Program: B.ScComp05   **Semester: I**   **SET: C**
Program (Specific): B.Sc.Comp. Science   **Course Type: Core**
Class: F.Y. B. Sc (Comp. Sci.)
Max. Marks: 35   **Name of the Course: Discrete Mathematics**
Course Code:22-MTC-112   **Time: 2Hr**
Paper: II

Instructions to the candidate:

1) *There are 4 sections in the question paper. Write each section on separate page.*
2) *All Sections are compulsory.*
3) *Figures to the right indicate full marks.*
4) *Draw a well labelled diagram wherever necessary.*

SECTION: A

Q1) Choose the correct option.   **(5 Marks)**
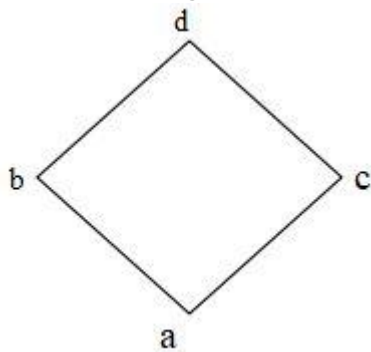
    i)   The inverse of the statement $p \rightarrow q$ is
    a) $q \rightarrow p$
    b) $\neg p \rightarrow \neg q$
    c) $\neg q \rightarrow \neg p$
    d) $p \rightarrow \neg q$

    ii)   Let P(x): x < 3 then the truth values of P(-1) and P(6) respectively are

    a) T, F
    b) F,T

c) T, T
d) F, F

iii)   In the poset $(D_{10}, |)$ the g.l.b. of $(2, 5)$ is
      a) 2
      b) 5
      c) 1
      d) 10

iv)   The Hasse diagram is the representation of which of the .
      following Lattices

a) D_4
b) D_{12}
c) D_5
d) D_6

v) There are 8 men and 7 women. In how many ways a committee of 4
    men and 3 women can be formed?

a) $8_{C_3} + 7_{C_4}$

b) $8_{C_3} \cdot 7_{C_4}$

c) $8_{C_4} \cdot 7_{C_3}$

d) $8_{C_4} + 7_{C_3}$

Q2) Attempt any 4 out of 6.   **(4 Marks)**

    i) Define an antisymmetric relation.

    ii)   Write the negation of the following statement.

       $\forall x \, (x^2 > x)$.

    iii) Draw the Hasse diagram of D_{18} = { 1,2,3,6,9,18 } with the relation
       R defined as xRy iff x divides y, $\forall$ x, y $\in D_{18}$

    iv) Find the characteristic equation corresponding to the recurrence
       relation

       $a_r + 6a_{r-1} + 9a_{r-2} = 0$

    v) How many 4 letter words can be formed using a,e,i,o and u
       without repetition?

    vi) If A and B are two subsets of a finite set U with $|A| = 30$,
       $|B| = 40 \; and \; |A \cap B| = 20,$ then find $|A \cup B|$.

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SECTION: B

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Q3) Attempt any 4 out 6   **(8 Marks)**

i) Check whether the propositions $\neg q \rightarrow \neg p$ and $(p \rightarrow q)$ are logically
equivalent.

ii) Use logical connectives and propositions p and q given below, to
    convert the following statements into symbolic form .

   p: It is below freezing..

   q: It is snowing.

      a)   It is below freezing and snowing.
      b)   If it is below freezing then it is snowing.

 iii) Identify the relation set R and draw the digraph from the matrix of
    relation R given below

$$M(R) = \begin{pmatrix} 0 & 0 & 1 & 0 \\ 1 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 \end{pmatrix} \text{ on the set A =\{1,2,3,4\}.}$$

iv) Show that the set S = {1,3,5,15} with the relation R is a lattice, where R is defined as xRy iff x divides y .

v) How many positive integers less than 1000 are divisible by 2 and 7 ?

vi) Solve the recurrence relation

$$a_r - 6a_{r-1} + 9a_{r-2} = 0$$

SECTION: C

Q4) Attempt any 4 out of 6.   **(8 Marks)**

i) Translate the following statement into logical expression using predicates, quantifiers and connectives, where the universe of Discourse is the set of integers.
" For each value of x , there is a value of y such that x + y = 12 ".

ii) Using pigeon hole principle show that if 5 integers are selected from the first 8 positive integers, then there must be a pair of these integers with sum equal to 9.

iii) Discuss whether the following relation defined on the set A= {a , b , c } is reflexive and symmetric, where R = { (a, a) , (b , b) , (c , c) , (a , b) }.

iv) Define a distributive lattice and give an example.

v) How many name plates can be made using 3 letters followed by 3 digits?

vi) Given 7 different Hindi books, 9 different Marathi books and 5 different English books, how many ways are there to select one book of each language?

SECTION: D

Q5) Attempt any 2 out of 4. (10 Marks)

i) Find the Disjunctive Normal Form of the Boolean function
$f(x,y,z) = (x \wedge \overline{(y \vee z)}) \vee (z \wedge y)$.

ii) Test the validity of the following argument by direct method.

$\neg p \wedge q, r \rightarrow p, \neg r \rightarrow s, s \rightarrow t \vdash t$

iii) Find the particular solution of the recurrence relation
$a_r - 5a_{r-1} = 2^r$,with $a_1 = 20$.

iv) Using Warshall's algorithm , obtain transitive closure of the relation
R= {(1 , 1) , (1 , 2), (2 , 3) , (3 , 1) , (3 , 2)} defined on the set
A= {1, 2, 3}.