Roll No. : .....

Total No. of Questions : **16**] [Total No. of Printed Pages : **4**

COMPSEM–122

M.Sc. (Ist Semester) Examination, Dec., 2022

COMPUTER SCIENCE

Paper – MSC–CS–CC–101

(Mathematics for Computer Science)

*Time : **3** Hours*] [*Maximum Marks : **40***

The question paper contains three Sections.

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 (Answer limit **200** words). Each question carries **3** marks.

Section–C **(Marks : 5 × 3 = 15)**

Note :– Answer any *three* questions by selecting *one* question from each Unit (Answer limit **500** words). Each question carries **5** marks.

Section–A

1. (i) Write the sum of the following matrices :

$$\begin{bmatrix} 2 & -1 & 0 \\ 0 & -2 & 1 \\ 3 & -3 & 2 \end{bmatrix} \quad \begin{bmatrix} 3 & 1 & -5 \\ 0 & 0 & -6 \\ 0 & 2 & -2 \end{bmatrix}$$

A B

(ii) State Pigeonhole principle.

(iii) Find the expansion of the following expression :

$$(a - b)^3$$

(iv) What do you mean by the following expression :

$$\forall\ x\ \mathrm{P}(x)$$

(v) What do you mean by Turing Machine ?

(vi) Write the truth table for the following :

$$(\mathrm{A} \wedge \mathrm{B}) \vee \mathrm{A}$$

(vii) What is the meaning of $\theta(n^3)$?

(viii) What is the slope of the following straight line $3x + 2y + 5 = 0$?

(ix) What do you mean by Transitive Closure ?

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

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

$$\vec{b} = 2\hat{j} - 3\hat{k}$$

Section–B

Unit–I

2. Find the vector product of the following vectors :

$$\vec{a} = 2\hat{i} + 3\hat{j} + \hat{k}$$

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

3. How many attempts will be required (maximum) to find out the Pin of a person's ATM card if Pin is supported to have four decimal digits and digits may be repeated ?

4. Write the expansion of the following expression :

$$(2x - 3y)^6$$

Unit–II

5. Prove the following using Mathematical induction :

$$1 + 2 + 2^2 + \ldots\ldots\ldots 2^n = 2^{n+1} - 1$$

for all non-negative integers n.

6. Explain the concept of existential quantifier with suitable example.

7. Explain the concept of finite automaton, a simple model of computation.

Unit–III

8. Prove that relation R is an equivalence type in the set P = {3, 4, 5, 6} given by the relation R = {(P, Q) : | P – Q| is even}.

9. Draw the Hasse diagram for divisibility relation on set {1, 2, 5, 10}.

10. Find the equation of straight lines passing through the points (2, 3) and (0, –5).

Section–C

Unit–I

11. Prove the following :

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

where n is a non-negative integer.

12. How many functions are there from a set with m elements to a set with n elements ?

Unit–II

13. Explain the concept of Turing machine as a model of computation. Compare it with linear bounded automaton.

14. Explain the four types of grammars as per Chomsky hierarchy.

Unit–III

15. Explain the asymptotic notations used to describe time complexity.

16. Find the radius and centre of the following circle :

$$3x^2 + 3y^2 - 8x - 10y + 3 = 0$$