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RNS INSTITUTE OF TECHNOLOGY
Department of Mathematics
I INTERNAL TEST (CS & IS)

SEM : III		**Date : 09-10-2020**
SUB : Discrete Mathematical Structures		**Time : 1:00 – 2:40 pm**
SUB CODE : 18CS36		**Max. Marks: 50**

Q.NO		Question	Marks	BCL	CO
1	a	Find the possible truth values of p, q and r in the following cases: (i) $p \to (q \vee r)$ is false (ii) $p \wedge (q \to r)$ is true.	4	L1, L2	CO1
	b	Define tautology and contradiction. Show that for any propositions p and q, (i) $(p \veebar q) \wedge (p \leftrightarrow q)$ is a contradiction. (ii) $[\neg(p \vee q) \vee (\neg p \wedge q)] \vee p$ is a Tautology.	6	L1,L2	CO1
OR					
2	a	Without using truth tables, prove that $[\neg p \wedge (\neg q \wedge r)] \vee \{(q \wedge r) \vee (p \wedge r)\} \Leftrightarrow r$	5	L3	CO1
	b	Using the laws of logic, prove that $[(\neg p \vee \neg q) \wedge (F_0 \vee p) \wedge p] \Leftrightarrow p \wedge \neg q$	5	L3	CO1
3	a	For any statements p and q, prove the following: (i) $\neg(p \downarrow q) \Leftrightarrow (\neg p \uparrow \neg q)$ (ii) $\neg(p \uparrow q) \Leftrightarrow (\neg p \downarrow \neg q)$	5	L3	CO1
	b	Define dual of a logical statement. Verify the principle of duality for $[\neg(p \wedge q) \to \sim p \vee (\neg p \vee q)] \Leftrightarrow (\neg p \vee q)$	5	L3	CO1
OR					
4	a	Write the converse, inverse and contra positive of the conditional: If a real number x^2 is greater than zero, then x is not equal to zero.	5	L3	CO1
	b	Test the validity of the following argument: I will get grade A in this course or I will not graduate. If I do not graduate, I will join army. I got grade A. Therefore, I will not join the army.	5	L3	CO1
5	a	Establish the validity of the following argument using the rules of inference: $p \to r, \quad \neg p \to q, \quad q \to s \quad \therefore\ \neg r \to s$	5	L3	CO1
	b	Find whether the following argument is valid or not: If a triangle has two equal sides then it is isosceles. If a triangle is isosceles, then it has two equal angles. The triangle ABC does not have two equal angles. Therefore, ABC does not have two equal sides.	5	L3	CO1
OR					
6	a	Consider the following open statements with the set of all real numbers as the universe: $p(x): x \geq 0,\ \ q(x): x^2 \geq 0,\ \ r(x): x^2 - 3x - 4 = 0,\ \ s(x): x^2 - 3 > 0$ Determine the truth values of the following:	5	L3	CO1

Bloom's Cognitive Levels (BCL): L1: Remember, L2: Understand, L3: Apply, L4: Analyse: Evaluate, L6: Create

		(i) $\forall x,\ p(x) \rightarrow q(x)$, (ii) $\forall x, q(x) \rightarrow s(x)$, (iii) $\forall x,\ r(x) \vee s(x)$, (iv) $\exists x,\ p(x) \wedge r(x)$ and (v) $\forall x,\ r(x) \rightarrow p(x)$			
	b	Define free variables and bound variables. Identify the bound variables and the free variables in each of the following expressions (or statements). In both cases the universe comprises all real numbers. (i) $\forall y, \exists z, [\cos(x+y) = \sin(z-x)]$, (ii) $\exists x, \exists y, [x^2 - y^2 = z]$	5	L3	CO1
7	a	Negate and simplify the following: (i)$\forall x, p(x) \rightarrow \neg q(x)$ (ii) $\exists x, [(p(x) \vee q(x)) \rightarrow r(x)]$	6	L3	CO1
	b	Write down the proposition in symbolic form and find its negation: If l, m, n are any integers where $l - m$ and $m - n$ are odd then $l - n$ is even	4	L3	CO1
OR					
8	a	Give a direct proof: "For all integers k and l, if k and l are both even the $k + l$ is even"	3	L3	CO1
	b	Prove by indirect method: "For all positive real numbers $x$and y, if the product xy exceeds 25 then $x > 5\ or\ y > 5$".	4	L3	CO1
	c	Prove by contradiction: "If m is an odd integer then $m + 11$ is an even integer".	3	L3	CO1
9	a	For any proposition $p, q\ and\ r$ prove the following (i) $p \uparrow (q \uparrow r) \Leftrightarrow \neg p \vee (q \wedge r)$ (ii) $\neg(p \uparrow q) \Leftrightarrow \neg p \downarrow \neg q$	5	L3	CO1
	b	Prove the following logical equivalences: (i) $\exists x, p(x) \rightarrow \forall x, q(x) \equiv \forall x, [p(x) \rightarrow q(x)]$ (ii) $\forall x, \{p(x) \wedge [q(x) \wedge r(x)]\} \equiv \forall x, [\{p(x) \wedge q(x)\} \wedge r(x)]$	5	L3	CO1
OR					
10	a	Prove this argument is valid: $\forall x,[p(x) \vee q(x)]$ $\exists x, \neg p(x)$ $\forall x,[\neg q(x) \vee r(x)]$ $\forall x,[s(x) \rightarrow \neg r(x)]$ ――――――― $\exists x, \neg s(x)$	4	L3	CO1
	b	Give (i) a direct proof, (ii) an indirect proof (iii) proof by contradiction for the following statement: "If n is an odd integer, then $n + 9$ is an even integer."	6	L3	CO1

