

D 73139

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Name.....

Reg. No.....

FIRST SEMESTER B.A./B.Sc. DEGREE EXAMINATION, NOVEMBER 2019

(CUCBCSS—UG)

BCA

BCA 1C 02—DISCRETE MATHEMATICS

(Common for 2014 and 2017 Admissions)

Time : Three Hours

Maximum : 80 Marks

**Section A**

*Answer all questions.*

*Each question carries 1 mark.*

1. Define Antisymmetric relation.
2. Construct the truth table for the proposition  $\sim(\sim p \wedge q)$ .
3. Define greatest lower bound of a poset.
4. Let  $A = \{x \in \mathbb{N} / 3 \leq x < 7\}$ ,  $B = \{2, 3, 5, 7, 11\}$  find  $A \Delta B$ .
5. Define a finite graph.
6. What is a subgraph.
7. Define a complete graph.
8. State maximum flow minimum cut theorem.
9. Define centre of a tree.
10. Define digraph.

(10 × 1 = 10 marks)

**Section B**

*Answer all questions.*

*Each question carries 2 marks.*

11. In a Boolean Algebra  $(B, +, \cdot, ')$  each  $a \in B$   $(a')' = a$ .
12. Translate into logical expression "A necessary condition for  $x$  to be prime is that either  $x$  is odd or  $x = 2$ ".

Turn over

13. If  $A = \{1, 3, 5, 7, 9\}$   $B = \{2, 3, 5, 7, 11\}$  find  $A - B$ ,  $B - A$  and  $A \Delta B$ .
14. Define a tree and draw all trees with 4 vertices.
15. Explain logical equivalent and logical consequences of a proposition.
16. Show that  $\overline{A \cap B} = \overline{A} \cup \overline{B}$ .
17. Define chromatic graph. Give an examples.
18. Draw a disconnected graph with 8 vertices and 2 components.

(8 × 2 = 16 marks)

### Section C

*Answer any six questions.*

*Each question carries 4 marks.*

19. Distinguish between symmetric and transitive relation with suitable examples.
20. Describe Hasse diagram with examples.
21. Show that  $\sim(p \wedge q)$  and  $\sim p \vee \sim q$  are logically equivalent.
22. Which elements of the poset  $(\{2, 4, 5, 10, 12, 20, 25\}, 1)$  are maximal and which are minimal ?
23. Prove that the number of vertices of odd degree in a graph is always even.
24. Prove that any connected graph with  $n$  vertices and  $n - 1$  edges is a tree.
25. Show that in any tree there are atleast 2 pendant vertices.
26. Any simple graph can be embedded in a plane such that every edge is drawn as a straight line segment, verify ?
27. Prove that the edge connectivity of a graph  $G$  can not exceed the degree of the vertex with the smallest degree in  $G$ .

(6 × 4 = 24 marks)

### Section D

*Answer any three questions.*

*Each question carries 10 marks.*

28. (a) Define power set of a set and Cartesian product with suitable examples. Also find  $P(A)$ ,  $P(B)$ ,  $A \times B$  and  $B \times A$  if  $A = \{1, 2, 3\}$ ,  $B = \{4, 5, 6, 7\}$ .
- (b) Show that  $\neg(p \vee (\neg p \wedge q))$  and  $(\neg p \wedge \neg q)$  are logically equivalent.

29. (a) Draw Hasse diagram representing the partial ordering  $\{(a, b) / a \text{ divides } b\}$  on  $\{1, 2, 3, 4, 6, 8, 12\}$ .
- (b) Show the Boolean Expressions  $(x_1, x_2) \cdot x_3$  and  $x_1 \cdot (x_2, x_3)$  are equal.
30. Define planar graph and prove that a graph has a dual iff it is planar.
31. (a) Prove that every tree has either one or two centre.
- (b) Prove that every circuit has an even number of edges in common with any cut-set.
32. (a) A connected graph is Euler graph iff it can be decomposed into circuits.
- (b) The max vertex connectivity of a graph  $G$  with  $n$  vertices and edges ( $e \geq n - 1$ ) is the integral part of the number  $\frac{2e}{n}$ .

(3 × 10 = 30 marks)

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