

## JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY-GURAJADA VIZINAGARAM

II B. Tech I Semester Regular/Supply Examinations, November – 2025

Discrete Mathematics &amp; Graph Theory

(AI&amp;ML, AI&amp;DS,CSE( DS, AI&amp;DS, CS, AI&amp;ML,AI))

Time: 3 hours

Max. Marks: 70

*Question paper consists of Part A, Part B.**Part A is compulsory, Answer all questions.**In Part B, Answer any one question from each unit.*

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## PART-A

(20 Marks)

- 1
  - a) Construct the truth table for  $(PVQ) \vee \neg P$ . [2]
  - b) Define principal disjunctive normal form. [2]
  - c) Symbolize the statement "Rama is handsome and Sita is beautiful". [2]
  - d) Symbolize the statement "Some horses are black" by using predicate logic.. [2]
  - e) Define an equivalence relation. [2]
  - f) Draw the Hasse diagram for  $\{(2, 3, 4, 9, 12, 18):/\}$ , where / denotes the relation division}. [2]
  - g) Define index of a sub group. [2]
  - h) Define coset. [2]
  - i) Find the generating function of the sequence 2, -2, 2, -2, ... [2]
  - j) Find the recurrence relation of the sequence 1, 1, 2, 3, 5, 8,... [2]

## PART-B

(50 Marks)

## Unit-1

- 2
  - a) Verify whether the following formula is a tautology or a contradiction  $\neg(P \vee (Q \wedge R)) \not\equiv (P \vee Q) \wedge (P \vee R)$ . [5]
  - b) Obtain the principal conjunctive normal form of  $(P \wedge Q) \vee (\neg P \wedge R)$ . [5]
- 3
 

(OR)

Discuss about Consistency of Premises in detail and show that the following premises are inconsistent. [10]

If Jack misses many classes through illness, then he fails high school.  
 If Jack fails high school, then he is uneducated.  
 If Jack reads a lot of books, then he is not uneducated.  
 Jack misses many classes through illness and reads a lot of books.

## Unit-2

- 4
  - a) Show that  $(\exists x)(M(x))$  follows logically from the premises  $(x)(H(x) \rightarrow M(x))$  and  $(\exists x)(H(x))$ . [5]
  - b) Verify the validity of the following argument by using the rules of inference [5]
 

"Every living thing is a plant or an animal.  
 John's goldfish is alive and it is not a plant.  
 All animals have hearts.  
 Therefore John's goldfish has a heart".

(OR)

- 5
  - a) Using proof by contradiction show that  $\sqrt{2}$  is not a rational number. [5]
  - b) Prove that  $(x)(P(x) \rightarrow Q(x)) \wedge (x)(Q(x) \rightarrow R(x)) \Rightarrow (x)(P(x) \rightarrow R(x))$ . [5]

## Unit-3

- 6
  - a) In a group of 1000 people, there are 750 who can speak Hindi and 400 who can speak Punjabi. How many can speak both Hindi and Punjabi. [5]
  - b) Show that if any five numbers from '1' to '8' are chosen, then two of them will add to 9. [5]

(OR)

- 7 a) Let  $S$  be the set of all integers. Define a relation  $R$  on  $S$  as  $R = \{a - b \text{ is an even number, for all } a, b \in S\}$ . Prove that the relation  $R$  is an equivalence relation. [5]
- b) Let  $\langle L, \leq \rangle$  be a lattice in which  $*$  and  $\oplus$  denote the operation of meet and join respectively. Prove that for any  $a, b \in L, a \leq b \Leftrightarrow a * b = a \Leftrightarrow a \oplus b = b$ . [5]

**Unit-4**

- 8 a) Show that the set of natural numbers  $N$  is a semi group under the operation  $x * y = \max \{x, y\}$ . [5]
- b) Show that in a group identity element is unique. [5]
- (OR)

- 9 Consider the group  $G = \{1, 2, 4, 7, 8, 11, 13, 14\}$  under multiplication modulo 15: [10]
- (i) Construct the multiplication table of  $G$ .
- (ii) Find the inverse of each element in  $G$ .
- (iii) Find the order and subgroups generated by 2, 7, and 11.
- (iv) Is  $G$  is Cycle.

**Unit-5**

- 10 a) Solve the linear recurrence relation  $H_n = H_{n-1} + (n - 1), n \geq 2, H_1 = 0$  of the handshake problem by using substitution method. [5]
- b) Solve the linear recurrence relation by using method of characteristic roots.  $a_n - 7a_{n-1} + 12a_{n-2} = 0, n \geq 2, a_0 = 2$  and  $a_1 = 5$ . [5]
- (OR)
- 11 a) Solve the recurrence relation  $a_n - 4a_{n-1} = 0, n \geq 1$  and  $a_0 = 5$  by using generating functions. [5]
- b) Find the general solution for the recurrence relation  $a_n - a_{n-1} = 4(n + n^3)$  where  $n \geq 1$  and  $a_0 = 5$ . [5]

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