Total No. of Questions : 5]

SEAT No. :

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F.Y. B.Sc. (Computer Science)

MATHEMATICS

MT - C 112 : Discrete Mathematics

(2019 Pattern) (Semester - I) (Paper - II)

Time : 2 Hours] *[Max. Marks : 35*

Instructions to the candidates:

1) *Q.1 is compulsory.*
2) *Solve any three questions from Q.2 to Q.5.*
3) *Figures to the right indicate full marks.*
4) *Neat diagrams must be drawn whenever necessary.*
5) *Use of single memory, non-programmable scientific calculator is allowed.*

Q1) Attempt any five of the following : **[5]**

a) Let p and q be the propositions having truth values 'True' and 'False' respectively. Find the truth value of the compound statement

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

b) Is D_{18} with the 'divides' relation a Boolean algebra? Justify.

c) Give an example of a relation on the set A = {1, 2, 3} which is reflexive and symmetric but not transitive.

d) Show that in a group of 13 people, there must be at least two having birthday in the same month.

e) Find the number of three digit numbers divisible by 5 which can be formed by using the digits 1, 2, 3, 4 and 5, if repetition of digits is allowed.

f) Find a_4, if the sequence $\{a_n\}$ is defined by the recurrence relation

$a_n = a_{n-1} + a_{n-2} \quad ; \quad a_0 = 1, a_1 = 1$

Q2) a) Find the number of integers from 1 to 500 (both inclusive) which are **[6]**

i) divisible by 2 or 3 or 5.

ii) neither divisible by 2 nor by 3, nor by 5.

OR

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Draw Hasse diagram for D_{45} with the partial order relation 'divides'.
Find glb (3, 15) and lub (9, 5).
Is it a complemented lattice? Justify. **[6]**

b) Test the validity of the following argument. **[4]**

$(p \to r) \to \sim s,\ q \to r,\ p \to q,\ s \vee t \vdash t$

Q3) a) Find conjunctive normal form of the function **[6]**

$f(x, y, z) = \overline{x} \vee (y \wedge (\overline{z} \vee x))$.

OR

Solve the following recurrence relation. **[6]**

$a_r - 7a_{r-1} + 10a_{r-2} = 3^r$, $a_0 = 0, a_1 = 1$.

b) Let $Q(x, y)$ be the statement "x has sent email message to y", where the universe of discourse for both x and y consists of all students in your class. Express each of the following quantification in English. **[4]**

i) $\exists x \exists y\ Q(x, y)$

ii) $\exists x \forall y\ Q(x, y)$

iii) $\forall x \exists y\ Q(x, y)$

iv) $\exists y\ \forall x\ Q(x, y)$

Q4) a) Using Warshall's algorithm, obtain transitive closure of the relation **[6]**
R = {(1, 2), (2, 2), (2, 4), (3, 2), (3, 4), (4, 1)}
on the set A = {1, 2, 3, 4}.

OR

Prove that if there are n_1 indistinguishable objects of type 1, n_2 indistinguishable objects of type 2, ----- n_k indistinguishable objects of type k, where $n_1 + n_2 + \text{---} + n_k = n$, then the number of permutations of these n objects is $\dfrac{n!}{n_1!n_2!....n_k!}$. **[6]**

Hence find number of arrangements of the letters in the word 'MATHEMATICA'

b) Let R be the relation on the set {1, 2, 3, 4} defined by
'x R y if and only if $|x - y| = 1$'. Draw the digraph of R. Also write matrix of R. **[4]**

Q5) Attempt any two of the following :

a) Let $[B, \bar{}, \vee, \wedge]$ be a Boolean algebra. For elements $a, b \in B$, Prove that $\overline{a \wedge b} = \bar{a} \vee \bar{b}$. **[5]**

b) Solve : $a_r - a_{r-1} - 12\, a_{r-2} = 0, \quad a_0 = 0, a_1 = 1.$ **[5]**

c) Show that if any 11 numbers are chosen from the set {1, 2, ..., 20}, then one of them will be a multiple of the other. **[5]**

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