

B.Tech II Year I Semester (R13) Regular &amp; Supplementary Examinations December 2015

**DISCRETE MATHEMATICS**

(Common to CSE and IT)

Time: 3 hours

Max. Marks: 70

**PART – A**

(Compulsory Question)

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- 1 Answer the following: (10 X 02 = 20 Marks)
- Show the following implication without constructing the truth table:  $(P \rightarrow Q) \rightarrow Q \Rightarrow P \vee Q$
  - State the pigeonhole principle.
  - State the properties of lattices.
  - Let  $(L, \leq)$  be a lattice and  $a, b, c \in L$ . Then prove  $a \vee b = b$  iff  $a \leq b$
  - In how many ways can 5 blue balls, 4 white balls and the rest 6 of different color balls be arranged in a row?
  - Define semi group.
  - What is the principle of mathematical induction?
  - Define the following terms. Give one suitable example for each:
    - Euler path.
    - Euler circuit.
  - Write about graph traversal techniques.
  - Write about isomorphic graphs.

**PART – B**

(Answer all five units, 5 X 10 = 50 Marks)

**UNIT – I**

- 2
- Show that among any 4 numbers one can find 2 numbers so that their difference is divisible by 3
  - Show that among any  $n+1$  numbers one can find 2 numbers so that their difference is divisible by  $n$
- OR**
- 3
- Let  $f: A \rightarrow R$  be defined by  $f(x) = (x-2) / (x-3)$ , where  $A = R - \{3\}$ . Is the function of objective? Find  $f^{-1}$ .
  - Prove that  $(A-B) \cup (B-A) = (A \cup B) - (A \cap B)$  for any two sets  $A$  and  $B$ .

**UNIT – II**

- 4 Let  $(L, \leq)$  be a lattice for any  $a, b, c \in L$ . Prove that  $b \leq c \Rightarrow a * b \leq a * c \Rightarrow a \wedge b \leq a \wedge c$ .

**OR**

- 5
- What is binary relation? Give properties of binary relation.
  - Let  $P(A)$  be the power set of any non empty set  $A$ , then prove that the relation  $\subset$  of set inclusion is not an equivalence relation.

**UNIT – III**

- 6
- Show that the set  $N$  of natural numbers is a semi group under the operation  $x * y = \max \{x, y\}$ . Is it a monoid?
  - Show that the set  $Z$  with binary operation  $*$  such that  $x * y = x^y$  is not semi group.

**OR**

- 7
- In how many different ways can the letters of the word 'OPTICAL' be arranged so that the vowels always come together?
  - In how many ways can a team of 5 persons can be formed out of a total of 10 persons such that two particular persons should not be included in any team?
  - In a birthday party, every person shakes hand with every other person. If there was a total of 28 handshakes in the party, how many persons were present in the party?

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**UNIT – IV**

- 8 (a) Suppose that  $m$  is a fixed integer and  $x \equiv y \pmod{m}$ . Then for every integer  $n \geq 1$ ,  $x^n \equiv y^n \pmod{m}$ . Prove this by mathematical induction
- (b) Suppose that  $f(n) = n \cdot f(n-1)$  with  $f(1) = 1$ . Prove by induction that  $f(n) = n \cdot (n-1) \cdot \dots \cdot 3 \cdot 2 \cdot 1$ .

**OR**

- 9 (a) Solve the Recurrence relation  $a_n = a_{n-1} + 6a_{n-2}$  given the initial conditions  $a_0 = 3$  and  $a_1 = 6$ .
- (b) Solve the recurrence relation  $a_n = 7a_{n-1} - 16a_{n-2} + 12a_{n-3} + n4^n$ , given  $a_0 = -2$ ,  $a_1 = 0$ ,  $a_2 = 5$ .

**UNIT – V**

- 10 (a) Explain Kruskal's algorithm with example.
- (b) When it can be said that two graphs  $G_1$  and  $G_2$  are isomorphic?

**OR**

- 11 (a) Explain DFS algorithm with an example.
- (b) Write about graph coloring.

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