Reg. No.

B.E./ B. TECH.DEGREE EXAMINATIONS, MAY 2023

First Semester

MA22253 - MATHEMATICS FOR DATA SCIENCE

(Artificial Intelligence and Data Science)

(Regulation2022)

TIME:3 HOURS **MAX. MARKS: 100**

COURSE OUTCOMES	STATEMENT	RBT LEVEL
CO 1	Perform operations on various discrete structures such as sets, functions and relations.	3
CO 2	Test the logic of a programme, having acquired knowledge of the necessary concepts..	3
CO 3	Identify structures on many levels as an application of the concepts and properties of algebraic structures.	3
CO 4	Apply the basic notions of groups, rings, fields which will be used to solve related problems.	3
CO 5	Execute the simplification of Boolean algebraic expression.	3

PART- A(20x2=40Marks)

(Answer all Questions)

		CO	RBT LEVEL
1.	Find all the partitions of $\{x, y, z\}$ and list them.	1	2
2.	If $A = \{0, 1\}$, $B = \{0, -1\}$ then find $A \times B$ & $B \times A$. Are they equal?	1	2
3.	Let $f : R \to R$ defined by $f(x) = x^2 + 1$. Find $f^{-1}(10)$ and $f^{-1}(-4)$	1	2
4.	Let $f(x) = x + 5, g(x) = 2x + 3$. Compute $f \circ g$ & $g \circ f$	1	2
5.	Express the statement "Good food is not cheap" in symbolic form	2	2
6.	Negate the statement: " John is playing football" in two different forms	2	2
7.	Write the converse and contra-positive of the conditional statement: Indian Criket team wins whenever match is played in Kolkata	2	2
8.	Find the truth value of $(x)(P \to Q(x)) \vee (\exists x)R(x)$ where P:2 >1, Q(x) : x >3, R(x) : x >4, with the universe of discourse is E = {2,3,4}	2	2
9.	Find the orders of the elements (-1) and 3 in $(R^*, \bullet)$ where $R^* = R - \{0\}$	3	2
10.	Verify whether G = {1,-1,i,-i} is a cyclic group	3	3

		CO	RBT LEVEL
11.	Find all right cosets of $\{[0],[3]\}$ in the group $(Z_6, +_6)$	3	2
12.	Check whether the permutation $g = \begin{pmatrix} 1 & 2 & 3 & 4 \\ 4 & 3 & 1 & 2 \end{pmatrix}$ is odd or even?	3	2
13.	What is the degree of the polynomial $f(x) = 6x^3 + 5x^2 + 3x - 2$ over Z_6	4	2
14.	What is the remainder when $f(x) = x^5 + 2x^3 + x^2 + 2x + 3 \in Z_5[x]$ is divided by $x - 1$	4	2
15.	Is $f(x) = x^3 + x + 4 \in Z_2[x]$ over Z and C irreducible?	4	2
16.	What are the units in the ring (Q, +, x)	4	2
17.	Draw the Hasse diagram for {(a,b)/ a divides b }on the set {1, 2, 3, 4, 6, 8, 12}	5	2
18.	Prove that (Z^+, |) is Poset where Z^+ is a set of positive integers.	5	3
19.	Apply Demorgan's law for $\overline{[(x + \bar{y})(\bar{x} + y)]}$	5	2
20.	Check whether $D_{12} = \{1, 2, 3, 4, 6, 12\}$ is a finite Boolean algebra.	5	2

PART- B (5x 10=50Marks)

		Marks	CO	RBT LEVEL
21. (a)	Let R be a binary relation on the set of positive integers such that $R = \{(a, b) / a = b^2\}$. What are the properties of R? Is R an equivalence relation? Partial ordering?	(10)	1	3
	(OR)			
(b)	If $S = \{1, 2, 3, 4, 5\}$ and if $f, g, h : S \to S$ are given by $f = \{(1,2), (2,1), (3,4), (4,5), (5,3)\}$. $g = \{(1,3), (2,5), (3,1), (4, 2), (5,4)\}$. $h = \{(1,2), (2,2), (3,4), (4,3), (5,1)\}$. Verify whether $f \circ g = g \circ f$ (i)explain why f and g has inverse but h does not (ii) find f^{-1} & g^{-1} (iii)prove that $(f \circ g)^{-1} = g^{-1} \circ f^{-1} \neq f^{-1} \circ g^{-1}$	(10)	1	3
22. (a)	Establish the relation $p \to (q \to r) \Rightarrow (p \to q) \to (p \to r)$	(10)	2	3
	(OR)			
(b)	Test the validity of the following: "Sonia is watching TV. If Sonia is watching a TV, then she is not studying. If she is not studying, then her father will not buy her a scooty. Therefore, Sonia's father will not buy her a scooty"	(10)	2	3

Q. Code:659750

23. (a) Prove that the non- zero elements of Z_7 is a group under multiplication **(10)** 3 3

(OR)

(b) Determine (i) $\alpha\beta$ (ii) α^3 (iii) β^4 (iv) α^{-1} and β^{-1} (v) $(\alpha\beta)^{-1}$, $\beta^{-1}\alpha^{-1}$ In a group $S_5=\{1,2,3,4,5\}$ where **(10)** 3 3

$$\alpha = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 \\ 2 & 3 & 1 & 4 & 5 \end{pmatrix} \ \& \ \beta = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 \\ 2 & 1 & 5 & 3 & 4 \end{pmatrix}$$

24. (a) Find $[777]^{-1}$ in the ring Z_{1009} **(10)** 4 3

(OR)

(b) Test the polynomial $x^2 + x + 4 \in Z_{11}[x]$ for irreducibility over Z_{11} **(10)** 4 3

25. (a) Given P(S),the set of all sub sets of S={a,b,c} and $\subseteq$,the inclusion relation on S (i)Show that $(P(S), \subseteq)$ is a poset (ii) Draw the Hasse diagram of the poset(iii) Find the minimal and maximal element and a chain of length 3 **(10)** 5 3

(OR)

(b) Let B = D_{30}={1,2,3,6,10,12,15,30}, the divisors of 30 with the divisibility as order. For any $a,b \in B$, $a+b = lcm(a,b)$, $a.b = \gcd(a,b)$, $a' = \frac{30}{a}$, Verify that $(B,+,\ .\ ,',\ 1,30)$ is a Boolean Algebra **(10)** 5 3

PART- C (1x 10=10Marks)

(Q.No.26 is compulsory)

		Marks	CO	RBT LEVEL
26.	Verify whether the compound proposition $(p \vee q) \rightarrow (p \wedge q)$ is a tautology or a contradiction. Also find the PDNF and PCNF of the same if it exists.	**(10)**	2	3

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