Roll No. ....

Total No. of Questions : 13]   [Total No. of Pages : 03

J-3298[S-1154]   **[2037]**

MCA (Semester - 1st)

COMPUTER MATHEMATICAL FOUNDATION (MCA - 104)

Time : 03 Hours   **Maximum Marks : 75**

Instruction to Candidates:

    1)   Section-A is **compulsory**.

    2)   Attempt any **Nine** questions from Section-B.

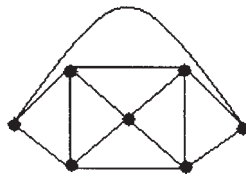### Section - A

Q1)   *(15 × 2 = 30)*

a) Let $D_i = \left[0, \frac{1}{i}\right] = \left\{x \in R \mid 0 \leq x \leq \frac{1}{i}; i \in N\right\}$ where R is the set of real numbers

    and N is the set of natural numbers, find $\overset{\infty}{\underset{n=1}{\cup}} D_n$ and $\overset{\infty}{\underset{n=1}{\cap}} D_n$.

b) State De-Morgan's laws.

c) Let A = {a, b, c}, find all the partitions of A.

d) Express the set of points of the rectangle and its interior in $R \times R$ (R is the set of real numbers) with corners at (0, 1), (0, 4), (3, 1) & (3, 4) as a Cartesian product.

e) Define an equivalence relation and give an example of equivalence relation on A = {1, 2, 3, 4}.

f) Let A and B are matrices s.t. $3A - 2B = \begin{bmatrix} 2 & 1 \\ -2 & -1 \end{bmatrix}$ and

    $-4A + B = \begin{pmatrix} -1 & 2 \\ -4 & 3 \end{pmatrix}$, find A and B.

g) Let $A = \begin{bmatrix} 1 & 2 & 4 \\ -2 & 5 & 3 \\ -1 & 6 & 3 \end{bmatrix}$. Write A as the sum of a symmetric & a skew symmetric matrix.

h) Define rank of a matrix.

i) Examine whether the equations

2x + 6y = –11, 6x + 20y – 6z = –3, 6y – 18z = –1 are consistent?

j) Let $A = \begin{bmatrix} 3 & -3 & 4 \\ 2 & -3 & 4 \\ 0 & -1 & 1 \end{bmatrix}$, find A^{-1}.

k) Show by using truth table that $(p \to r) \wedge (q \to r) \Leftrightarrow (p \vee q) \to r$.

l) Explain the principle of mathematical Induction.

m) What are the types of quantifier? Give an example of each.

n) Define chromatic number and find chromatic of the graph.

o) Define Hamiltonian graph and give an example.

Section - B

(9 × 5 = 45)

Q2) For integers *a* & *b*, define *aRb* if 2a + 3b = 5n for some integer *n*. Show that *R* defines an equivalence relation on *Z*. Also find the equivalence class of 0.

Q3) Define the relation *P* & *Q* on {1, 2, 3, 4} by P = {(a, b):|a – b|=1} and Q = {(a, b): a – b is even}. Represent P and Q as graphs. Determine $P \circ Q, P^2, Q^2$ and represent them clearly as graphs.

Q4) Two finite sets have *x* and *y* number of elements. The total number of subsets of the first set is four times the total no. of subsets of the second set. Find the value of *x – y*.

Q5) Define the following terms :
(a) Partition of a set.
(b) Complement of a set.
(c) Symmetric relation.
(d) Transitive relation.
(e) Partial order relation.

Q6) If $A = \begin{bmatrix} 1 & 1 & 3 \\ 1 & 3 & -3 \\ -2 & -4 & -4 \end{bmatrix}$ show that $A^2 - 20A + 8I = 0$; where I, 0 are unit

matrix and null matrix of order 3. Using the result find A^{-1}.

Q7) Find the value of *k* such that the system of equations

$x + ky + 3z = 0$

$4x + 3y + kz = 0$

$2x + y + 2z = 0$

has non trivial solutions.

Q8) Using Gauss Elimination method determine for what value of λ & μ the following equations have (i) no solution. (ii) a unique solution. (iii) infinite no. of solution.

$x + y + z = 6$

$x + 2y + 3z = 10$

$x + 2y + \lambda z = \mu$

Q9) Using Matrix inversion method solve

$$\begin{bmatrix} 1 & 2 & 3 \\ 3 & -1 & 1 \\ 4 & 2 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$$

Q10) Use Mathematical Induction to prove that

$1 + 2 + 2^2 + \ldots\ldots\ldots + 2^n = 2^{n+1} - 1$ for all non negative integer n.

Q11) Determine whether or not the following argument is valid.

If I like biology, then I will study it.

Either I study biology or I fail the course.

If I fail the course, then I do not like biology.

Q12) Define a bipartite graph, complete bipartite graph, complete graph, Eulerian graph, directed graph with an example for each.

Q13) Discuss any shortest path algorithm with a simple example.

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