

# KAMARAJ COLLEGE (Autonomous)

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(Affiliated to Manonmaniam Sundaranar University, Tirunelveli)

(5 Pages)

Reg. No:.....

Question Code: 26E01105

Course Code: 24UECS21/25UECS21

UG Degree - End Semester Examinations, April 2026

Second Semester

B.Sc., COMPUTER SCIENCE

Discrete Mathematics

(For those who joined in July 2024 and June 2025 onwards)

Time : 3Hours

Maximum : 75 Marks

## PART - A (10 × 1 = 10 Marks)

Answer ALL Questions

Choose the correct answer:

CO:1 1. A set is \_\_\_\_\_

- K:2
- (a) An ordered collection of elements
- (b) A repeated collection of numbers
- (c) A well-defined collection of distinct objects
- (d) A sequence of elements

CO:1 2. The power set of a set with  $n$  elements has \_\_\_\_\_

- K:2
- (a)  $n$  elements
- (b)  $2^n$  elements
- (c)  $n^2$  elements
- (d)  $n + 1$  elements

CO:2 3. A relation  $R$  on set  $A$  is reflexive if \_\_\_\_\_

- K:2
- (a)  $(a, b) \in R$
- (b)  $(b, a) \in R$
- (c)  $(a, a) \in R$  for all  $a \in A$
- (d)  $R$  is empty

CO:2 4. A relation is called an equivalence relation if it is \_\_\_\_\_

- K:2
- (a) Reflexive, symmetric, and transitive
- (b) Symmetric and transitive
- (c) Reflexive and symmetric
- (d) Reflexive and transitive

CO:3 5. A function is bijective if it is \_\_\_\_\_

- K:2
- (a) Only one-one
- (b) Only onto
- (c) Both one-one and onto
- (d) Neither one-one nor onto

- CO:3 6. The domain of  $g \circ f$  consists of \_\_\_\_\_  
 K:2 (a) All elements of  $B$  (b) All  $x \in A$  such that  $f(x) \in$   
 domain of  $g$   
 (c) All elements of  $C$  (d) All elements of  $A \cup B$
- CO:4 7. A compound proposition that is always true regardless of truth  
 K:1 values is called \_\_\_\_\_  
 (a) Tautology (b) Contradiction  
 (c) Contingency (d) Converse
- CO:4 8. Two propositions  $p$  and  $q$  are logically equivalent if \_\_\_\_\_  
 K:2 (a) They are both always false (b) They have the same truth  
 value for all possible truth  
 assignments  
 (c) They are both always true (d) They contain the same  
 variables
- CO:5 9. Let  $A$  and  $B$  are matrices. Order of matrix  $A$  is  $(a \times b)$  and order of  
 K:1 matrix  $B$  is  $(c \times d)$ , then for  $AB$  to exist, correct relation is given by  
 \_\_\_\_\_  
 (a)  $a = c$  (b)  $c = d$   
 (c)  $b = c$  (d)  $a = d$
- CO:5 10. A square matrix is singular if and only if its determinant is  
 K:2 \_\_\_\_\_.  
 (a) Negative (b) 0  
 (c) 1 (d) Positive

**PART - B (5 X 5 = 25 Marks)**

**Answer ALL Questions choosing either (a) or (b).**

**Answer should not exceed 250 words.**

- CO:1 11. (a) There are 100 students in a Student Activity Club of which  
 K:3 35 like drawing and 45 like music. 10 students are interested  
 in both drawing and music. Find the number of students that  
 like either of them or neither of them.

**(OR)**

- (b) Let  $U = \{0,1,2,3,4,5,6,7,8,9,10\}$ ,  $A = \{1,2,3,6,7,8\}$ ,  
 $B = \{1,2,7,8,9,4\}$  perform the following operations  
 i. Union of  $A$  and  $B$   
 ii. Intersection of  $A$  and  $B$   
 iii. Difference between  $A$  and  $B$

- iv. Complement of A
- v. Symmetric Difference between A and B

CO:2 12. (a) Analyse the properties of inverse relation.

