Roll No. ....

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

MCA (Sem. - 1st)

COMPUTER MATHEMATICAL FOUNDATION

SUBJECT CODE : MCA - 104

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) (a) Let A and B be sets, then $(A \cap B) \cup (A \cap B^c) = A$.

(b) A town has population of 60,000. Out it 32,000 read 'The Hindustan Times' paper and 35,000 read 'Times of India' paper, while 7,500 both the newspapers. Indicate how many read neither The Hindustan Times not Times of India.

Q2) Prove that every equivalence relation on a set generates a unique partition of the set. The blocks of this partition correspond to the R-equivalence classes.

Section - B

(1 × 10 = 10)

Q3) (a) Prove by using induction that if $n \geq 1$, then $1.1! + 2.2! + ... + n.n! = (n+1)! - 1$.

(b) Prove $(p \wedge q) \rightarrow p \vee q$ is a tautology but $(p \vee q) \rightarrow (p \wedge q)$ is not.

Q4) (a) Let M(x) be "x is a mammal". Let A(x) be "x is an animal" and let W(x) be "x is warm blooded".

(i) Translate into formula : Every mammal is warm blooded.

(ii) Translate into English : $(\exists x)\ [A(x) \wedge \sim M(x)]$.

(b) Prove by construction of truth tables that

$\sim (p \rightarrow q) = \sim (\sim p \vee q) = p \wedge \sim q$.

Section - C

(1 × 10 = 10)

Q5) Solve the following system of equations by Gauss elimination method :

$x_1 + 2x_2 + 3x_3 + 4x_4 = 10$
$7x_1 + 10x_2 + 5x_3 + 2x_4 = 40$
$13x_1 + 6x_2 + 2x_3 - 3x_4 = 34$
$11x_1 + 14x_2 + 8x_3 - x_4 = 64$

Q6) (a) Find the inverse of the matrix $A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 3 & 2 \\ 3 & 3 & 4 \end{bmatrix}$. Also determine its rank.

(b) Prove that inverse of non-singular symmetric matrix is symmetric.

Section - D

(1 × 10 = 10)

Q7) (a) Define Euler graph. Prove that a connected graph G is an Euler graph if and only if all the vertices of G are of even degree.

(b) Define a bipartite graph. Prove that a graph is bipartite if and only if it contains no circuit of odd lengths.

Q8) (a) Define planar graph. Prove that the graph k_5 is not planar.

(b) Describe an algorithm for finding shortest path.

Section - E

(10 × 2 = 20)

Q9)

a) What do you mean by equivalent sets?
b) State De-Morgan's law.
c) Define complement of a set.
d) What is meant by domain and range of a relation?
e) Let X={1,2}, R={(1,1), (2,1), (2,2)}, S = {(1,2), (2,1), (2,2)}. Verify that $(SoR)^{-1} = R^{-1}oS^{-1}$.
f) Construct a truth table for $p \wedge \sim p$.
g) Use universal quantifiers to state that the sum of two rational numbers is rational.
h) What do you understand by the term rank of a matrix?
i) Does the inverse of a square matrix always exist? If yes, prove the statement and if not state the condition under which the inverse of square matrix exists.
j) What is a simple graph? Give an example.

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