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DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

End Semester Examination – Summer 2019

Course: B. Tech in CE/ CS / CS&E

Semester: III

Subject Name: Discrete Mathematics

Subject Code: BTCOC302

Max. Marks: 60

Date: 29 / 05 / 2019

Duration: 3 Hrs.

**Instructions to the Students:**

1. Solve ANY FIVE questions out of the following.
2. The level question/expected answer as per OBE or the Course Outcome (CO) on which the question is based is mentioned in ( ) in front of the question.
3. Use of non-programmable scientific calculators is allowed.
4. Assume suitable data wherever necessary and mention it clearly.

	(Level/ CO)	Marks
<b>Q.1 Solve Any Three of the following.</b>		
A) Among integers 1 to 1000, i. How many of them are not divisible by 3 nor by 5 nor by 7? ii. How many are not divisible by 5 or 7 but divisible by 3?	Application	4
B) Among integers 1 to 300, i. How many of them are not divisible by 3 nor by 5 nor by 7? ii. How many of them are divisible by 3 but not by 5, nor by 7?	Application	4
C) i. Obtain the Conjunctive Normal Form of $(p \wedge q) \vee (\sim p \wedge q \wedge r)$ ii. Obtain the Disjunctive Normal Form of $\sim (p \rightarrow (q \wedge r))$	understand	4
D) Transcribe the following into logical notation. Let the universe of discourse be the real numbers. i. For any value of $x$ , $x^2$ is non-negative. ii. For every value of $x$ , there is some value of $y$ such that $x \cdot y = 1$ . iii. There are positive values of $x$ and $y$ such that $x \cdot y > 0$ . iv. There is a value of $x$ such that if $y$ is positive, then $x + y$ is negative.	understand	4
<b>Q.2 Solve Any Two of the following.</b>		
A) $X = \{2, 3, 6, 12, 24, 36\}$ R on $X = \{(x, y) \in R, x \text{ divides } y\}$ (a) Construct Hasse diagram. (b) Find maximal and minimal element? (c) Is poset a lattice? Justify.	Synthesis	6
B) Given $A = \{1, 2, 3, 4\}$ and $B = \{x, y, z\}$ . Let R be the following relation from A to B:	understand	6



$$R = \{(1, y), (1, z), (3, y), (4, x), (4, z)\}$$

- (a) Determine the matrix of the relation.
- (b) Find the inverse relation  $R^{-1}$  of  $R$ .
- (c) Determine the domain and range of  $R$ .

C) Given:  $A = \{1, 2, 3, 4\}$ . Consider the following relation in  $A$ :

understand 6

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

- (a) Draw its directed graph.
- (b) Is  $R$  (i) reflexive, (ii) symmetric, (iii) transitive, or (iv) antisymmetric?
- (c) Find  $R^2 = R \circ R$ .

**Q.3 Solve the following.**

A) Consider the second-order homogeneous recurrence relation  $a_n = a_{n-1} + 2a_{n-2}$  with the initial conditions  $a_0 = 2$ , and  $a_1 = 7$ ,

Application 6

- (a) Find the next three terms of the sequence.
- (b) Find the general solution.
- (c) Find the unique solution with the given initial conditions.

B) Solve the following recurrence

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$$t_n = 6t_{n-1} - 11t_{n-2} + 6t_{n-3}$$

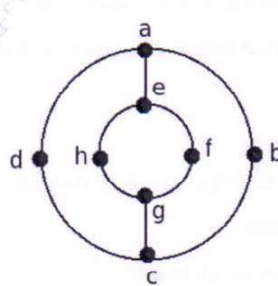
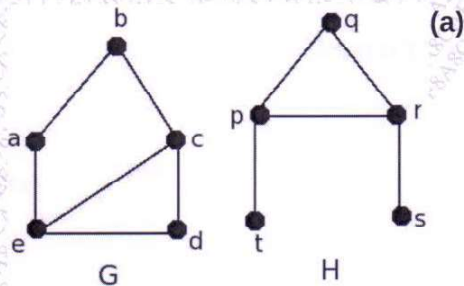
with initial conditions

$$t_0 = 1, t_1 = 5, \text{ and } t_2 = 15$$

**Q.4 Solve Any Two of the following.**

A) Define the isomorphic graph. Are the following graphs shown in fig. (a) and (b) isomorphic?

Understand 6



B) (a) Draw the graph  $K_{2,5}$ .

Understand 6



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(b) Define the following terms:

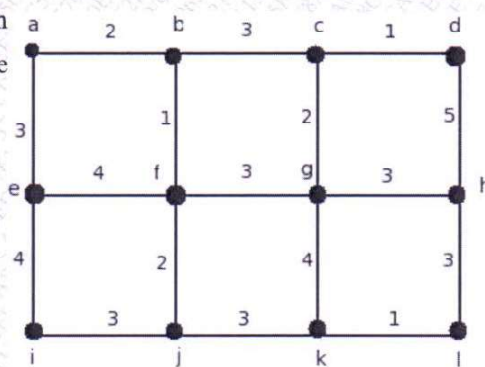
- (i) Planar Graph      (ii) Bipartite Graph      (iii) Complete graph

(c) Draw the 2-regular graph with 5 vertices.

- C) Write the Euler's Formula. Prove that in planar graph  $G$  with  $p$  vertices and  $q$  edges, where  $p \geq 3$  then  $q \geq 3p - 6$ . Knowledge      6

**Q.5 Solve the following.**

- A) Use Prim's algorithm to find a minimum spanning tree in the graph shown in Figure given below.



Understand      6

- B) Construct a Binary Search Tree by inserting the following sequence of numbers:

10, 12, 5, 4, 20, 8, 7, 15, 13.

Also Find Preorder, Inorder and Postorder traversal of Binary Search Tree.

Application      6

**Q.6 Solve the following.**

- A) Define the following terminology:

- (i) Identity Element      (ii) Monoid      (iii) Group      (iv) Algebraic System  
(v) Ring      (vi) Inverse Element

Knowledge      6

- B) Consider the group  $G = \{1, 2, 3, 4, 5, 6\}$  under multiplication modulo 7.

Understand      6

- (a) Find the multiplication table of  $G$ .  
(b) Find the  $2^{-1}$ ,  $3^{-1}$ ,  $6^{-1}$ .  
(c) Find the orders and subgroups generated by 2 and 3.

\*\*\* End \*\*\*

