Sub Code:KCS303

Paper Id: 110323 Roll No:

B. TECH.
(SEM III) THEORY EXAMINATION 2019-20
DISCRETE STRUCTURES & THEORY OF LOGIC

Time: 3 Hours *Total Marks: 100*

Note: 1. Attempt all Section as required. In case any missing data, then choose suitably.

SECTION A

1. Attempt **2 x 10 = 20**

Qno.	Question	Marks	CO
a.	Define various types of functions.	2	CO1
b.	How many symmetric and reflexive relations are possible from a set A containing 'n' elements?	2	CO1
c.	Let Z be the group of integers with binary operation * defined by $a*b=a+b-2$, for all $a,b\in Z$. Find the identity element of the group $\langle Z,*\rangle$	2	CO2
d.	Show that every cyclic group is abelian.	2	CO2
e.	Prove that a lattice with 5 elements is not a boolean algebra.	2	CO3
f.	Write the contra positive of the implication: "if it is Sunday then it is a holiday".	2	CO4
g.	Show that the propositions $p\rightarrow q$ and $\neg p\vee q$ are logically equivalent.	2	CO4
h.	Show that there does not exist a graph with 5 vertices with degrees 1, 3, 4, 2, 3 respectively.	2	CO5
i.	Obtain the generating function for the sequence 4, 4, 4, 4, 4, 4, 4	2	CO5
j.	Define Pigeon hole principle.	2	CO5

SECTION B

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

Qno.	Question	Marks	CO
a.	Prove that $\frac{1}{\sqrt{1}}+\frac{1}{\sqrt{2}}+\frac{1}{\sqrt{3}}+.....+\frac{1}{\sqrt{n}}>\sqrt{n}$ for $n\geq 2$ using principle of mathematical induction	10	CO1
b.	What do you mean by cosets of a subgroup? Consider the group Z of integers under addition and the subgroup H = {…., -12, -6, 0, 6 12, ……} considering of multiple of 6 (i) Find the cosets of H in Z (ii) What is the index of H in Z.	10	CO2
c.	Show that the following are equivalent in a Boolean algebra $a\leq b\Leftrightarrow a*b'=0\Leftrightarrow b'\leq a'\Leftrightarrow a'\vee b=1$	10	CO3
d.	Show that $((P\vee Q)\wedge\neg(\neg Q\vee\neg R))\vee(\neg P\vee\neg Q)\vee(\neg P\vee\neg R)$ is a tautology by using equivalences.	10	CO4
e.	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.	10	CO5

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SECTION C

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

Qno.	Question	Marks	CO
a.	Find the numbers between 1 to 500 that are not divisible by any of the integers 2 or 3 or 5 or 7.	10	CO1
b.	Is the "divides" relation on the set of positive integers transitive? What is the reflexive and symmetric closure of the relation? $R = \{(a, b) \mid a > b\}$ on the set of positive integers?	10	CO1

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

Qno.	Question	Marks	CO
a.	What is Ring? Define elementary properties of Ring with example.	10	CO2
b.	Prove or disprove that intersection of two normal subgroups of a group G is again a normal subgroup of G.	10	CO2

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

Qno.	Question	Marks	CO
a.	Let $(L, \vee, \wedge, \preceq)$ be a distributive lattice and $a,b \in L$. if $a \wedge b = a \wedge c$ and $a \vee b = a \vee c$ then show that $b = c$	10	CO3
b.	Obtain the principle disjunctive and conjunctive normal forms of the formula $(\neg p \rightarrow r) \wedge (q \leftrightarrow p)$	10	CO3

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

Qno.	Question	Marks	CO
a.	Explain various Rules of Inference for Propositional Logic.	10	CO4
b.	Prove the validity of the following argument "if the races are fixed so the casinos are crooked then the tourist trade will decline. If the tourist trade decreases, then the police will be happy. The police force is never happy. Therefore, the races are not fixed.	10	CO4

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

Qno.	Question	Marks	CO
a.	Solve the following recurrence equation using generating function G (K) -7 G (K-1) + 10 G (K-2) = 8K + 6	10	CO5
b.	A collection of 10 electric bulbs contain 3 defective ones (i) In how many ways can a sample of four bulbs be selected? (ii) In how many ways can a sample of 4 bulbs be selected which contain 2 good bulbs and 2 defective ones? (iii) In how many ways can a sample of 4 bulbs be selected so that either the sample contains 3 good ones and 1 defectives ones or 1 good and 3 defectives ones?	10	CO5