



23146054

QP CODE: 23146054

Reg No : .....

Name : .....

**B.Sc DEGREE (CBCS) REGULAR / IMPROVEMENT / REAPPEARANCE  
EXAMINATIONS, DECEMBER 2023**

**First Semester**

**Core Course - MM1CRT01 - FOUNDATION OF MATHEMATICS**

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

2017 Admission Onwards

88514B45

Time: 3 Hours

Max. Marks : 80

**Part A**

*Answer any **ten** questions.*

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

1. Give an example for Universal quantifier.
2. Define Modus tollens for propositional logic.
3. Define Universal generalization.
4. Describe what is the Cartesian product of  $A_1, A_2, \dots, A_n$ .
5. Can we define the sum and product of any two functions. Define the sum and product of two functions wherever possible.
6. Given  $f : A \rightarrow B$ . Illustrate  $f^{-1}$  using a figure
7. Draw the diagraph that represent the relation  $\{(1, 1), (1, 2), (1, 3), (2, 2), (2, 3), (3, 3)\}$  on  $\{1, 2, 3\}$
8. Show that the "divides" relation on the set of all positive integers is not an equivalence relation.
9. Let R be an equivalence relation on a set A. Then prove that if  $[a] = [b]$  then  $[a] \cap [b] \neq \phi$ .
10. Frame a quartic equation with rational coefficients one of whose roots is  $\sqrt{5} + \sqrt{2}$ .





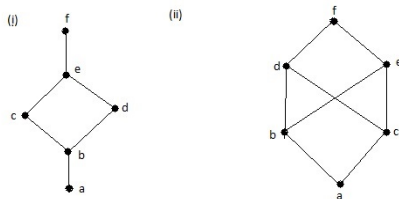
11. If  $\alpha, \beta, \gamma, \delta$  are the roots of the equation  $4x^4 - 4x^3 - 25x^2 + x + 6 = 0$ , find the values of  $\alpha + \beta + \gamma + \delta$  and  $\alpha\beta\gamma\delta$ .
12. Find the limits to the values of  $c$  such that  $x^3 - 3x + c = 0$  may have all its roots real.  
(10×2=20)

### Part B

Answer any **six** questions.

Each question carries **5** marks.

13. Show that  $\neg(p \oplus q)$  and  $p \leftrightarrow q$  are equivalent.
14. Show that  $\neg\forall x[P(x) \rightarrow Q(x)] \equiv \exists x[P(x) \wedge \neg Q(x)]$ .
15. Show that if ' $n$ ' is an integer and  $n^3 + 5$  is odd, then ' $n$ ' is even by using the method of contradiction.
16. Using De Morgan's law deduce that  $\overline{A \cup (B \cap C)} = (\overline{C} \cup \overline{B}) \cap \overline{A}$
17. Define and plot the ceiling function.
18. Suppose that the relations  $R$  and  $S$  on a set  $A$  are represented by the matrices  
 $M_R = \begin{bmatrix} 0 & 1 & 0 \\ 1 & 1 & 1 \\ 1 & 0 & 0 \end{bmatrix}$  and  $M_S = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$ . What are the matrices representing  $R \cup S$  and  $R \cap S$ .
19. Determine whether the posets with these Hasse Diagrams are lattices.



20. Solve the equation  $4x^5 + x^3 + x^2 - 3x + 1 = 0$ , given that it has rational roots?
21. Solve the equation  $6x^6 - 25x^5 + 31x^4 - 31x^2 + 25x - 6 = 0$  ?

(6×5=30)

### Part C

Answer any **two** questions.

Each question carries **15** marks.





22. (a) Construct the truth table for the following compound propositions:

$$(i)(p \leftrightarrow q) \oplus (\neg p \leftrightarrow \neg r)$$

$$(ii)(p \oplus q) \rightarrow (p \wedge q).$$

- (b) Use truth table to establish which of the following statements are tautologies, which are contradictions and which are contingencies.

$$(i)(p \rightarrow q) \leftrightarrow (\neg p \vee q)$$

$$(ii)(p \wedge \neg q) \wedge (\neg p \vee q)$$

$$(iii)[(p \rightarrow q) \wedge \neg p] \rightarrow \neg q$$

23. a) Define different set operations. Illustrate using Venn diagrams.

- b) Let  $R_3$  be the relation defined on the set of all strings  $S$  by  $sR_3t$  either when  $s = t$  or both  $s$  and  $t$  are bit strings of length 3 or more that begin with the same three bits. What are the sets in the partition of the set of all bit strings arising from  $R_3$  on the set of all bit strings?

24. (A) Let  $A$  be the set of students in a college and  $B$  be the set of books in college library. Let  $R_1$  and  $R_2$  be relations consisting of all ordered pairs  $(a, b)$ , where  $a$  is required to read the book  $b$  in a course and where student  $a$  has read the book  $b$ , respectively. Describe the ordered pairs in each of the following relations:

$$(a) R_1 \cup R_2 \quad (b) R_1 \cap R_2 \quad (c) R_1 - R_2 \quad (d) R_2 - R_1 \quad (e) R_1 \oplus R_2.$$

- (B) Prove that the relation  $R$  on a set  $A$  is transitive if and only if

$$R^n \subseteq R \text{ for } n = 1, 2, 3, \dots$$

25. a) If  $\alpha, \beta, \gamma$  are the roots of  $x^3 + px^2 + qx + r = 0$ , obtain the equation whose roots are  $\alpha + \frac{1}{\beta\gamma}, \beta + \frac{1}{\gamma\alpha}, \gamma + \frac{1}{\alpha\beta}$ .

- b) Find the equation whose roots are those of  $x^4 - 2x^3 + 3x - 5 = 0$  each diminished by 2.

(2×15=30)

