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**M1MCA05/CT05**

**M.C.A. Ist Semester Examination 2017-18**

**DISCRETE MATHEMATICS**

**PAPER-V**

**Time : Three Hours**  
**Maximum Marks : 80**

**PART - A**

**[Marks : 20]**

Answer all questions (50 words each).

All questions carry equal marks.

**PART - B**

**[Marks : 40]**

Answer *five* questions (250 words each).

Selecting *one* from each unit. All questions carry equal marks.

**PART - C**

**[Marks : 20]**

Answer any *two* questions (300 words each).

All questions carry equal marks.

**M1MCA05/CT05/50**

**P.T.O.**

## PART - A

### UNIT - I

1. (i) What is the difference between subset & proper subset.

(ii) Draw directed graph of following relation

$$R = \{(1, 1), (1, 3), (2, 2), (2, 4), (3, 1), (3, 3), (3, 4), (4, 1), (4, 3)\}$$

defined on set  $A = \{1, 2, 3, 4\}$

### UNIT - II

(iii) Find range of the function  $\frac{1}{x-1}$ .

(iv) Define conditional and biconditional statements.

### UNIT - III

(v) Suppose  $A = \begin{bmatrix} 1 & 2 \\ 4 & 3 \end{bmatrix}$  &  $B = \begin{bmatrix} 0 & -1 \\ -2 & 3 \end{bmatrix}$ .

Find  $A^T \cdot B^T$ .

(vi) Find value of determinant

$$\begin{vmatrix} 2 & 1 & 3 \\ 4 & 6 & -1 \\ 5 & 1 & 0 \end{vmatrix}$$

#### UNIT - IV

(vii) Find the minimum number of students in a class to be sure that three of them are born in the same month.

(viii) Prove  $\binom{17}{6} = \binom{16}{5} + \binom{16}{6}$ .

#### UNIT - V

(ix) Find all integers  $n$  such that

$$2 < 8 - 3n < 18$$

(x) Find general solution of the equation

$$x^2 + 3 \equiv 0 \pmod{6}$$

## PART - B

### UNIT - I

2. Show that :

$$(i) \quad (A \cup B)' = A' \cap B'$$

$$(ii) \quad (A \cap B)' = A' \cup B'$$

3. Let R be the relation on the positive integers N defined by the equation  $x + 3y = 12$  that is

$$R = \{(x, y) : x + 3y = 12\}$$

- (a) Write R as a set of ordered pairs
- (b) Find (i) domain (ii) range & (iii) inverse of R
- (c) Find composition relation R
- (d) Find matrix of R.

## UNIT - II

4. If  $f : R \rightarrow R$  and  $g : R \rightarrow R$  defined as

$$f(x) = x^2 + 1 \text{ and } g(x) = 1 - \frac{1}{1-x}$$

then find  $(f \circ g)$  and  $(g \circ f)$ .

5. Determine the validity of the following argument if 7 is less than 4, then 7 is not a prime number 7 is not less than 4  
7 is a prime number.

## UNIT - III

6. Out of 12 employees, a group of four trainees is to be sent for software testing and 2A training for month :
- (a) In how many ways can the 4 employees be selected
  - (b) What is there are two employees who refuses to go together for training
  - (c) There are two employees who are a couple want to go together otherwise not

7. A fair coin is tossed 6 times; call heads a success find :

- (a) the probability that exactly two heads occur
- (b) the probability of getting at least four heads
- (c) the probability of getting no head

#### UNIT - IV

8. Find the inverse of matrix  $\begin{bmatrix} 1 & 0 & 2 \\ 2 & -1 & 3 \\ 4 & 1 & 8 \end{bmatrix}$ .

9. Solve the following system of equations using determinants (cramer's rule).

$$2y - 3z = 0$$

$$x + xy = -4$$

$$3x + 4y = 3$$

#### UNIT - V

10. Let  $a = 37$ ,  $b = 249$

- (a) Find  $d = \gcd(a, b)$
- (b) Find integers  $m$  and  $n$  such that  $d = ma + nb$
- (c) Find  $\text{lcm}(a, b)$

11. Suppose  $a \neq 1$ . Let  $\rho$  be proposition on  $n \geq 1$  defined by

$$\rho(n): 1 + a + a^2 + \dots + a^n = \frac{a^{n+1} - 1}{a - 1}$$

Show that  $\rho$  is true for all  $n$ .

### PART - C

#### UNIT - I

12. Among integers 1 to 300. How many of them are divisible neither by 3, nor by 5, nor by 7 ? How many of them are divisible by 3 but not by 5 nor by 7.

#### UNIT - II

13. Check the validity of following argument

$$p \rightarrow q, q \rightarrow r \vdash p \rightarrow r \text{ (Law of Syllogism)}$$

#### UNIT - III

14. Solve the following system of equation by G augmented matrix M

$$x + 2y - 4z = -3$$

$$2x + 6y - 5z = 2$$

$$x + 11y - 4z = 12$$

## UNIT - IV

15. (a) There are six roads between A and B and four roads between B and C. Find the number of ways that one can drive :

- (i) from A to C by way of B
- (ii) round trip from A to C by way of B
- (iii) round trip from A to C by way of B

without using the same road more than once.

(b) In certain programming language variable should be of length three and should be made up of two letters followed by a digit or of length two made up to a letter following by a digit. How many possible variables ?

## UNIT - V

16. Solve the congruence equation :

$$1092x \equiv 213 \pmod{2295}$$