Code No : **19CST305/19ITT305**

R19

II B. Tech I Semester Regular Examinations, March - 2021
MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE
(Common CSE and IT)

Time : 3 Hours **Max. Marks : 60**

Note : Answer **ONE** question from each unit **(5 × 12 = 60 Marks)**

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UNIT-I

1. a) Define tautology and contradiction and verify that $\neg(P \leftrightarrows Q) \Leftrightarrow (P \vee Q) \wedge \neg(P \wedge Q)$ is a tautology. [6M]

   b) Verify the validity of the following argument by using rules of inference [6M]
   ``If there was a ball game, then travelling was difficult. If they arrived on time, then travelling was not difficult. They arrived on time. Therefore, there was no ball game".

(OR)

2. a) Define principal disjunctive normal form and find PDNF of $(P \wedge Q) \vee (\neg P \wedge R) \vee (Q \wedge R)$. [6M]

   b) Verify the principal of duality for [6M]
   $\neg(P \wedge Q) \longrightarrow (\neg P \vee (\neg P \vee Q)) \Leftrightarrow (\neg P \vee Q)$.

UNIT-II

3. a) Show that the relation ``congruence modulo m" over the set of positive integers is an equivalence relation. [6M]

   b) Let A be the set of factors of a particular positive integer m and let $\leq$ be the relation divide, i.e. [6M]
   $\leq = \{(x, y)/x \in A \wedge y \in A \wedge (x \text{ divides } y)\}$. Draw the Hasse diagrams for $m = 12$ and $m = 45$.

(OR)

4. a) Consider the relation $R = \{(a, a), (a, b), (a, c), (b, b), (b, d), (c, c), (c, d)\}$. Draw digraph for the relation R and represent its adjacency matrix. [6M]

   b) In a lattice, show that [6M]
   $(a * b) \oplus (c * d) \leq (a \oplus c) * (b \oplus d)$, for $a, b \in L$

UNIT-III

5. a) Prove that $< z_5, +_5 >$ is an abelian group, where `$+_5$' is the addition modulo 5 of set of integers. [6M]

   b) Let G be a set of all rational numbers and let [6M]
   $a * b = a + b + \frac{ab}{2}, \forall\, a, b, \in Q$. Show that $< G, * >$ is a group.
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(OR)

6. a) State and prove division algorithm. [6M]

   b) Find the $gcd(1000, 625)$ and $lcm(1000,625)$ using prime factorization and verify that [6M]

   $gcd(1000, 625) \times lcm(1000, 625) = 1000 \times 625.$

UNIT-IV

7. a) How many strings of six lower case letters of the english alphabet contain [6M]

   (i) exactly one vowel,

   (ii) exactly two vowels,

   (iii) at least one vowel.

   b) What is the coefficient of $x^{101}y^{99}$ in the expansion of $(2x - 3y)^{200}$. [6M]

(OR)

8. a) Solve the linear recurrence relation by using substitution method $a_n = a_{n-1} + 3^n, n \geq 1, a_0 = 1.$ [6M]

   b) Solve the recurrence relation by using the method of characteristic roots [6M]

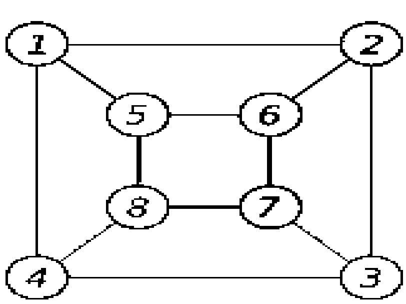
   $a_n - 7a_{n-1} + 12a_{n-2} = 0, n \geq 2, a_0 = 2$ and $a_1 = 5$.

UNIT-V

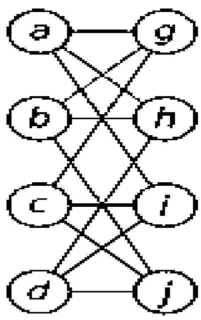
9. a) Explain adjacency and incidence matrices with suitable examples. [6M]

   b) When we say that two graphs G and G' are isomorphic. Check whether the following two graphs are isomorphic or not? [6M]

Graph G



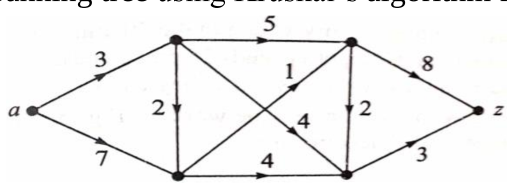
Graph G'



(OR)

10. a) Write Prim's algorithm to find the minimal spanning tree. [6M]

    b) Find the minimal spanning tree using Kruskal's algorithm for the given graph [6M]



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