Reg. Number:	24BAI1631

VIT
Vellore Institute of Technology
CHENNAI

Continuous Assessment Test (CAT) – I AUGUST 2025

Programme	:	B.Tech	Semester	:	FALL SEMESTER 2025 – 26
Course Code & Course Title	:	BMAT205L & Discrete Mathematics and Graph Theory	Slot	:	D1+TD1+TDD1
Faculty	:	Dr. Radha S., Dr. Devi Yamini S., Dr. Poulomi De, Dr. Somnath Bera, Dr. Sankarsan Tarai, Dr. Basua Debananda, Dr. Gayathri M., Dr. Mohd Imran Idrisi, Dr. Sriraman R., Dr. Rajesh Kumar Mohapatra, Dr. Pavithra R., Dr. Amit Kumar Rahul	Class Number	:	CH2025260100755, CH2025260100757, CH2025260100759, CH2025260100760, CH2025260100761, CH2025260100762, CH2025260100763, CH2025260100764, CH2025260100765, CH2025260100766, CH2025260100768, CH2025260100769
Duration	:	90 Minutes	Max. Mark	:	50

General Instructions:

- Write only your registration number on the question paper in the box provided and do not write other information
- Use statistical tables supplied from the exam cell as necessary
- Use graph sheets supplied from the exam cell as necessary
- Only non-programmable calculator without storage is permitted

Answer all questions

Q. No	Sub Sec.	Description	Marks
1.	(a)	Prove that the premises $a \to (b \to c), d \to (b \wedge \neg c)$ and $(a \wedge d)$ are inconsistent.	4
	(b)	Show that the conclusion $\forall x\big(P(x) \to \neg Q(x)\big)$ follows from the premises $\exists x(P(x) \wedge Q(x)) \to \forall y(R(y) \to S(y))$ and $\exists y(R(y) \wedge \neg S(y))$.	6
2.	(a)	(i) Write the converse, inverse and contrapositive of the following statement. "If Sandra finishes her work, she will go to the basketball game." **(2 Marks)** (ii) Write down the mathematical notation and its duals for the following statements: **(3 Marks)** 1. "If the student has submitted the assignment and passed the course then submission of the assignment implies passing the course." 2. "Either the network connection is inactive and the server is not responding, or the network connection is inactive and the server is responding or the network connection is active."	5
	(b)	Without constructing the truth tables, find the principal disjunctive normal forms (PDNF) of $(\neg p \to q) \wedge (q \leftrightarrow q)$.	5
3.	(a)	Let S = NxN and * be the operation on S defined by $(a, b) * (a', b') = (aa', bb')$ i. Show that $(S,*)$ is a semigroup. **(2 Marks)**	5

		ii. Define $f:(S,*) \to (Q, .)$ such that $f(a,b) = \frac{a}{b}$. Show that f is a homomorphism. **(3 Marks)**	
	(b)	Prove that the set $Z_5 = \{0,1,2,3,4\}$ is a finite abelian group under addition modulo 5 as composition.	5
4.	Construct the decoding table for the group code given by the generator matrix $G = \begin{bmatrix} 1 & 0 & 0 & 1 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 1 & 1 & 0 & 1 \end{bmatrix}$, use the decoding table to decode the following received words: 000 110, 000 011, 000 101, 110 001, 101 001 and 011 111.		10
5.	(a)	How many 4-letter words can be formed from the letters of the word "BANANA"?	5
	(b)	A committee of 5 is to be formed from 6 men and 5 women. How many ways can this be done if the committee must include at least 2 women (Without Repetition)?	5

**********All the best **********