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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S2 (S) Examination January 2026 (2024 Scheme)

Course Code: PCCST205

Course Name: DISCRETE MATHEMATICS

Max. Marks: 60 Duration: 2 hours 30 minutes

PART A

(Answer all questions. Each question carries 3 marks)

		CO	Marks
1	Let *A*, *B*, and *C* be sets. Show that $\overline{A \cup (B \cap C)} = (\overline{C} \cup \overline{B}) \cap \overline{A}$.	CO1	(3)
2	Determine whether the POSET *({1, 3, 6, 9, 12}, |)* is a lattice or not.	CO1	(3)
3	Write the inverse, converse, and contrapositive of the following conditional statement. *If she practices every day and eats healthy food, then she will perform well in the competition.*	CO2	(3)
4	Prove that if n is an integer and $3n + 2$ is even, then n is even using a proof by contraposition.	CO2	(3)
5	Use mathematical induction to prove the inequality $n < 2^n$ for all positive integers n.	CO3	(3)
6	Find the unique solution of the following recurrence relation $a_{n+1} - 3a_n = 0, n \geq 0, a_0 = 5$.	CO3	(3)
7	Show that the cube roots of unity form a cyclic group.	CO4	(3)
8	Prove that in a group (G,*), $(a * b)^{-1} = b^{-1} * a^{-1}$ for all $a, b \in G$.	CO4	(3)

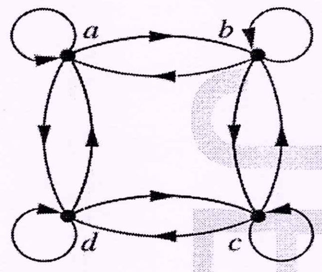
PART B

(Answer any one full question from each module, each question carries 9 marks)

Module -1

			CO	Marks
9	a)	Let $U = \{ 1, 2, 3, 4 \}$ and $A = P(U)$ and R be the subset relation on A ($\subseteq$). Draw Hasse diagram and find out the minimal, maximal, greatest and lowest element of A.	CO1	(9)
10	a)	Consider the functions given by $f(x) = 3x + 4$ and $g(x) = x^2$. Find $g \circ f$ and $f \circ g$.	CO1	(4)

b) Determine whether the relation with the directed graph shown is an equivalence relation? CO1 (5)



Module -2

11 a) Using rules of inference to show that $\neg p$ logically follows from the premises $(p \to q) \land (r \to s), (q \to t) \land (s \to u), \neg(t \to u), (p \to r)$. CO2 (6)

b) Find the argument form for the following argument and determine whether it is valid. Can we conclude that the conclusion is true if the premises are true? CO2 (3)

If Socrates is human, then Socrates is mortal.

Socrates is human.

$\therefore$ *Socrates is mortal.*

12 a) Prove the given equivalence using truth table. CO2 (4)

$(p \land (p \Leftrightarrow q)) \to q \equiv T$.

b) Use rules of inference to show that if $\forall x(P(x) \to (Q(x) \land S(x)))$ and $\forall x(P(x) \land R(x))$ are true, then $\forall x(R(x) \land S(x))$ is true. CO2 (5)

Module -3

13 a) Prove that $1^2 + 3^2 + 5^2 + \ldots + (2n+1)^2 = \frac{(n+1)(2n+1)(2n+3)}{3}$ whenever n is a nonnegative integer, using mathematical induction. CO3 (5)

b) Solve these recurrence relations together with the initial conditions given. CO3 (4)

$a_n = 4a_{n-1} - 4a_{n-2}$ for $n \geq 2, a_0 = 6, a_1 = 8$.

14 a) Find all solutions of the recurrence relation $a_n = -5a_{n-1} - 6a_{n-2} + 42 * 4^n$ with $a_1 = 56$ and $a_2 = 278$. CO3 (9)

Module -4

15	a)	If $(G,*)$ and $(H,\circ)$ be groups with respective identities e_G and e_H. Show that for the homomorphism $f: G \to H$ $f(a^{-1}) = [f(a)]^{-1}$ for every $a \in G$	CO4	(3)
	b)	Prove that the set *{0,1,2,3,4,5}* is a cyclic group of order 6 under addition modulo 6. Draw the composition table.	CO4	(6)
16	a)	State and prove Lagrange's theorem.	CO4	(5)
	b)	Prove that the set Q^+ of all nonzero rational numbers forms a group under the operation of multiplication.	CO4	(4)

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