



# PRESIDENCY UNIVERSITY

## BENGALURU

Roll No.																			
----------	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

**Mid - Term Examinations – MARCH 2026**

**Date:** 11-03- 2026 **Time:** 11.45am to 01.15pm

<b>School:</b> SOCSE	<b>Program:</b> B.Tech.	
<b>Course Code:</b> MAT2605	<b>Course Name:</b> Discrete Mathematics	
<b>Semester:</b> IV	<b>Max Marks:</b> 50	<b>Weightage:</b> 25%

<b>CO - Levels</b>	<b>C01</b>	<b>C02</b>	<b>C03</b>
<b>Marks</b>	<b>22</b>	<b>16</b>	<b>12</b>

**Instructions:**

- (i) Read all questions carefully and answer accordingly.
- (ii) Do not write anything on the question paper other than roll number.

### Part A

**Answer ALL the Questions. Each question carries 2marks. 5Q x 2M=10M**

1	Write the logical equivalences of De’Morgan’s law and Associative law.	2 Marks	L1	C01
2	Compute how many positive integers not exceeding 1000 are divisible by 7 or 11?	2 Marks	L2	C02
3	Find the coefficient of $x^{13}$ in the expansion of $(x + 1)^{20}$ .	2 Marks	L2	C02
4	Identify how many bit strings of length seven either start with two bits 11 or end with a bit 0.	2 Marks	L2	C02
5	Describe the Cartesian product of the sets $A = \{1, 2\}$ and $B = \{a, b, c\}$ ?	2 Marks	L2	C03

### Part B

**Answer the Questions.**

**Total Marks 40M**

6	a	Prove that $((\neg q \wedge p) \wedge q)$ is a contradiction using a truth table.	6 Marks	L2	C01
	b	Interpret the logical expression $(p \vee \neg r) \wedge (\neg p \vee (q \vee \neg r))$ and translate it into an equivalent digital circuit using logic gates input bits $p, q,$ and $r$ .	4 Marks	L3	
<b>Or</b>					
7	Examine the validity of the argument “If Sachin takes aptitude test, then he will qualify for placements. If Sachin does not play cricket, then he will take aptitude test. Sachin disqualified from placements. Therefore, Sachin played cricket”.		10 Marks	L3	C01

8	a	Compare the following propositions $p \vee (q \wedge r)$ and $(p \vee q) \wedge (p \vee r)$ . Using a truth table, determine whether they are logically equivalent.	6 Marks	L3	C01
	b	Simplify $\neg(p \vee (\neg p \wedge q))$ using logical laws to show it is equivalent to $\neg p \wedge \neg q$ .	4 Marks	L3	

**Or**

9	a	Show that $(r \vee s)$ follows logically from the premises $c \vee d, c \vee d \rightarrow h, \neg h \rightarrow (a \wedge \neg b), (a \wedge \neg b) \rightarrow (r \vee s)$ .	6 Marks	L3	C01
	b	Interpret the rule of inference used in the argument: "If it rains today, then we will not have a barbecue today. If we do not have a barbecue today, then we will have a barbecue tomorrow. Therefore, if it rains today, then we will have a barbecue tomorrow."	4 Marks	L3	

10	A bagel shop has onion bagels, poppy seed bagels, egg bagels, salty bagels, pumper-nickel bagels, sesame seed bagels, raisin bagels, and plain bagels. Determine how many ways are there to choose		10 Marks	L3	C02
	(i) a dozen bagels (ii) a dozen bagels with at least one of each kind? (iii) a dozen bagels with at least three egg bagels and no more than two salty bagels? (iv) a dozen bagels with no salty bagels (v) a dozen bagels with one salty bagel				

**Or**

11	a	Use mathematical induction to show that $1 + 2 + 2^2 + \dots + 2^n = 2^{n+1} - 1$ , for all non-negative integers $n$ .	7 Marks	L3	C02
	b	How many cards must be selected from a standard deck of 52 cards to guarantee that at least three cards of the same suit are chosen?	3 Marks	L2	

12	Consider the function $f: \mathbf{R} \rightarrow \mathbf{R}$ is defined by $f(x) = ax + b$ , for $a, b \in \mathbf{R}$ and $a \neq 0$ . Show that $f$ is invertible and find the inverse of $f$ .		10 Marks	L3	C03
----	---	--	----------	----	-----

**Or**

13	If $f(x) = x + 2, g(x) = x - 2$ and $h(x) = 3x$ for $x \in \mathbf{R}$ , where $\mathbf{R}$ is the set of real numbers, then compute the following compositions:		10 Marks	L3	C03
	(i) $g \circ f$ (ii) $g \circ g$ (iii) $f \circ h$ (iv) $h \circ g$ (v) $f \circ h \circ g$				