Reg No.:_______________ Name:__________________________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Third semester B.Tech examinations (S) September 2020

Course Code: CS201

Course Name: DISCRETE COMPUTATIONAL STRUCTURES

Max. Marks: 100 Duration: 3 Hours

PART A

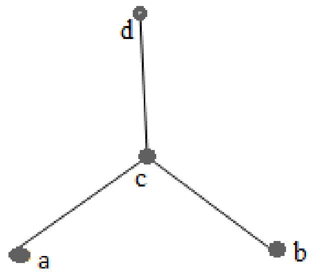
Answer all questions, each carries 3 marks. Marks

1		Show that A x (B∩C) = (AxB)∩ (AxC)	(3)
2		Prove that if a relation R on set A is transitive & irreflexive, then it is asymmetric.	(3)
3		If 9 books are to be kept in 4 shelves, there must be atleast one shelf which contains atleast 3 books. Justify	(3)
4		In how many ways can 6 boys and 4 girls sir in a row? In how many ways can they sit in a row if just the girls are to sit together?	(3)

PART B

Answer any two full questions, each carries 9 marks.

5	a)	Consider f, g and h are functions on set of integers. $f(n)=n+2$, $g(n)=n^2$, $h(n)=3n$. Determine fogoh, gofoh, hofog, fog.	(4)
	b)	If S=N x N and the binary operation * is defined by (a,b)*(c,d)=(ac,bd) for all a,b,c,d in N, show that (S,*) is a semigroup. Is it monoid?	(5)
6	a)	Which of the following relations on {0,1,2,3} are equivalence relation? Justify the answer. R1={(0,0),(1,1),(2,2),(3,3)} R2={(0,0),(0,2),(2,0),(2,2),(2,3),(3,2),(3,3)} R3={(0,0),(1,1),(1,2),(2,1),(2,2),(3,3)} R4={(0,0),(1,1),(2,2),(,3,3),(2,3),(3,2)}	(4)
	b)	Find the number of integers between 1 and 250 both inclusive that are not divisible by any of the integers 2,3,5	(5)
7	a)	Solve the recurrence relation $a_n - 2a_{n-1} = 3^n$; $a_1=5$	(5)
	b)	Determine whether POSET represented by Hasse diagram given below have greatest element, least element, minimal element, maximal element.	(4)



PART C

Answer all questions, each carries 3 marks.

8 Prove that the order of each sub group of a finite group G is a divisor of the order of group G. (3)

9 Let G be a group and suppose that a and b are any elements of G. Show if $(ab)^2=a^2b^2$ then group is abelian. (3)

10 Let $(L,\leq)$ be a lattice and a,b,c,d elements of L. (3)

Prove that if $a\leq c$ and $b\leq d$ then $\mathbf{a \vee b \leq c \vee d}$

11 Define principle of duality in Boolean algebra. (3)

PART D

Answer any two full questions, each carries 9 marks.

12 a) Prove that the necessary and sufficient condition that a non-empty subset of a group G be a subgroup is a,b ε H => ab^{-1} ε H. (5)

b) State and prove Absorption properties of lattice (4)

13 a) Is D_{12} a complemented lattice? Explain (4)

[D_{12} is set of divisors of 12 for the relation R={(x,y)|x divides y}]

b) Show that (Z, •, *) is a ring where a•b=a+b-1 and a*b=a+b-ab (5)

for every a, b є Z (Set of all integers).

14 a) Show that the set {1, 2, 3, 4, 5} is not a group under addition modulo 6 (4)

b) Define boolean algebra and explain how it is related to lattice. (5)

PART E

Answer any four full questions, each carries 10 marks.

15 a) Show that $(p\vee q) \wedge (p\rightarrow r) \wedge (q\rightarrow r)$ tautologically implies r without using truth table (5)

b) Express the following statements in predicate logic. (5)

i)Some students are clever.

ii)All men are kind.

iii) Some person in this class has visited the Grand Canyon.

16	a)	Suppose x is a real number. Consider the statement " if $x^2=4$, then $x=2$" Construct the converse, inverse, contrapositive of the given statement	(5)
	b)	Prove the following implication $\forall x[P(x)\rightarrow Q(x)], \forall x[R(x)\rightarrow \neg Q(x)] \Rightarrow \forall x[R(x)\rightarrow \neg P(x)]$	(5)
17	a)	Show that $p\rightarrow\neg s$ is a valid inference from premises $p\rightarrow(q\vee r)$, $q\rightarrow\neg p$, $s\rightarrow\neg r$	(5)
	b)	Prove that $n(n+2)$ is divisible by 4 by mathematical induction, if n is any even positive integer.	(5)
18	a)	Show that $\neg p \wedge (\neg q\wedge r) \vee (q\wedge r) \vee (p\wedge r) \equiv r$ using truth table.	(5)
	b)	Given the premises P1: All men are selfish. P2: All politicians are men. Prove that the conclusion "All politicians are selfish" is a valid conclusion.	(5)
19	a)	Show that $((p\rightarrow q)\wedge(q\rightarrow r))\rightarrow(p\rightarrow r)$ is a tautology.	(5)
	b)	Prove that $\exists z\, Q(z)$ is a valid conclusion from the premises $\forall x[P(x)\rightarrow Q(x)], \exists y\, P(y)$	(5)
20	a)	If the product of two integers a and b is even, then either a is even or b is even. Prove the statement by contraposition.	(5)
	b)	Using proof by contradiction method, prove that "if 3n+2 is odd, then n is odd"	(5)

****