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D1BAM2402

Name: .....

Reg. No.: .....

FIRST SEMESTER FYUGP EXAMINATION NOVEMBER 2024

APPLIED MATHEMATICS

MINOR

AMA1MN104: MATHEMATICAL LOGIC, SET THEORY AND COMBINATORICS

Time: 2 Hrs. **Maximum Marks: 70**

M: Mark BL: Bloom's Taxonomy Level (1 to 6) CO: Course Outcome

Section A: Answer all questions. Each carries 3 marks. Ceiling: 24 Marks				
No.	**Question**	**M**	**BL**	**CO**
1.	Define the Biconditional statement. Give its truth table.	3	1	CO1
2.	Evaluate whether the following two propositions are logically equivalent. 1. $\sim (P \wedge Q) \vee (P \wedge \sim Q)$ 2. $P \vee \sim Q$	3	5	CO1
3.	Use an existential quantifier to represent the statement "There is at least one prime number greater than 100."	3	3	CO1
4.	Negate each proposition, where the UD = set of integers. 1) $(\forall x)(x^2 = x)$ 2) $(\exists x)(\|x\| = x)$	3	6	CO1
5.	State whether the following are true or false. i. {Ø} = Ø ii. Ø ⊆ Ø iii. Ø ∈ {Ø} iv. $\{x \mid x \neq x\} = \phi$ v. {x, y}={ y, x} vi. {x} ∈ {{x}, y} **(PTO)**	3	4	CO2

6.	Rewrite each set using the listing method. I. The set of months that begin with the letter A. II. The set of letters of the word GOOGOL. III. The set of months with exactly 31 days. IV. The set of solutions of the equation $x^2 - 5x + 6 = 0$	3	5	CO2
7.	Find the number of positive integers less than or equal to 2076 and are divisible by 3, 5, or 7.	3	2	CO2 CO3
8.	Solve the following equations: $\begin{bmatrix} x-1 & 2 & 0 \\ 0 & y+3 & 4 \\ -3 & 1 & z+2 \end{bmatrix} = \begin{bmatrix} -2 & 2 & 0 \\ 0 & -1 & 4 \\ -3 & 1 & -2 \end{bmatrix}$	3	1	CO3
9.	Construct two matrices A and B such that their multiplication is not possible. Explain why the multiplication cannot be performed, and create new matrices with compatible dimensions that allow for successful multiplication.	3	6	CO3
10.	Five marbles are drawn at random from a bag of seven green marbles and four red marbles. Find the probability that three are green and two are red.	3	4	CO3

Section B: Answer all questions. Each carries 6 marks.
Ceiling: 36 Marks

No.	Question	M	BL	CO
11.	Let t be a tautology and p an arbitrary proposition. Find the truth value of each. 1) $(\sim t) \rightarrow p$ 2) $(p \wedge t) \rightarrow p$ 3) $p \rightarrow t$ 4) $p \rightarrow (p \wedge t)$ 5) $(p \vee t) \rightarrow t$ 6) $t \leftrightarrow (p \vee t)$	6	2	CO1
12.	Check the validity of the following argument If Bill likes cats, he dislikes dogs. Bill likes dogs. _____ ∴ Bill dislikes cats.	6	6	CO1

13.	Using the Venn diagram express the following i. $(A \cup B) \cap C$ ii. $(A \oplus B) \cup C$ iii. $A \cap (B \cup C)$	6	3	CO2
14.	Let A and B be finite sets such that $A \subseteq B$, $\|A\| = b$, $\|B\| = a + b$. Find the cardinality of each set. i. $A \cup B$ ii. $A - B$ iii. $B - A$ iv. $A \cap B$	6	2	CO2
15.	Find the number of positive integers less than or equal to 1776 and divisible by: i. Two, three, or five. ii. Two, three, or five, but not 15. iii. Two, three, or five, but not six. iv. Two, three, or five, but not 30.	6	5	CO2 CO3
16.	Explain about different types of matrices.	6	3	CO3
17.	A committee of 5 people needs to be selected from 8 men and 6 women. However, the committee must include at least 2 women. Analyze how many different ways the committee can be formed under this restriction and show all calculations.	6	4	CO3
18.	Imagine you're organizing a banquet where 10 people need to be seated at a rectangular table, but three specific individuals must sit at the same end of the table. Create a problem where you calculate how many valid seating arrangements are possible, accounting for this restriction, and solve it using permutation principles.	6	6	CO3

Section C: Answer any one question. Each carries 10 marks. (1 x 10 = 10 Marks)

No.	Question	M	BL	CO
19.	Determine the first day in each of the following years. I. 2000 II. 2020 III. 2076 IV. 3000 V. 2025	10	4	CO3
20.	A bag contains 4 red marbles, 5 blue marbles, and 3 green marbles. Two marbles are drawn without replacement. Calculate the following: i. The probability that both marbles are red. ii. The probability that one marble is red and the other is blue. iii. The probability that neither marble is green. iv. The probability that both marbles are of the same color. v. The probability that at least one marble is red.	10	2	CO3