Reg No.:_______________ Name:__________________________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Third Semester B.Tech Degree (S,FE) Examination January 2022 (2015 Scheme)

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		Let X={1,2,3,4} and R={|x>y}. Draw the graph of R and give its matrix.	(3)
2		Assume A = {1,2,3} and ρ(A) be its power set. Let ⊆ be the subset relation on power set. Draw the Hasse diagram of (ρ(A), ⊆).	(3)
3		Prove that if any 30 people are selected, then we may choose a subset of 5 so that all 5 were born on the same day of the week.	(3)
4		In how many ways can we arrange "FUZZTONE" so that all vowels come together?	(3)

PART B

Answer any two full questions, each carries 9 marks.

5	a)	Let f(x)=x+2, g(x)=x-2, h(x)=3x, for x ϵ R, the set of real numbers. Find gof, fog,fof, foh, hog, hof and fohog.	(4)
	b)	Consider a set of integers from 1 to 250. Find a) How many of these numbers are divisible by 3 or 5 or 7 b) How many are divisible by 3 or 7 but not 5. c) Number of integers divisible by 3 or 5.	(5)
6	a)	Solve the recurrence relation $a_n = -3a_{n-1} - 3a_{n-2} - a_{n-3}$ with $a_0 = 5$, $a_1 = -9$, and $a_2 = 15$.	(5)
	b)	Draw the Hasse diagram for divisibility on the set {1, 2, 3, 4, 5, 6, 7, 8}.	(4)
7	a)	Prove that the set of Idempotent elements of a commutative monoid{M,*,e} forms a submonoid of M.	(4)
	b)	Show that a mapping f:R->R be defined by f(x)=ax+b, where a,b,x ϵ R, a≠0 is invertible. Define its inverse.	(5)

PART C

Answer all questions, each carries 3 marks.

8 Show that the set {0,1,2,3} is not a group under multiplication modulo 4. (3)

9 Define ring homomorphism. (3)

10 Draw the lattice for <D_{30}, /> where D_{30} be the set of all divisors of 30. / denotes the relation divides. (3)

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

PART D

Answer any two full questions, each carries9 marks.

12 a) If * is the operation defined on S =Q X Q, where Q is the set of rational numbers and * is given by (a,b) * (c,d)=(ac,bc+d). Find whether (S,*) is a group? (6)

b) Let < D_{20}, |> denote the poset of all divisors of 20. (3)
Show that D_{20} is a lattice.

13 a) Explain Distributive lattice with an example. (4)

b) Show that (Z, θ, Θ) is a ring where a θ b = a+b-1 and a Θ b = a+b–ab (5)

14 a) Prove that the order of a subgroup of a finite group divides the order of the group. (4)

b) Simplify the boolean algebraic expression AB+A (B+C)+B(B+C). (5)

PART E

Answer any four full questions, each carries 10 marks.

15 a) Show that $(t \wedge s)$ can be derived from premises $p \rightarrow q$, $q \rightarrow \urcorner r$, r, $p \vee (t \wedge s)$. (5)

b) Symbolize the following statement. (i). All men are giants. (ii). Given any positive integer there is a greater positive integer. (5)

16 a) Show that the following premises are in consistent. (5)
If Ram gets his degree he will go for a job. If he goes for a job he will get married soon. If he goes for higher study he will not get married. Ram gets his degree and he goes for higher study.

b) Prove by contra positive that if n^2 is even integer then n is even. (5)

17 a) Show that $(a \rightarrow b) \wedge (a \rightarrow c)$, $\urcorner (b \wedge c)$, $(d \vee a) \Rightarrow d$ (5)

b) (5)
Show that from $(\exists x)(F(x) \wedge S(x)) \rightarrow \forall y(M(y) \rightarrow W(y))$

$$(\exists y)(M(y) \wedge \urcorner W(y))$$

Concludes $(x)\ (F(x) \rightarrow \exists x\ S(x))$.

18	a)	Construct truth table for (i) $(p \leftrightarrow q) \leftrightarrow ((p \wedge q) \vee (\neg p \wedge \neg q))$	(5)
	b)	Show that premises “All men are mortal“ and Socrates is a man “implies “ Socrates is a Mortal“.	(5)
19	a)	Show that $(p \rightarrow q) \wedge (q \rightarrow r) \rightarrow (p \rightarrow r)$ is a tautology.	(5)
	b)	Prove by mathematical induction that $6^{(n+2)} + 7^{(2n+1)}$ is divisible by 43 for each positive integer n.	(5)
20	a)	Use a truth table to verify the distributive law $p \wedge (q \vee r) \equiv (p \wedge q) \vee (p \wedge r)$.	(5)
	b)	Prove that 23^n -1 is divisible by 11 for all positive integers n.	(5)

****