

## U.G. 3rd Semester Examination - 2021

### MATHEMATICS

[PROGRAM]

Course Code : BMTMSERT304

Course Title : Logic and Sets

Full Marks : 50

Time : 2 Hours

*The figures in the right-hand margin indicate marks.*

Answer all the questions by choosing correct alternative:

2×25=50

- If a set contains 4 elements then the number of subsets is
  - 8
  - 16
  - 24
  - 32
- The number of distinct equivalence classes of the equivalence relation  $p$  on  $z$  defined by " $a p b$  if and only if " $a-b$  is divisible by 5" for  $a, b \in z$  is-
  - 4
  - 6
  - 3
  - 5
- A relation  $\rho$  is defined on the set  $z$  by " $a p b$ " if and only if " $ab > 0$ " for  $a, b \in z$  is

- Reflexive, symmetric and transitive
- Reflexive, not symmetric and transitive
- Not reflexive, symmetric and transitive
- Reflexive, symmetric and not transitive

4. How many five digit numbers can be made from the digits 1 to 7 if repetition is allowed?

- 16807
- 54629
- 23467
- 32354

5. Which of the following diagram indicates the best relation between Author, Lawyer and Singer?



6. Which of the following is an empty set?

- Prime numbers upto 10
- Even numbers upto 10
- Prime numbers divisible by 2
- Prime numbers divisible by 3

7.  $(p \rightarrow q) \wedge (p \rightarrow r)$  is logically equivalent to

- $p \rightarrow (q \wedge r)$
- $p \rightarrow (q \vee r)$
- $p \wedge (q \vee r)$
- $p \vee (q \wedge r)$

8. If  $A = \{a, b, p\}$ ,  $B = \{2, 3\}$ ,  $C = \{p, q, r, s\}$  then  $n[(A \cup C) \times B]$  is
- a) 8    b) 20  
c) 12     d) 16
9. If  $A = \{x : x \text{ is a multiple of } 3\}$  and  $B = \{x : x \text{ is multiple of } 5\}$ , then  $A - B$  is
- a)  $A \cap B'$                                         b)  $A' \cap B$   
c)  $A' \cap B'$                                        d)  $(A \cap B)'$
10. How many rational and irrational numbers are possible between 0 and 1?
- a) 0     b) Finite  
c) Infinite     d) 1
11. Negation can be determined by
- a) NOT gate                                         b) AND gate  
c) NOR gate                                         d) NAND gate
12. Let  $n(A) = m$  and  $n(B) = n$  then the total number of non-empty relations that can be defined from A to B is
- a)  $m^n$     b)  $n^m$   
c)  $2^{mn} - 1$                                          d)  $2^{mn}$
13. If  $A = \{2, 3, 5, 6\}$ ,  $B = \{8, 10, 13, 20\}$  and  $\rho$  be a relation defined by  $\rho = \{(2, 8), (2, 20), (3, 10), (5, 10), (6, 20)\}$  then  $\rho^{-1}$ .
- a)  $\{(8, 2), (20, 2), (10, 3), (10, 5), (20, 6)\}$   
b)  $\{(8, 2), (2, 20), (3, 10), (10, 5), (20, 6)\}$   
c)  $\{(2, 8), (2, 20), (3, 10), (5, 10), (6, 20)\}$   
d) None of the above
14. Which of the set is singleton set?
- a) Set of odd prime numbers  
b) Set of even prime numbers  
c) Set of odd numbers  
d) Set of prime numbers
15. If X and Y are two sets, such that  $X \cup Y$  has 40 elements, X has 28 elements and Y has 22 elements, how many elements does  $X \cap Y$  have?
- a) 30     b) 20  
c) 10     d) 5
16. What is contrapositive for statement if p then q?
- a) If not q then not p  
b) If q then p  
c) If not p then q  
d) If not p then not q

17. If  $A = \{2, 4, 6, 8\}$  and  $B = \{2, 5, 7, 8\}$  then symmetric difference  $B \Delta A$  is—
- a)  $\{2, 4, 5, 6, 7, 8\}$     b)  $\{4, 5, 6, 7\}$   
 c)  $\{2, 4, 6, 7\}$         d)  $\{2, 4, 6, 7, 8\}$
18. Which of the following is an infinite set?
- a)  $\{x \in \mathbb{N} : x \leq 10\}$     b)  $\{x \in \mathbb{R} : x^2 - 1 = 0\}$   
 c)  $\{e^x \in \mathbb{R} : x \in [1, 2]\}$     d)  $\{x \in \mathbb{N} : x^2 - 1 = 0\}$
19. If  $A = \{\emptyset\}$ , then the cardinality of the power set of A is
- a) 0                                b) 1  
 c) 2                                d) 4
20. "The inverse of an equivalence relation is an equivalence relation"— This statement is
- a) Always true  
 b) Always false  
 c) Sometimes true  
 d) True only in one scenario
21. Let,  $(S, \leq)$  be a poset. An element  $a \in S$  is said to be a minimal element if
- a)  $x < a$ , for no  $x \in S$     b)  $x < a$ , for all  $x \in S$   
 c)  $a < x$ , for no  $x \in S$     d)  $a = x$ , for no  $x \in S$

22. Let,  $Q(x, y)$  denote the statement " $x = y + 3$ ". What are the truth values of the propositions  $Q(1, 2)$  and  $Q(3, 0)$  respectively?
- a) T, T                                b) F, F  
 c) T, F                                d) F, T
23. If  $n(A) = 3$ ,  $n(B) = 6$  and  $A \subseteq B$ . Then the number of elements in  $A \cup B$  is equal to
- a) 9                                        b) 3  
 c) 6                                        d) 12
24. Which of the following is contrapositive of " $p \Rightarrow q$ "?
- a)  $\neg q \Rightarrow \neg p$                 b)  $q \Rightarrow p$   
 c)  $\neg p \Rightarrow \neg q$                 d)  $p \vee \neg p$
25. Let,  $A = \{e^x : x \in \mathbb{R}\}$  &  $B = \{x^2 : x \in \mathbb{R}\}$ . Then the cardinality of  $A \cap B$  is
- a) 0  
 b) infinite  
 c) 1  
 d) 2