

MASTER OF COMPUTER APPLICATION  
FIRST SEMESTER (REPEAT)  
MATHEMATICAL FOUNDATION OF COMPUTER SCIENCE  
MCA-103

**SET  
A**

[USE OMR SHEET FOR OBJECTIVE PART]

Duration: 3 hrs.

Full Marks: 70

Time: 30 mins.

Marks: 20

**(Objective)**

Choose the correct answer from the following:

1X20=20

- $A \Delta B =$ 
  - $(A - B) \cap (B - A)$
  - $(A \cap B) - (B \cap A)$
  - Both a and b
  - None
- ${}^{27}C_0 =$ 
  - 1
  - 0
  - 27
  - None
- Number of permutations from the coins of 3 denominations are:
  - 5
  - 3
  - 6
  - 7
- If  $A = \begin{bmatrix} 2 & -3 \\ 5 & 4 \end{bmatrix}$  and  $B = \begin{bmatrix} 7 & -3 \\ 9 & 1 \end{bmatrix}$ , then  $A + B = ?$ 
  - $A + B = \begin{bmatrix} -9 & 0 \\ 14 & 5 \end{bmatrix}$
  - $A + B = \begin{bmatrix} 9 & 0 \\ 14 & 5 \end{bmatrix}$
  - $A + B = \begin{bmatrix} 9 & 0 \\ 1 & 5 \end{bmatrix}$
  - $A + B = \begin{bmatrix} 9 & 0 \\ 14 & -5 \end{bmatrix}$
- Two statements are logically equivalent if their truth values are:
  - True
  - False
  - Same
  - All of the above
- $A = \{0\}$  is known as:
  - 0
  - 1
  - Undefined
  - None
- The set of cube root of unity forms a/an:
  - Abelian Group
  - Monoid
  - Semi-Group
  - None
- If  $f(x) = \frac{1}{x-2}$  then  $f(x)$  is undefined at.....
  - $x = 2$
  - $x = 0$
  - $x = 0$
  - $x = 1$

9. A non empty set  $G$ , together with a binary operation  $*$  is said to form a group if it satisfies:
- |   |   |
|---|---|
| a. (I) Associativity,<br>(II) Existence of Identity       | b. (I) Associativity,<br>(II) Existence of Inverse                                |
| c. (I) Existence of Identity<br>(II) Existence of Inverse | d. (I) Associativity,<br>(II) Existence of Identity<br>(III) Existence of Inverse |
10. The subset  $\{1, -1\}$  will be a subgroup of  $G = \{1, -1, i, -i\}$
- |                         |                       |
|-------------------------|-----------------------|
| a. Under Multiplication | b. Under Addition     |
| c. None of the above    | d. Under Substraction |
11. The matrix  $A$  is singular if:
- |                 |              |
|-----------------|--------------|
| a. $ A  \neq 0$ | b. $ A  > 0$ |
| c. $ A  < 0$    | d. $ A  = 0$ |
12. If  $A = \{1, 2, 3\}$ ,  $B = \{1, 2, 3\}$  then  $A - B$  is:
- |                 |           |
|-----------------|-----------|
| a. $\emptyset$  | b. $\Phi$ |
| c. Both a and b | d. None   |
13.  $A - B =$
- |                 |                 |
|-----------------|-----------------|
| a. $A \cap B$   | b. $A^c \cap B$ |
| c. Both a and b | d. None         |
14. If  $A = \{1, 2, 3\}$  which of the following is not a subset of  $A$ ?
- |            |                |
|------------|----------------|
| a. $\{1\}$ | b. $\{\{1\}\}$ |
| c. $\Phi$  | d. $\{3, 2\}$  |
15.  $\sim (p \wedge q) =$
- |                         |                           |
|-------------------------|---------------------------|
| a. $\sim p \vee \sim q$ | b. $\sim p \wedge \sim q$ |
| c. Both a and b         | d. None                   |
16.  $(A')$
- |             |          |
|-------------|----------|
| a. $A$      | b. $A''$ |
| c. $\infty$ | d. None  |
17. Two sets are said to be equivalent if they contain:
- |                             |                  |
|-----------------------------|------------------|
| a. Equal number of elements | b. Same elements |
| c. Both a and b             | d. None          |
18. If  $\sim C_1 = \sim C_2$  then:
- |                 |                |
|-----------------|----------------|
| a. $x = y$      | b. $x + y = n$ |
| c. Both a and b | d. None        |
19. The set of even numbers w. r. t subtraction is a/an:
- |                  |          |
|------------------|----------|
| a. Semi group    | b. Group |
| c. Abelian group | d. None  |
20. Which of the following is not an example of set?
- |                   |                           |
|-------------------|---------------------------|
| a. Set of vowels  | b. Set of animals         |
| c. Set of flowers | d. Set of beautiful girls |

**( Descriptive )**

Time : 2 hr. 30 mins.

Marks : 50

[ Answer question no.1 & any four (4) from the rest ]

1. a) Prove that, 5+5=10  
i)  $(A \cap B)^c = A^c \cup B^c$   
ii)  $(A \cup B)^c = A^c \cap B^c$   
b) Define Group, Subgroup, Normal Subgroup, Semi group and Quotient group with examples.
2. a) If  $f(x) = x^2 + 2x$ ,  $A = \begin{bmatrix} 1 & 2 \\ 4 & -3 \end{bmatrix}$ , find  $f(A)$  5+5=10  
b) Show that  $\sim p \vee \sim q$  and  $\sim (p \wedge q)$  are logically equivalent.
3. a) Prove that the set of integers  $Z$  forms an abelian group w.r.t. usual addition. 5+5=10  
b) Test whether  $(p \rightarrow q) \vee (r \rightarrow \sim r)$  is a tautology or contradiction.
4. a) Find  $A^{-1}$  if  $A = \begin{pmatrix} -1 & 0 & 2 \\ 2 & -2 & 3 \\ 1 & 2 & 4 \end{pmatrix}$  5+5=10  
b) Show that  $(p \wedge \sim q) \wedge (\sim p \vee q)$  is a contradiction.
5. a) If, 5+5=10  
 $p$  : Animesh is brilliant  
 $q$  : Animesh is regular  
Then write inverse, converse and contrapositive statements.  
b) Find the number of possible ways in which the letters of the word COTTON can be arranged so that the two 'T' s do not come together.
6. a) What do you mean by Adjoint and inverse of a matrix? 2+5+3=10  
b) If  $A = \begin{bmatrix} -2 & 2 \\ 2 & 1 \end{bmatrix}$  and  $B = \begin{bmatrix} 1 & -1 \\ 1 & 2 \end{bmatrix}$ , Show that  
 $(A + B)^2 \neq A^2 + 2AB + B^2$

7. a) Prove that fourth root of unity forms an abelian group. 5+5=10  
b) How many words can be formed using the letters of the word UMBRELLA so that vowels are not coming together?
8. a) Write power sets of  $A = \{0,1, \{0\}\}$  3+7=10  
b) Define equivalence relation. Show that the relation Z is an equivalence relation.

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