Reg No.: ____________________ Name : ____________________

CREATING TECHNOLOGY LEADERS OF TOMORROW ESTD 2002

Jyothi Engineering College(Autonomous)

B. Tech Degree S2 (S) Examination, June 2026 (2025 Scheme)

25CST205 - DISCRETE MATHEMATICS

Total Mark: 60 **Total Time: 2hrs 30 min**

		CO	MARK

PART A

(Answer All Questions. Each question carries 3 marks)

1.	Let $g : R \to R$ where $g(x) = x^4 - x$ for all $x \epsilon R$. Is this a one- to -one function?	CO2 (3)
2.	Let R be the relation on the set of real numbers such that xRy if and only if x and y are real numbers that differ by less than 1 i.e, $\lvert x - y\rvert < 1$. Show that R is not an equivalence relation.	CO2 (3)
3.	Write each of these statements in the form "if p, then q" in English. "The apple trees will bloom if it stays warm for a week."	CO1 (3)
4.	What are the negations of the statements $\forall x(x^2 > x) \text{and} \exists x(x^2 = 2)$?	CO1 (3)
5.	Find the sequence generated by the function $x^2 + 3x + 7 + \frac{1}{1 - x^2}$.	CO5 (3)
6.	There are n guests at a centennial hall. Each person shakes hands with everybody else exactly once. Define recursively the number of shake hands a_n that occur.	CO5 (3)
7.	Let G be a group with subgroups H and K. If number of elements in G and K are 660 and 66 respectively, and if K $\subset$ H $\subset$ G, what are the possible values of number of elements in H.	CO6 (3)
8.	If **S= NxN** , the set of ordered pairs of positive integers with the operation ***** defined by $(a, b) \star (c, d) = (ad + bc, bd)$, prove that **(S, *)** is a semi group.	CO6 (3)

PART B

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

Module - 1

9. a)	Let A={1,2,3,6,9,18}, and the relation is divisibility, draw a Hasse diagram. Is it a lattice?	CO4 (5)
b)	A total of 1230 students have taken a course in Spanish, 875 have taken a course in French, and 115 have taken a course in Russian. Further, 105 have taken courses in both Spanish and French, 25 have taken courses in both Spanish and Russian, and 15 have taken courses in both French and Russian. If 2090 students have taken at least one of Spanish, French, and Russian, how many students have taken a course in all three languages?	CO2 (4)

OR

10. a)	Draw Hasse diagram for set of divisors of 24, $(D_{24}, /)$. Prove that it is a lattice.	CO4 (5)

b) Suppose that R is the relation on the set of strings english letters such that aRb if and only if $L(a) = L(b)$ where $L(x)$ is the length of the string. Check whether this relation is an equivalence relation. CO2 (4)

Module - 2

11. a) Prove that $\sqrt{2}$ is irrational by giving a proof by contradiction. CO1 (5)

b) What is the minimum number of students required in a discrete mathematics class to be sure that at least six will receive the same grade, if there are five possible grades, A, B, C, D, and F? CO2 (4)

OR

12. a) Check the validity of the argument. "If horses or cows eat grass, then the mosquito is the national bird. If the mosquito is the national bird, then peanut butter tastes good on hot dogs. But peanut butter tastes terrible on hot dogs. Therefore, cows didn't eat grass." CO1 (5)

b) 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." CO1 (4)

Module - 3

13. a) Using generating functions, solve the recurrence relation $a_n = 6a_{n-1} - 9a_{n-2}$, where $a_0 = 2$ and $a_1 = 3$. CO5 (5)

b) A vending machine dispensing books of stamps accept only one-dollar coins, \$1 bills and \$5 bills. CO5 (4)

i) Find a recurrence relation for the number of ways to deposit n dollars in the vending machine,where the order in which coins and bills are deposited matters.

ii) What are the initial conditions and how many ways are there to deposit \$10 for a book of stamps?

OR

14. a) Solve using generating function method the recurrence relation $a_k = 3a_{k-1}$ for $k = 1, 2, 3, \ldots\ldots\ldots$ and the initial condition $a_0 = 2$. CO5 (5)

b) Use mathematical induction to prove that $2^n < n!$ for every integer $n \geq 4$. CO5 (4)

Module - 4

15. a) If H and K are subgroups of a Group G, then show that $H \cap K$ is also a subgroup of G. CO6 (5)

b) Define even and odd permutations and identify the following as even or odd. CO6 (4)

i) $\begin{pmatrix} 1 & 2 & 3 & 4 \\ 1 & 2 & 4 & 3 \end{pmatrix}$

ii) $\begin{pmatrix} 1 & 2 & 3 & 4 \\ 1 & 4 & 2 & 3 \end{pmatrix}$

OR

16. a) Let Z_n be the group of all integers mod n under modular addition. List CO6 (5)

(i) all generators of Z_9

(ii) all cyclic subgroups of Z_9, with their order.

b) Let $f : (R^+, \bullet) \rightarrow (R, +)$ is a function defined by $f(x) = \log_{10} x, \forall x \varepsilon R^+$. Verify whether f is an isomorphism. CO6 (4)

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