

Discrete Structure and Theory of Logic (BCS-303)

M. M. 20

Time: 1.5 Hrs.

Course outcomes	
CO	Find/state/Define (L1-Remember) the various terms and concepts of sets, relations, functions, basic properties of lattices, algebra, theory of logics, graphs and counting computing techniques etc.
CO2	Discuss/ Explain (L2-Understand) the various identities of sets, relations & functions, lattices, algebra and express the arrangements of basic elements of Boolean algebra, K map and graphs.
CO3	Apply/use (L3-Apply) the logical ability such as reasoning, logical deduction and examine the correctness of algorithms. Setup mathematical model real life problem by applying advanced counting/computing techniques which will increase their problem solving approach as well as their programming skills.

Section A

(1X5 = 5 Marks)

Q1. Attempt all questions:

- a) Define the Union and Intersection of two sets with examples. CO1
- b) Find the inverse of the statement "If I study, then I pass the exam." CO1
- c) Define Universal and Existential Quantifiers with examples. CO1
- d) Write the statement "Shikhar will find a good job when he will follow the rules of PSIT" into logical expression. CO1
- e) State the goals of a Discrete Structure. CO1

Section B

(2.5X4 = 10 Marks)

Q2. Attempt all questions:

- a i) Explain the propositions out of the following sentences: CO2
- A. $4 + 7 = 12$ B. What are you doing?
- C. $3n \leq 81, n \in \mathbb{N}$ D. Peacock is our national bird
- Or
- ii) Explain by truth table that (A) $\neg(p \wedge q) \equiv \neg p \vee \neg q$ (B) $\neg(p \rightarrow q) \equiv p \wedge \neg q$ CO2
- b i) Describe the proof of $p \rightarrow (q \rightarrow r) \equiv (p \wedge q) \rightarrow r$ without using truth table. CO2

Or

- ii) In the following statements, Describe the truth value of $\forall xP(x)$ and $\exists xP(x)$. CO2

- (a) $P(x) : x + 1 > x$, domain consists of all real numbers?
- (b) $P(x) : x < 2$, domain consists of all real numbers?
- (c) $P(x) : x^2 > 0$, domain consists of all integers?
- (d) $P(x) : x^3 < 20$, domain is positive integers not exceeding 3?

- c i) Express each of these statements into logical expressions using predicates, quantifiers, and logical connectives. CO2

- a) No one is perfect.
- b) Not everyone is perfect.
- c) All your friends are perfect.
- d) At least one of your friends is perfect.
- e) Everyone is your friend and is perfect.

Or

- ii) Prove De Morgan's law of sets, $\overline{A \cap B} = \bar{A} \cup \bar{B}$. CO2

- d i) For $A = \{1, 3, 5\}$ and $B = \{1, 2, 3\}$, discuss $A - B$, $B - A$, $A \cup B$, $A \cap B$ and $A \oplus B$. CO2

Or

- ii) Let p : Jupiter is a planet and q : India is an island be any two simple statements. Describe (or give) verbal sentence describing each of the following statements. CO2

$\neg p$ (ii) $p \vee \neg q$ (iii) $\neg p \vee q$ (iv) $p \rightarrow \neg q$

Section C

(5X1 = 5 Marks)

Q3

- i) Show that the premises "It is not sunny this afternoon and it is colder than yesterday," "We will go swimming only if it is sunny," "If we do not go swimming, then we will take a canoe trip," and "If we take a canoe trip, then we will be home by sunset" lead to the conclusion "We will be home by sunset." CO3

Or

- ii) Show that the premises "Amit, a student in this class, knows how to write programs in JAVA," and "Everyone who knows how to write programs in JAVA can get a high-paying job" imply the conclusion "someone in this class can get a high-paying job." CO3