B.TECH-CSE

Assignment-3

Semester-3rd (Odd), Session:2025-26

BCS-303: Discrete structure and Theory of Logic

Unit-3 **Unit-Name**: Theory of Logic	**Course Outcome: CO3 –** Employ the rules of propositions and predicate logic to solve the complex and logical problems.
Date of Distribution:	**Faculty Name**: Mr. Anil Gupta

Sr.	MANDATORYQUESTIONS	BL
1	Let p: Jupiter is a planet and q: India is an island is any two simple statements. Give verbal sentence describing each of the following statements. (i) $\neg p$ (ii) $p \vee \neg q$ (iii) $\neg p \vee q$ (iv) $p \rightarrow \neg q$ (v) $p \leftrightarrow q$	3
2	Determine the truth value of each of the following statements (i) If $6 + 2 = 5$, then the milk is white. (ii) China is in Europe or $\sqrt{3}$ is an integer (iii) It is not true that $5 + 5 = 9$ or Earth is a planet (iv) 11 is a prime number and all the sides of a rectangle are equal.	5
3	Find the converse, inverse, and contra positive of each of the following implication. (i) If x and y are numbers such that $x = y$, then $x^2 = y^2$(ii) If a quadrilateral is a square then it is a rectangle.	1
4	Construct the truth table for the following statements. (i) $\neg p \wedge \neg q$ (ii) $\neg(p \wedge \neg q)$ (iii) $(p \vee q) \neg q$ (iv) $(\neg p \rightarrow r) \wedge (p \leftrightarrow q)$	3
5	Verify whether the following compound propositions are tautologies or contradictions or Contingency. (i) $(p\wedge q) \neg(p \vee q)$ (ii) $((p \vee q) \neg p) \rightarrow q$ (iii) $(p \rightarrow q) \leftrightarrow (\neg p \rightarrow q)$ (iv) $((p \rightarrow q) \wedge (q \rightarrow r))\rightarrow (p \rightarrow r)$	3
6	Show that (i) $\neg (p \wedge q) \equiv \neg p \vee \neg q$ (ii) $\neg (p \rightarrow q) \equiv p \wedge \neg q$.	3
7	Using truth table check whether the statements $\neg (p \vee q) \vee (\neg p \wedge q)$ and $\neg p$ are logically	4

	equivalent.	
8	(A) Show that $p \to (q \to r)$ is logically equivalent to $(p \wedge q) \to r$. (B) Establish the validity of the argument $u \to r$ $(r \wedge s) \to (p \vee t)$ $q \to (u \wedge s)$ $\neg t$ q $\therefore p$	3
9	Write the argument below in symbolic form. If the argument is valid, prove it. If the argument is not valid, give a counterexample: If I watch football, then I don't do mathematics If I do mathematics, then I watch hockey ∴ If I don't watch hockey, then I watch football	2
10	Use logical equivalences and the rules of inference to determine whether the following argument is valid. $\neg(\neg p \vee q)$ $\neg z \to \neg s$ $(p \wedge \neg q) \to s$ $\neg z \vee r$ $\therefore r$	4
11	Let $R(x, y, z)$ be "$x + y = z$." Find these truth values: a). $R(2, -1, 5)$ b). $R(x, 3, z)$	1
12	Express each of these statements using quantifiers. Then form a negation of the statement, so that no negation is left of a quantifier. Next, express the negation in simple English. 1. "Some old dogs can learn new tricks." 2. "Every bird can fly." 3. $\forall x(x\ 2 > x)$	5
13	Convert in 1st-order predicate logic. 1. No one talks. 2. Everyone loves himself. 3. Everyone loves everyone. 4. Every student smiles. 5. Every student walks or talks.	3
14	What are quantifiers? Define Universal quantifier (∀) and Existential quantifier (∃) with example.	1
15	Let Q(x, y) be the statement "x+y=x−y". If the domain for both variables consists of all integers, what are the truth values? a. Q(1, 1) b. Q(2, 0) c. $\forall y\, Q(1, y)$ d. $\exists x\, Q(x, 2)$ e. $\exists x\ \exists y\, Q(x, y)$ f. $\forall x\ \exists y\, Q(x, y)$	1

	(ii) What are you doing? (iii) $3n \leq 81, n \in \mathbb{N}$ (iv) Peacock is our national bird (v) How tall this mountain is!	
	SUPPLEMENTARY QUESTIONS	
1	Check whether the statement $p \rightarrow (q \rightarrow p)$ is a tautology or a contradiction without using the truth table.	5
2	Prove: - $p \rightarrow (q \rightarrow r) \equiv (p \wedge q) \rightarrow r$ without using truth table.	5