QP CODE: 21102496

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Reg No : ....

Name : ....

B.Sc DEGREE (CBCS) EXAMINATION, OCTOBER 2021

First Semester

Core Course - MM1CRT01 - FOUNDATION OF MATHEMATICS

(Common to B.Sc Computer Applications Model III Triple Main, B.Sc Mathematics Model I, B.Sc Mathematics Model II Computer Science)

2017 Admission Onwards

D12DD6B1

Time: 3 Hours

Max. Marks : 80

Part A

*Answer any **ten** questions.*

*Each question carries **2** marks.*

1. Prove any one of the De Morgan's Laws of logical equivalence.
2. Define Existential quantifier.
3. Give a direct proof to show that the sum of two odd integers is even.
4. Express the difference of the sets A and B and the complement of A using Venn diagrams
5. Suppose $A_i = \{1, 2, , 3, \ldots, i\}$ for $i = 1, 2, 3, \ldots$. Find $\cup_{i=1}^{\infty} A_i$
6. Differentiate between bijection and surjection
7. List the ordered pairs in the relation R from $\{0, 1, 2, 3, 4\}$ to $\{0, 1, 2, 3\}$ where $(a, b) \in R\, if\, and\, only\, if\, a + b = 4.$
8. Draw the diagraph that represent the relation $\{(1, 1), (1, 4), (2, 2), (3, 3), (4, 1)\}\, on\, the\, set\, \{1, 2, 3, 4\}.$
9. Show that the "divides" relation on the set of all positive integers is not an equivalence relation.
10. Form a rational quartic whose roots are $1, -1, 2 + \sqrt{3}$.
11. If α, β, γ are the roots of the equation $27x^3 + 42x^2 - 28x - 8 = 0$, find the values of $\alpha + \beta + \gamma$ and $\alpha\beta\gamma$.
12. Find atleast one root of the equation $2x^5 + x^4 + x + 2 = 12x^2(x + 1)$?

(10×2=20)

Part B

*Answer any **six** questions.*

*Each question carries **5** marks.*

13. Check whether $p \vee \neg(p \wedge q)$ a tautology.

14. Use rules of inference to show that the hypotheses 'It is not sunny this afternoon and it is colder than yesterday', ' we will go swimming only if it is sunny', ' If we do not go to swimming, then we will take a canoe trip' and ' If we take a canoe trip, then we will be home by sunset' lead to the conclusion 'We will be home by sunset'.

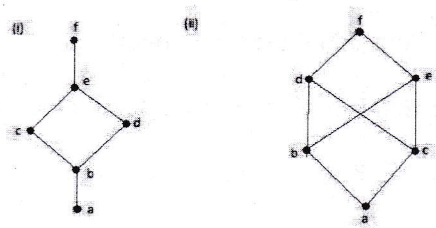
15. Define the following with an example:
    (i) Universal instantiation.
    (ii) Universal generalization
    (iii) Existential instantiation

16. Prove that $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$

17. Show that the function f defined from R to R by $f(x) = ax + b$ with a, b constants, is an invertible function where $a \neq 0$. Also find the inverse of f

18. What are the sets in the partition of the integers arising from congruence modulo 4.

19. Determine whether the posets with these Hasse Diagrams are lattices.



20. If α, β, γ be the roots of the equation$x^3 + qx + r = 0$,form the equation whose roots are $\beta + \gamma - 2\alpha, \gamma + \alpha - 2\beta, \alpha + \beta - 2\gamma$.

21. Solve the equation $6x^4 - 13x^3 - 35x^2 - x + 3 = 0$, given that one of its roots is $2 - \sqrt{3}$?

(6×5=30)

Part C

*Answer any **two** questions.*

*Each question carries **15** marks.*

22. (a) State and prove De-Morgan's laws for quantifiers.
    (b) Show that $\neg\forall x[P(x) \rightarrow Q(x)] \equiv \exists x[P(x) \wedge \neg Q(x)]$.
    (c) What do you mean by negation of quantified expressions?
    (d) Translate the following sentences into logical expressions.

(i) You will get an A in the class if and only if you either do every exercise in this book or you get an A on the final.

(ii) You cannot ride the roller coaster if you are under 4 feet tall and unless you are more than 16 years old.

23. a) Evaluate $f + g, fg, f \circ g, g \circ f$ for the functions f and g defined from R to R by $f(x) = x^2 + 1$ and $g(x) = x + 2$

b) Given the poset $(\{2, 4, 6, 9, 12, 18, 27, 36, 48, 60, 72\}, /)$.Find the maximal element, minimal element ,greatest element and least element if any. Also compute the upperbounds and least upperbound of $\{2, 9\}$ and lower bounds and greatest lowerbound of $\{60, 72\}$.

24. Let R and S be relations on a set A represented by the matrices

$$M_R = \begin{bmatrix} 0 & 1 & 0 \\ 1 & 1 & 1 \\ 1 & 0 & 0 \end{bmatrix} \ and\ M_S = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$$ .Find the matrices that represents

$(a)\ R \cup S\ (b)\ R \cap S\ (c)\ S \circ R\ (d)\ R \circ R\ (e)\ R \oplus S$

25. a) Solve $x^4 + 3x^3 + x^2 - 2 = 0?$

b) Determine the nature of the roots of the equation $x^4 + 3x^2 + 2x - 7 = 0?$

(2×15=30)