+1)}{2}$ edges.

Q8) Define breadth first search algorithm (BFS) and back tracking algorithm for shortest path with example.

Section - E

(10 × 2 = 20)

Q9) a) Draw the truth table for $\sim(p \vee q) \vee (\sim p \wedge \sim q)$.

b) Define principle of mathematical induction.

c) Prove that $A - B = A \cap B'$.

d) Using Venn diagram show that $A \Delta (B \Delta C) = (A \Delta B) \Delta C$.

e) If A and B are two $m \times n$ matrices and 0 is the null matrix of the type $m \times n$, show that $A + B = 0$ implies $A = -B$ and $B = -A$.

f) If A and B are two equivalent matrices, then show that rank A = rank B.

g) Prove that every invertible matrix posseses a unique inverse.

h) Draw the graphs of the chemical molecules of

i) Methane (CH_4).

ii) Propane (C_3H_8).

i) Draw the digraph G corresponding to adjacency matrix

$$A = \begin{bmatrix} 0 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 \\ 1 & 1 & 0 & 1 \\ 1 & 1 & 1 & 0 \end{bmatrix}$$

j) Give an example of a graph that has an Eulerian circuit and also Hamiltonian circuit.

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