

Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
B.Tech Degree S2 (R,S) Examinations April 2026 (2024 Scheme)



Course Code: PCCST205

Course Name: DISCRETE MATHEMATICS

Max. Marks: 60

Duration: 2 hours 30 minutes

PART A

Q. No.	(Answer all questions. Each question carries 3 marks)	CO	Marks
1	Let $R = \{(1,1), (1,2), (2,2), (3,3), (3,4), (4,4)\}$ be a relation on the set $A = \{1,2,3,4\}$. Check if R is an equivalence relation.	CO1	(3)
2	Each student in arts section at some college has a Mathematics requirement M and Science requirement S . A poll of 140 students shows that 60 students have met the requirement M , 45 have met S , 20 have met both M and S . Determine how many students have met neither of the two requirements.	CO1	(3)
3	Construct a truth table of the compound proposition $[\neg(p \wedge q) \vee q] \rightarrow \neg p$.	CO2	(3)
4	Find the minimum number of students in a class to be sure that 4 out of them are born in the same month. Write the statement of the principle used.	CO2	(3)
5	Use mathematical induction to show that $n < 2^n$ for all positive integers n .	CO3	(3)
6	Find the unique solution of the recurrence relation $2a_n - 3a_{n-1} = 0, a_0 = 81, n \geq 1$	CO3	(3)
7	For every group G prove that the inverse element of G is unique.	CO4	(3)
8	Define coset of a group. Give an example.	CO4	(3)

PART B

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

Module -1

- 9 a) Show that the relation R on $Z \times R$ $y \Rightarrow x - y$ is divisible by 4 is an equivalence relation for the integers x and y . Also find the equivalence classes. CO1 5
- b) If $i = 1, 2, 3, \dots$ let $A_i = \{i, i + 1, i + 2, \dots\}$, prove that CO1 4
- a) $\bigcup_{i=1}^n A_i = \{1, 2, 3, 4, \dots\}$
- b) $\bigcap_{i=1}^n A_i = A_n$
- 10 a) Let X be a set and $P(X)$ be the power set of X . Prove that $(P(X), \subseteq)$ is a Poset. If $X = \{a, b, c\}$, draw the Hasse diagram. CO1 5
- b) Check whether the following functions are bijective. CO1 4
- a) $f: R \rightarrow R$ defined by $f(x) = 3x + 7$ for all $x \in R$
- b) $g: R \rightarrow R$ defined by $g(x) = x^2$ for all $x \in R$.

Module -2

- 11 a) Establish the validity of the argument by method of proof by contradiction CO2 5

$$r \rightarrow \neg q$$

$$r \vee s$$

$$s \rightarrow \neg q$$

$$p \rightarrow q$$

.....

$$\neg p$$

- b) Let $p(x)$, $q(x)$ and $r(x)$ denote the following statements CO2 4

$$p(x): x^2 - 7x + 10 = 0, \quad q(x): x^2 - 2x - 3 = 0, \quad r(x) = x < 0$$

For the universe of all integers, determine the truth or falsity of following statements. If the statement is false give the counter example.

a) $\forall x [p(x) \rightarrow \neg r(x)]$

b) $\exists x[p(x) \rightarrow r(x)]$

- 12 a) If today is Monday, I have test of Mathematics or Physics. If my Physics professor is sick, I will not have a test of Physics. Today is Monday, and my Physics professor is sick. Therefore, I have a test of Mathematics. Establish the validity of the argument.

- b) Prove the statement without using truth table. CO2 4

$$[(p \rightarrow q) \wedge \neg q] \Leftrightarrow \neg(p \vee q)$$

Module -3

- 13 a) Solve the recurrence relation $a_{n+2} - 3a_{n+1} + 2a_n = 3 + 5n, n \geq 0$ CO3 5

- b) Use mathematical induction to show that CO3 4

$$1 + 2 + 2^2 + 2^3 \dots \dots \dots + 2^n = 2^{n+1} - 1 \text{ for all non-negative integers } n.$$

- 14 a) Solve the recurrence relation CO3 5

$$a_{n+2} - 5a_{n+1} + 6a_n = 2, n \geq 0, a_0 = 1, a_1 = 2 \text{ using generating function.}$$

- b) Solve the recurrence relation CO3 4

$$a_n = 10a_{n-1} + 29a_{n-2}; n \geq 2, a_0 = 0, a_1 = 10.$$

Module -4

- 15 a) List all the elements in the symmetric group S_3 , under function composition. Prove that (S_3, o) is a group. Is it an abelian group? Justify. CO4 5

- b) Let $f: G \rightarrow H$ be a group homomorphism. If G is abelian, prove that H is abelian. CO4 4

- 16 a) If H, K are subgroups of G , then prove that $H \cap K$ is a subgroup of G . CO4 5
- b) Prove that G is abelian if and only if $(ab)^2 = a^2b^2$ for all $a, b \in G$. CO4 4
