Department of Mathematics

Question Bank

Branch:CSE/IS/DS

Subject	**Discrete Mathematics and Graph Theory**	**Module 1: Fundamentals of Logic**
Subject Code	**21CIDS31**	

#	Questions	CO's	Marks	BLT
1.	Construct the truth tables for the following compound propositions (i) $p \wedge (\sim q)$ (ii) $(\sim p) \vee q$ (iii) $p \rightarrow (\sim q)$	1	04	
2.	Let p and q be primitive statements for which the conditional $p \rightarrow q$ is false. Determine the truth values of the following compound propositions: i. $p \wedge q$ ii. $(\sim p) \vee q$ iii. $q \rightarrow p$ iv. $(\sim q) \rightarrow (\sim p)$	1	04	1,2
3.	Let p, q and r be propositions having truth values 0, 0 and 1 respectively. Find the truth values of the following compound propositions i. $(p \vee q) \vee r$ ii. $(p \wedge q) \wedge r$ iii. $(p \wedge q) \rightarrow r$ iv. $p \rightarrow (q \wedge r)$ v. $p \wedge (r \rightarrow q)$ vi. $p \rightarrow (q \rightarrow (\sim r))$	1	05	1,2
4.	If the statement q has the truth value 1, determine all truth value assignments for the primitive statements p, r and s for which the truth value of the statement: $(q \rightarrow [(\neg p \vee r) \wedge \neg s]) \wedge [\neg s \rightarrow (\neg r \wedge q)]$ is 1.	1	05	2,3
5.	Prove that, for any proposition p, q, r the compound proposition $\{p \rightarrow (q \rightarrow r)\} \rightarrow \{(p \rightarrow q) \rightarrow (p \rightarrow r)\}$ is a tautology."	1	05	2,3
6.	Prove that, following are tautology. i $p \vee [(\neg p \wedge q)]$ ii $(p \vee q) \vee \neg p$	1	09	3,4
7.	Prove that for any three propositions p, q and r: i) $[(p \vee q) \rightarrow r] \Leftrightarrow [(p \rightarrow r) \wedge (q \rightarrow r)]$	1	05	3,4
8.	Prove following logical equivalence without using Truth table. i. $[(p \vee q) \wedge (p \vee \neg q)] \vee q \Leftrightarrow p \vee q$ ii. $[p \vee q \vee (\neg p \wedge \neg q \wedge r)] \Leftrightarrow (p \vee q \vee r)$ iii. $p \rightarrow (q \rightarrow r) \Leftrightarrow (p \wedge q) \rightarrow r$ iv. $(p \vee q) \vee (\neg p \wedge \neg q \wedge r) \Leftrightarrow (p \vee q \vee r)$	1	09	3,4

9.	Prove that i. $(p \to r) \vee (q \to r) \equiv (p \wedge q) \to r$ ii. $\neg (p \vee (\neg p \wedge q)) \equiv \neg p \wedge \neg q$	1	09	2,3
10.	Define inverse, converse and contrapositive for a conditional $p \to q$. Also show that i) Conditional and its contrapositive logically equivalent. ii) Converse and the inverse are logically equivalent	1	04	2,3
11.	Write converse, inverse and contrapositive of i. If a quadrilateral is a parallelogram, then its diagonals bisect each other. ii. If a real number $x2$ is greater than zero, then x is not equal to zero. iii. If a triangle is not isosceles, then it is not equilateral. (4) If two lines are parallel, then they are equidistant	1	04	2,3
12.	Test the validity of the argument: If Ravi goes out with friends, he will not study, If Ravi does not study, his father becomes angry, His father is not angry therefore Ravi has not gone out with friends	1	04	2,3
13.	Establish the validity of the following Argument. i) $p, p \to q, s \vee r, r \to \sim q \therefore s \vee t$ ii) $(\sim p \vee \sim q) \to (r \wedge s), r \to t, \sim t \therefore p$ iii) $p \to q, q \to (r \wedge s), \neg r \vee (\neg t \vee u), p \wedge t, \therefore u$ iv) $u \to r, (r \wedge s) \to (p \vee t), q \to (u \wedge s), \sim t, q, \therefore p$	1	09	3,4
14.	For the universe of all integers, let p(x), q(x), r(x), s(x) and t(x) denote the following open statements p(x): $x > 0$, q(x): x is even, r(x): x is a perfect square, s(x): x is divisible by 3, t(x): x is divisible by 7. Write the following symbolic statements in words and indicate its truth value: i) $\forall x, [r(x) \to p(x)]$ ii) $\exists x, [s(x) \wedge \sim q(x)]$ iii) $\forall x, \sim[r(x)]$ iv) $\forall x, [r(x) \vee t(x)]$	1	05	3,4
15.	Let p (x, y) and q (x, y) denote the following open statements. P (x, y): $x2 \geq y$, q (x, y): $(x+2) < y$ If the universe for both of x, y is the set of all real numbers, determine the truth value of each of the following statements: $(\boldsymbol{i})\ p\ (2, 4)$ $(\boldsymbol{ii}) q\ (1, \pi)$ $(\boldsymbol{iii}) p\ (-3,8) \wedge q\ (1,3)$ $(\boldsymbol{iv})\ p\ (1/2, 1/3)\ V \sim q\ (-2, -3)$ $(\boldsymbol{v})\ p\ (2,2) \to q\ (1, 1)$	1	05	3,4

	$(\boldsymbol{vi})$ $p\,(1,2) \leftrightarrow \sim q\,(3,8)$.			
16.	Write down the following statements in symbolic form using quantifiers: (1) Every real number has an additive inverse (2) The set of real numbers has a multiplicative identity. (3) The integer 58 is equal to the sum of two perfect squares.	1	05	2,3
17.	Determine the truth value of each of the following quantified statements, the universe being the set of all non-zero integers. (i) $\exists\, x,\ \exists\, y,\ [xy = 1]$ (ii) $\exists\, x,\ \forall\, y,\ [xy = 1]$ (iii) $\forall\, x,\ \exists\, y,\ [xy = 1]$ (iv) $\exists\, x,\ \exists\, y,\ [(2x + y = 5)\Lambda(x - 3y = -8)]$ (v) $\exists\, x,\ \exists\, y,\ [(3x - y = 17)\Lambda(2x + 4y = 3)]$	1	05	3,4

Course Learning Outcome: at the end of the course, the student will be able to:

CO1	Discuss logical reasoning to verify the correctness of the logical statements and Perform set operations.
CO2	Illustrate the concepts of relations, partially ordered sets and lattices in data bases and data structures.
CO3	Employ generating function techniques to solve recurrence relations problems
CO4	Examine recurrence relations to solve problems involving an unknown sequence in engineering problems
CO5	Demonstrate the fundamental concepts in graph theory to learn network analysis.
CO6	Employ the concepts of graphs to understand Mathematical structures, trees, and shortest path techniques in computer applications.