Subject Code: KCS303

PAPER ID-311218

Roll No:

B TECH
(SEM-III) THEORY EXAMINATION 2020-21
DISCRETE STRUCTURE & THEORY OF LOGIC

Time: 3 Hours *Total Marks: 100*

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

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

Q no.	Question	Marks	CO
a.	Check whether the function $f(x) = x^2 - 1$ is injective or not for $f : R \to R$.	2	CO3
b.	Let R be a relation on set A with cardinality n. Write down the number of reflexive and symmetric relation on set A.	2	CO2
c.	Define group.	2	CO3
d.	Define ring.	2	CO3
e.	Let A = {1, 2, 3, 4, 6, 8, 9, 12, 18, 24} be ordered by the relation 'a divides b'. Find the Hasse diagram.	2	CO3
f.	If L be a lattice, then for every a and b in L prove that $a \wedge b = a$ if and only if $a \leq b$.	2	CO3
g.	Write the negation of the following statement: "If I wake up early in the morning, then I will be healthy."	2	CO1
h.	Express the following statement in symbolic form: "All flowers are beautiful."	2	CO1
i.	Define complete and regular graph.	2	CO4
j.	Prove that the maximum number of vertices in a binary tree of height h is 2^{h+1}, $h \geq 0$.	2	CO4

SECTION B

2. Attempt any *three* of the following:

Q no.	Question	Marks	CO
a.	If $f : R \to R$, $g : R \to R$ and $h : R \to R$ defined by $f(x) = 3x^2 + 2$, $g(x) = 7x - 5$ and $h(x) = 1/x$. Compute the following composition functions i. (fogoh)(x) ii. (gog)(x) iii. (goh)(x) iv. (hogof)(x)	10	CO3
b.	State and prove Lagrange theorem for group.	10	CO3
c.	Prove that in any lattice the following distributive inequalities hold i. $a \wedge (b \vee c) \geq (a \wedge b) \vee (a \wedge c)$ ii. $a \vee (b \wedge c) \leq (a \vee b) \wedge (a \vee c)$	10	CO3
d.	Prove the validity of the following argument "If I get the job and work hard, then I will get promoted. If I get promoted, then I will be happy. I will not be happy. Therefore, either I will not get the job, or I will not work hard."	10	CO1
e.	If a connected planar graph G has n vertices, e edges and r region, then $n - e + r = 2$.	10	CO5

SECTION C

3. Attempt any *one* part of the following:

a.	Prove by mathematical induction for all positive integers that $3.5^{2n+1} + 2^{3n+1}$ is divisible by 17.	10	CO2
b.	Find the numbers between the 100 to1000 that are divisible by 3 or 5 or 7.	10	CO2

4. Attempt any *one* part of the following:

a.	A subgroup H of a group G is a normal subgroup if and only if $g^{-1}hg \in H$ for every $h \in$ and $g \in G$.	10	CO3
b.	In a group (G, *) prove that i. $(a^{-1})^{-1} = a$ ii. $(ab)^{-1} = b^{-1}a^{-1}$	10	CO3

5. Attempt any *one* part of the following:

a.	Simplify the Boolean function $F(A, B, C, D) = \sum (0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 11)$ Also draw the logic circuit of simplified F.	10	CO3
b.	Simplify the following Boolean expressions using Boolean algebra i. $xy + x'z + yz$ ii. $C(B + C)(A + B + C)$ iii. $A + B(A + B) + A(A' + B)$ iv. $XY + (XZ)' + XY'Z(XY + Z)$	10	CO3

6. Attempt any *one* part of the following:

a.	Define tautology, contradiction and contingency? Check whether $(p \vee q) \wedge (\sim p \vee r) \rightarrow (q \vee r)$ is a tautology, contradiction or contingency.	10	CO1
b.	Translate the following statements in symbolic form i. The sum of two positive integers is always positive. ii. Everyone is loved by someone. iii. Some people are not admired by everyone. iv. If a person is female and is a parent, then this person is someone's mother.	10	CO1

7. Attempt any *one* part of the following:

a.	Construct the binary tree whose inorder and preorder traversal is given below. Also, find the postorder traversal of the tree. Inorder: d, g, b, e, i, h, j, a, c, f Preorder: a, b, d, g, e, h, i, j, c, f	10	CO4
b.	Solve the following recurrence relation $a_n - a_{n-1} + 20a_{n-2} = 0$ where $a_0 = -3$, $a_1 = -10$	10	CO3