QP CODE: 24900066

Reg No:.....

Name:.....

MAHATMA GANDHI UNIVERSITY, KOTTAYAM

FIRST SEMESTER MGU-UGP (HONOURS) REGULAR EXAMINATION NOVEMBER 2024

First Semester

Core Course - MG1CCRBCA101 - DISCRETE MATHEMATICS

(2024 ADMISSION ONWARDS)

Duration: 2 Hours Maximum Marks: 70

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Interest (I), Appreciation (Ap), and Skill (S)

Students should attempt atleast one question from each course outcome to enhance their overall outcome attainability.

[Learning Domain][CO No(s)]

Part A
Short Answer Type Questions
Answer any 5 questions
Each question carries 2 marks

1	Define the conjunction of two propositions and write the truth table.	[K]	[3]
2	Apply De Morgan's law to find the negation of the statement " Heather will go to the concert or Steve will go to the concert".	[A]	[4]
3	Write the set of positive integers less than 10 in (a) Roaster form (b) Set builder form	[U]	[1]
4	Given the universal set: U = {1, 2, 3, 4, 5, 6, 7, 8, 9, 10}, find the sets specified by the Bit Strings: (a) 1111001111 (b) 0101111000	[U]	[2]
5	Is the relation on $R = \{(0,0),(0,2),(2,0),(2,2),(2,3),(3,2),(3,3)\}\ on\ \{0,1,2,3\}$ an equivalence relation.	[A]	[6]

6 Define a directed graph with an example. [K] [6]

7 Show that the matrix $A = \begin{bmatrix} 2 & 5 \\ 4 & 10 \end{bmatrix}$ is singular. [U] [7]

8 Solve using the Matrix method: $4x - y = 1, -2x + 5y = 1$ [A] [8]

(5 × 2 = 10)

Part B

Short Answer Type Questions
Answer any 5 questions
Each question carries 6 marks

9 Choose propositions from the following statements and negate them (a) 8 is a prime number. (b) All mathematicians are men. (c) 9 > 4. [U] [3]

10 Choose which rule of inference is used in the following arguments: [E] [5]
(a) Linda is an excellent swimmer.
If Linda is an excellent swimmer, then she can work as a lifeguard.
Therefore, Linda can work as a lifeguard.
(b) Kangaroos live in Australia and are marsupials.
Therefore, Kangaroos are marsupials.

11 Show by an example that [U] [1]
$A \times B \neq B \times A$,where A and B are nonempty unless $A = B$

12 (a) Define a bit string and the length of a bit string. Also, find the length of 10101010011. [U] [2]
(b) Find the bitwise XOR of 10101110 and 01010000.

13 How many reflexive relations are there on a set with n elements? [U] [6]

14 Determine whether the relation represented by the following matrix is an equivalence relation: [An] [6]
$A = \begin{bmatrix} 1 & 1 & 1 \\ 0 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$

15 Find the values of x,y,z and a which satisfy the matrix equation [U] [7]

$$\begin{bmatrix} x+3 & 2y+6 \\ z-1 & 4a-6 \end{bmatrix} = \begin{bmatrix} 0 & -7 \\ 3 & 2a \end{bmatrix}$$

16 Solve the following system of equations using the Cramer's rule: [A] [8]
$2x - y + 3z = 9, x + y + z = 6, x - y + z = 2$

(5 × 6 = 30)

Part C

Essay Type Questions

Answer any 3 questions

Each question carries 10 marks

17 (a) Write a short note on the conditional and biconditional statements. [U] [3]

(b) What are the contrapositive, the converse, and the inverse of the conditional statement:

"The home team wins whenever it is raining."

18 (a) Define a tautology. [A] [4]

(b) Prove that $(\neg p \wedge (p \rightarrow q)) \rightarrow \neg q$ is a tautology.

19 State and Prove Distributive Laws and Associative Laws of logical equivalence [U] [2]

20 If the relations R_1 and R_2 on a set A are represented by the matrices [An] [6]

$M_{R_1} = \begin{bmatrix} 0 & 1 & 0 \\ 1 & 1 & 1 \\ 1 & 0 & 0 \end{bmatrix}$ and $M_{R_2} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$.

Find the matrices that represent

(a) $R_1 \cup R_2$

(b) $R_1 \cap R_2$

(c) $R_1 \circ R_2$

(d) $R_2 \circ R_1$

21 If $A = \begin{bmatrix} 1 & 2 & -1 \\ 2 & 0 & 3 \\ 0 & 1 & 2 \end{bmatrix}$, $B = \begin{bmatrix} 3 & -1 & 1 \\ 0 & 0 & 2 \\ 4 & -3 & 2 \end{bmatrix}$, [U] [7]

verify the result $(A+B)^2 = A^2 + BA + AB + B^2$

22 If $A = \begin{bmatrix} 3 & -3 & 4 \\ 2 & -3 & 4 \\ 0 & -1 & 1 \end{bmatrix}$ find [A] [8]

(a) A^{-1}

(b) Show that $A^3 = A^{-1}$

(3 × 10 = 30)

END OF THE QUESTION PAPER

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