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Total No. of Pages : 03

Total No. of Questions : 18

B.Tech. (CSE/IT) (2018 Batch) (Sem.-4)

**DISCRETE MATHEMATICS**

Subject Code : BTCS-401-18

M.Code : 77626

Time : 3 Hrs.

Max. Marks : 60

**INSTRUCTIONS TO CANDIDATES :**

1. **SECTION-A** is **COMPULSORY** consisting of **TEN** questions carrying **TWO** marks each.
2. **SECTION-B** contains **FIVE** questions carrying **FIVE** marks each and students have to attempt any **FOUR** questions.
3. **SECTION-C** contains **THREE** questions carrying **TEN** marks each and students have to attempt any **TWO** questions.

**SECTION-A****Answer briefly :**

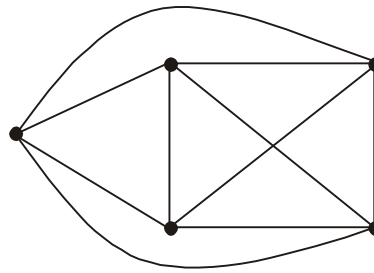
1. Find the Cartesian product  $A \times A$  if  $A = \{0, 1, 3\}$ .
2. Construct the truth table of the compound proposition  $(p \vee \neg q) \rightarrow (p \wedge q)$ .
3. Define contrapositive of a conditional statement and find the same for of the following statement:  
  
*"If you do your homework, you will not be punished"*
4. What is the power set of the empty set? What is the power set of the set  $\{\phi\}$ ? Here  $\phi$  is an empty set.
5. State pigeonhole principle.
6. Find the greatest common divisor of 414 and 662 using the Euclidean algorithm.
7. Draw a Complete graph with 5 vertices.
8. Does there exists a simple graph with six vertices of degrees 1,1,3, 4,6,7? Justify.
9. Define a permutation group.
10. For any a,b in a Boolean algebra prove that  $(a+b)' = a'b'$ .

**SECTION-B**

11. Show that  $\neg(p \vee (\neg p \wedge q))$  and  $\neg p \wedge \neg q$  are logically equivalent by developing a series of logical equivalences.
12. In a survey it was found that 21 people liked product A, 26 liked product B and 29 liked product C. If 14 people liked products A and B, 12 liked products C and A, 14 people liked products B and C and 8 liked all the three products. Find how many liked product C only?
13. Let A be the set of integers and R be the relation defined on  $A \times A$  by  $(a,b)R(c,d)$  if  $ad=bc$ . Prove that R is an equivalence relation.
14. Explain the following with suitable examples :
  - a) Connected graph
  - b) Planar graph
  - c) Vertex colouring of a Graph
  - d) Rooted tree
15. Show that the set  $G=\{1,2,3,4,5,6\}$  is a finite abelian group of order 6 w.r.t. multiplication modulo 7.

**SECTION-C**

16.
  - a) Prove that  $\sqrt{2}$  is irrational by giving a proof by contradiction.
  - b) Find the number of arrangements of the letters of the word INDEPENDENCE. In how many of these arrangements
    - i) All the vowels always occur together.
    - ii) Vowels never occur together.
17.
  - a) Prove that a finite integral domain is a field.
  - b) Using Boolean algebra, show that :
$$abc+ab'c+abc'+a'bc=ab+bc+ca$$
18.
  - a) Determine whether the following graph is :



- i) Hamiltonian, if yes, find the Hamiltonian cycle.
  - ii) Eulerian, if yes, find the Euler cycle.
- b) Use the well-ordering property to prove the division algorithm which states that if  $a$  is an integer and  $d$  is a positive integer, then there are unique integers  $q$  and  $r$  with  $0 \leq r < d$  and  $a = dq + r$ .

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**NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.**