K:4

**(OR)**

(b) Let  $A = \{1, 2, 3, 4\}$ . Determine the type of relation for the following relations.

i.  $R = \Phi$

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

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

CO:3 13. (a) Identify the type of function.

K:4

- i. Let  $A=\{1,2,3\}$ ,  $B=\{a,b,c\}$  and  $f=\{(1,a),(2,b),(3,c)\}$
- ii.  $f(x)=x^2$ , where domain =  $\{-2, -1, 1, 2\}$
- iii. Let  $A=\{1,2\}$ ,  $B=\{a,b,c\}$  and  $f=\{(1,a),(2,b)\}$
- iv. Let  $A=\{1,2,3\}$  and  $f=\{(1,1),(2,2),(3,3)\}$

**(OR)**

(b) Let  $f(x)=x^2$ ,  $g(x)=x+2$

Check whether:  $(f+g)^2 = f^2 + g^2$

CO:4 14. (a) Construct a truth table for  $(P \wedge Q) \Rightarrow (P \vee \sim Q)$

K:4

**(OR)**

(b) State and Prove De Morgan's Laws.

CO:5 15. (a) Find the inverse of the matrix  $\begin{bmatrix} 2 & 1 & 1 \\ 3 & 2 & 1 \\ 2 & 1 & 2 \end{bmatrix}$

K:4

**(OR)**

(b) Differentiate between symmetric matrix & skew symmetric matrix with an example

**PART - C (5 X 8 = 40 Marks)**

**Answer ALL Questions choosing either (a) or (b).**

**Answer should not exceed 500 words.**

CO:1 16. (a) Let

K:5

$A=\{1,2,3,4\}$ ,

$B=\{x|x \text{ is an even number in } A\}$ ,

$C=\{2,4,6\}$

- i. Determine whether  $A=B$
- ii. Compare the cardinality of sets B and C.

Examine whether two sets can have the same cardinality but not be identical, using B and C as examples.

**(OR)**

(b) Let

$$A=\{1,2,3\},$$

$$B=\{a,b\},$$

$$C=\{2,3\}$$

- i. Find  $A \times B$  and  $B \times A$ .
- ii. Determine whether  $A \times B = B \times A$ .
- iii. Construct a relation  $R \subseteq A \times A$  such that:  $(x,y) \in R$  if  $x < y$
- iv. Find all ordered pairs in R and determine its cardinality.

CO:2 17. (a) Analyze the properties of relation with an example for each  
K:6 property.

**(OR)**

(b) Let  $A=\{1,2,3,4\}$  and

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

- i. Construct the reflexive, symmetric, and transitive closures of R
- ii. Construct a relation  $R'$  that is both symmetric and transitive containing R.

CO:3 18. (a) Let

K:6  $f:R \rightarrow R$  and  $g:R \rightarrow R$  be defined by:  $f(x) = 2x+1$ ,  $g(x) = x^2 - 3$

- i. Find  $(g \circ f)(x)$
- ii. Find  $(f \circ g)(x)$

Show that  $g \circ f \neq f \circ g$

**(OR)**

(b) Let:  $f(x)=x^3 + 1$

Show that

- i. f is one-one and onto
- ii. Find  $f^{-1}(x)$
- iii. Verify the result

CO:4 19. (a) Evaluate the following formula are tautology or  
K:5 contradiction

- i.  $\sim P \Rightarrow P$
- ii.  $P \Rightarrow (P \vee Q)$
- iii.  $\sim A \wedge B \Rightarrow \sim(A \vee B)$

**(OR)**

(b) Translate the following sentences in the symbolic form.

- i. Some people who trust others are rewarded
- ii. If anyone is good then John is good
- iii. Someone is teasing
- iv. It is not true that all roads lead to Rome.

CO:5 20. (a) Elaborate the operations on matrices.

K:6

**(OR)**

(b) Discuss the properties of Conjugate of a matrix and Determinant of a matrix.