Printed Pages:02 **Sub Code: NCS302**

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B. Tech.

(SEM III) THEORY EXAMINATION 2018-19

DISCRETE STRUCTURES AND GRAPH THEORY

Time: 3 Hours ***Total Marks: 100***

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.
2. Any special paper specific instruction.

SECTION A

1. Attempt *all* questions in brief. 2 x 10 = 20

a. What is Hasse diagram. Give example.

b. Find the transitive closure of the relation R = {(3,3), (2,2), (1, 3), (2, 1)} on A = {1, 2, 3, 4}

c. Let A is a set with 10 distinct elements. Describe the following:-
(i) No. of different binary relations on A.
(ii) No. of different symmetric relations on A.

d. Show that $p \Rightarrow q$ and $\sim q \Rightarrow \sim p$ are logically equivalent

e. State and prove Lagrange's theorem.

f. Define chromatic number of a graph. Also define four color theorem.

g. Define monoid and subgroup.

h. A connected planar graph has 10 vertices each of degree 3. In how many regions does a representation of this planar graph split the plane.

i. Define Complemented and Bounded lattice.

j. What are the contrapositive, converse, and the inverse of the conditional statement "The home team wins whenever it is raining?"

SECTION B

2. Attempt any *three* of the following: 10 x 3 = 30

a. Find the number of integers between 1 and 250 that are not divisible by any of the integers 2, 3, 5 &7.

b. Prove that the necessary and sufficient condition for a non-empty subset H of a group (G, *) to be a subgroup of G is if a, b $\in$ H $\Rightarrow$ a * $b^{-1} \in$ H.

c. Draw the Hasse diagram of Poset $(\{\{1\},\{2\},\{4\},\{1,2\}\{1,4\},\{2,4\},\{3,4\},\{1,3,4\},\{2,3,4\}\}, \subseteq)$ where composition is usual subset.

d. Obtain PCNF and PDNF of formula $(\sim p \vee \sim q) \rightarrow (p \leftrightarrow \sim q)$

e. Find all solutions of the recurrence relation $a_n = 4a_{n-1} - 4a_{n-2} + (n + 1)2^n$.

SECTION C

3. Attempt any *one* part of the following: 10 x 1 = 10

(a) Define Equivalence relation and equivalence classes. Let R be the relation on the set of real numbers such that xRy if and only if x and y are real numbers that differ by less than 1, that is $|x - y| < 1$. Show that R is not an equivalence relation

(b) Using Mathematical Induction prove
$7+77+777+\ldots\ldots\ldots\ldots + 777\ldots7 = 7/81[10^{n+9}-9n-10]$ for every n € N.

4. Attempt any *one* part of the following: 10 x 1 = 10

(a) What is Ring. Define elementary properties of Ring with example.

(b) Define abelian group. Prove that if (G, *) is an abelian group, if and only if $(a * b)^2 = a^2 * b^2$

5. Attempt any *one* part of the following: 10 x 1 = 10

(a) Let $(A, \leq)$ and $(B, \leq)$ be two posets. Prove that $(A \times B, \leq)$ is a poset, where $(a, b) \leq (c, d)$ if and only if $a \leq c, b \leq d$.

(b) Draw Karnaugh map and simplify the Boolean expression: -
A'B'C'D'+ A'B C' D + A' B' C D + A'B'C D' + A'B C D

6. Attempt any *one* part of the following: 10 x 1 = 10

(a) Using indirect method of proof, derive $p \rightarrow \sim s$ from the premises
$p \rightarrow (q \vee r)$, $q \rightarrow \sim p$, $s \rightarrow \sim r$ and p

(b) Show that the following premises are inconsistent.
(i) If Nirmala misses many classes through illness then he fails high school.
(ii) If Nirmala fails high school, then he is uneducated.
(iii) If Nirmala reads a lot of books then he is not uneducated.
(iv) Nirmala misses many classes through illness and reads a lot of books.

7. Attempt any *one* part of the following: 10 x 1 = 10

(a) Define planar graph. Prove that for any connected planar graph, v – e+ r = 2

Where v, e, r is the number of vertices, edges, and regions of the graph respectively.

(b) In how many ways can a photographer at a wedding arrange six people in a row, including the bride and groom, if
i) the bride must be next to the groom?
ii) the bride is not next to the groom?
iii) the bride is positioned somewhere to the left of the groom?