Roll No. : ....

Total No. of Questions : **16**]   [Total No. of Printed Pages : **3**

SEM–1003

M.Sc. (IVth Semester) (Due of Ist Semester) Examination, 2021

COMPUTER SCIENCE

Paper – MCS–101

(Mathematics for Computer Science)

Time : 1½ Hours]   [*Maximum Marks : 40*

Note :– Answer all subparts of a question together.

Section–A **(Marks : 1 × 10 = 10)**

Note :– Answer all *ten* questions (Answer limit **50** words). Each question carries **1** mark.

Section–B **(Marks : 3 × 5 = 15)**

Note :– Answer any *five* questions by selecting at least *one* question from each Unit. Each question carries **3** marks. Answer should not exceed **200** words.

Section–C **(Marks : 5 × 3 = 15)**

Note :– Answer any *three* questions by selecting at least *one* question from each Unit. Each question carries **5** marks. Answer should not exceed **500** words.

Section–A

1. (i) Find the value of $(10 - 6)!$.

   (ii) How many terms will be there in the expansion of $(x - y)^{15}$?

   (iii) Write one major difference between existential and universal quantifiers.

   (iv) Give an example of compound statement that is tautology.

   (v) Define greatest lower bound of a poset.

(vi) Find the slope of line :

$$2x + 3y + 5 = 0$$

(vii) Find the scalar product of the following vectors :

$$\vec{a} = \hat{i} + \hat{j} + \hat{k}$$

$$\vec{b} = \hat{i} - 2\hat{j} - \hat{k}$$

(viii) Give examples of two propositions that are logically equivalent.

(ix) What do you mean by Big O notation ?

(x) Find the product of the following matrices :

$$A = [1 \ 2 \ 3]; B = \begin{bmatrix} 0 \\ 2 \\ 1 \end{bmatrix}$$

Section–B

Unit–I

2. Find the number of 4-lettered permutations of letters of the word 'EXAMINATION'.

3. How many students should be there in a class to ensure that at least two students should have born on same day (week day) ?

4. Using binomial theorem, expand $(x - y^3)^4$.

Unit–II

5. Compute the truth table of statement :

$$(p \Rightarrow q) \Leftrightarrow (\sim q \Rightarrow \sim p)$$

6. Explain both types of quantifiers with examples.

7. Prove the following using mathematical induction :

$$1 + 2^n < 3^n \quad \text{for } n \geq 2$$

Unit–III

8. Let A = $\mathbb{Z}$, the set of integers and let R be defined by aRb if and only if $a \leq b$. Is R an equivalence relation ?

9. Let $s = \{a, b, c\}$ and A = P(s). Here P represents power set. Draw the Hasse diagram of the poset A with the partial order $\subseteq$ (set inclusion).

10. Find the equation of straight line passing through points (2, 3) (–5, 6).

Section–C

Unit–I

11. (a) Let n be a non-negative integer. Then prove the following :

$$\sum_{k=0}^{n} 2^k \binom{n}{k} = 3^n$$

(b) There are 6 different candidates for President of a party. In how many different orders can the names of the candidates be printed on a ballot ?

12. (a) Find the dot and cross product of the following vectors :

$$\vec{a} = 2\hat{i} - \hat{j} - \hat{k}$$
$$\vec{b} = \hat{j} + \hat{k}$$

(b) A professor writes 40 discrete maths true/false questions. Of the statements in these questions, 17 are true. If the questions can be positioned in any order, how many different answer keys are possible ?

Unit–II

13. Use mathematical induction to prove that $n^3 - n$ is divisible by 3 whenever n is a positive integer.

14. Show that following are logically equivalent :

$$\neg \forall x \left(p(x) \rightarrow Q(x)\right)$$

and

$$\exists x \left(p(x) \wedge \neg Q(x)\right).$$

Unit–III

15. (a) Draw the Hasse diagram representing the partial ordering $\{(a, b) \mid a \text{ divides } b\}$ on $\{1, 2, 3, 4, 6, 8, 12\}$.

(b) Which elements of the poset ({2, 4, 5, 10, 12, 20, 25}, 1) are maximal and which are minimal ?

16. (a) Find the equation of circle having center (2, 5) and radius 3.

(b) Find the slope of line passing through points (0, 1) and (–1, 5).