Bloom's Cognitive Levels (BCL): L1: Remember, L2: Understand, L3: Apply, L4: Analyse: Evaluate, L6: Create

QUIZ

Duration: 10 marks **Choose the best answer** $\mathbf{10 \times 1 = 10}$

1. **"The difference of a real number and itself is zero" can be expressed as**
(a) $\forall x, \quad x - x! = 0$ (b) $\forall x, \quad x - x = 0$ (c) $\forall x, \forall y, \; x - y = 0$ (d) $\exists x, \quad x - x = 0$

2. **"The product of two negative real numbers is not negative" is given by**
(a) $\exists x, \forall y, [(x < 0) \wedge (y < 0) \rightarrow (xy > 0)]$ (b) $\exists x, \exists y, [(x < 0) \wedge (y < 0) \wedge (xy > 0)]$
(c) $\forall x, \exists y, [(x < 0) \wedge (y < 0) \wedge (xy > 0)]$ (d) $\forall x, \forall y, [(x < 0) \wedge (y < 0) \rightarrow (xy > 0)]$

3. **"Anil is out for a trip or it is not rainy or Raju is playing chess".**
(a) Anil is out for a trip. (b) Raju is playing chess (c) (a) and (b) (d) (a) or (b).

4. **The premises $(\boldsymbol{p} \wedge \boldsymbol{q}) \vee \boldsymbol{r}$ and $\boldsymbol{r} \rightarrow \boldsymbol{s}$ imply which of the conclusion?**
(a) $p \vee r$ (b) $q \vee s$ (c) $p \vee s$ (d) $q \vee r$

5. **What rule of inference used here? "It is cloudy and drizzling now. Therefore it is cloudy now"**
(a) Addition (b) Simplification (c) Amplification (d) Conjunction

6. **Which rule of inference is used in this argument? "If it is Saturday then mall will be crowded. It is Saturday. Thus, mall is crowded".**
(a) Modus pones (b) Modus Tollens (c) Disjunctive syllogism (d) Rule of syllogism.

7. **Which of the following propositions is tautology?**
(a) $(p \vee q) \rightarrow q$ (b) $p \vee (q \rightarrow p)$ (c) $p \vee (p \rightarrow q)$ (d) both b & c

8. **If $\boldsymbol{p}$: I am in Bengaluru $\boldsymbol{q}$: I love cricket, then $\neg \boldsymbol{q} \rightarrow \boldsymbol{p}$ is**

(a) If I love cricket then I'm in Bengaluru. (b) If I don't love cricket then I'm in Bengaluru.
(c) If I am in Bengaluru then I love cricket. (d) none.

9. **$\boldsymbol{p} \wedge \boldsymbol{q}$ is logically equivalent to** (a) $\neg(p \rightarrow \neg q)$ (b) $p \rightarrow \neg q$ (c) $\neg p \rightarrow \neg q$ (d) $\neg p \rightarrow q$

10. **$\boldsymbol{p} \rightarrow \boldsymbol{q}$ is logically equivalent to** (a) $\neg p \vee q$ (b) $p \vee \neg q$ (c) $\neg p \vee q$ (d) $\neg p \wedge q$
