

CAT- I May 2023

Programme	: B. Tech	Semester	: FALL Inter Semester 2022-23
Course	: Discrete Mathematics and Graph Theory	Code	: BMAT205L
Faculty	: Dr. Om Namha Shivay, Dr. Kalyan Manna, Dr. Avinash Kumar Mittal, Dr. Durga Nagarajan, Dr. Vidhya V, Dr. Devi Yamini S. Dr. Uma Maheswari S. Dr. Rajesh Kumar Mohapatra, Dr. Manigandla Prasannalakshmi, Dr. Amit Kumar Rahul, Dr. Biswajit Mallick, Dr. Lakshmanan S	Slot(s)	: C2+TC2+TCC2
		Class	: CH2022232500303, CH2022232500293, CH2022232500294, CH2022232500295, CH2022232500296, CH2022232500297, CH2022232500299, CH2022232500300, CH2022232500298, CH2022232500301, CH2022232500302, CH2022232500304
Time	: 90 Mins	Max. Marks	: 50

Answer ALL the Questions

1.	(a) Symbolize the statements using proposition or predicates appropriately. (i) Ram never goes to hospital unless he has severe health issues (ii) Students can go to class, not to ground (iii) Mother is the best cook in the home	(3) (7)
2.	(b) Without using truth table, find the PDNF and PCNF of $p \vee (\neg p \rightarrow (q \vee (\neg q \rightarrow r)))$ and verify the results using truth table	(10)
3.	(a) Show that $P \vee Q, Q \rightarrow R, P \rightarrow S, \neg S \Rightarrow R \wedge (P \vee Q)$ by (i) direct (ii) indirect method (b) Show that $\forall x (P(x) \rightarrow Q(x)) \wedge \exists x ((Q(x) \rightarrow R(x)) \Leftrightarrow \exists x (R(x) \vee \neg P(x)))$	(5) (5)
4.	(a) Verify the validity of the following argument: Every living thing is a plant or an animal. Sam's dog is alive and it is not a plant. All animals have hearts. Therefore, Sam's dog has a heart. (b) Let $G = \{a + b\sqrt{2} \in \mathbb{R} \mid a, b \in \mathbb{Q}\}$. Prove that the non-zero elements of G forms an abelian group under usual multiplication (Assume associative law holds)	(5) (5)
5.	(b) Prove that $Z_7 = \{0,1,2,3,4,5,6\}$ is a group under addition modulo 7. What are the inverse elements of Z_7 and find all its subgroups. Justify Lagrange theorem. Given the generator matrix $G = \begin{bmatrix} 1 & 0 & 0 & 1 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 1 & 1 & 0 & 1 \end{bmatrix}$, corresponding to the encoding function $e: B^3 \rightarrow B^6$ (i) Find all the encoding words (ii) Find the corresponding parity check matrix and use it to decode the following received words and hence find the original message. Are all the words decoded uniquely? (a) 110101 (b) 001111 (c) 110001 (d) 111111	(10)

$$G = \text{Im} m \mid \begin{matrix} \uparrow \\ \text{matrix} \end{matrix}$$

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$$H = A^T \mid I_{(n-m)} \times n$$

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