

**Paper No. 2: Discrete Mathematics (2737)**

**Duration: 2½ Hours**

**Total Marks: 70**

Q.1 (a) If we define a relation R on a set of integers I as follow then check [7]  
whether R is equivalence relation or not.

$$R = \{ (x, y) \mid x, y \in I, x - y \text{ is divisible by } 5 \}.$$

(b) Explain following with example: [7]

(i) Greatest Lower Bound (ii) Least Upper Bound

**OR**

Q.1 (a) Draw Hasse diagram for the following POSETs: [7]

(i)  $\langle P(A), \subseteq \rangle$ , where  $A = \{a, b, c\}$

(ii)  $\langle S_{12}, D \rangle$ , where D denotes the relation of divisor

(iii)  $\langle S_6, \leq \rangle$ , where  $\leq$  denotes the relation of "Less than or equal to".

(b) State and prove following properties of Lattice: [7]

(i) Commutative Law (ii) Associative Law

Q.2 (a) Explain permutation and combination with example. [7]

(b) How many words can be formed using all letters of 'TULSI' ? How many of them starts with 'T' ? [7]

**OR**

Q.2 State Inclusion – Exclusion principle. Using this principle, find the [14]  
number of integers from 1001 to 3000 which are not divisible by each  
of 3, 5 and 7.

Q.3 (a) Construct truth tables for the following: [7]

(i)  $p \wedge (q \vee r) \Leftrightarrow (p \wedge q) \vee (p \wedge r)$

(ii)  $((\neg q) \wedge (q \leftrightarrow p)) \rightarrow (\neg p)$

(b) Using Mathematical Induction Principle, prove that  $n^3 + 2n$  is divisible [7]  
by 3 for all natural numbers n.

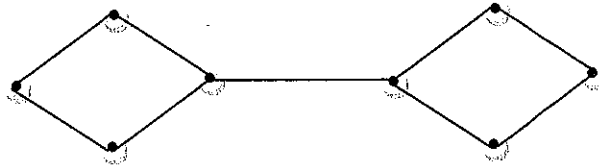
OR

- Q.3 (a) Explain Tautology and Contradiction with example. [7]
- (b) In each of the following cases, verify whether given two formulas are equivalent or not. [7]
- (i)  $\neg(p \vee q \vee r)$  and  $(\neg p) \wedge (\neg q) \wedge (\neg r)$
- (ii)  $p \vee (p \wedge q)$  and  $p$

- Q.4 (a) Define the following terms: [7]
- (i) Simple graph (ii) Adjacent vertices (iii) isolated vertex (iv) cycle  
(v) connected graph (vi) regular graph (vii) subgraph.
- (b) Explain the following graph operations with example: [7]
- (i) Union of two graphs (ii) Intersection of two graphs.

OR

- Q.4 (a) Consider the following graph and answer the questions given below: [7]



- (i) Give names to each vertices and edges
- (ii) Find degree of each vertices
- (iii) Find any two circuits.
- (iv) Find centre(s) of the graph.
- (b) Explain isomorphism of graphs with example. [7]
- Q.5 (a) Prove that a tree with  $n$  vertices has  $n - 1$  edge. [7]
- (b) Describe Travelling Salesman problem. [7]

OR

- Q.5 Write a note on the following: [14]
- a) Konigsberg Seven Bridge Problem
- b) Adjacency matrix of a graph.

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