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Mid Semester Examination 2023

Name of the Program: MCA

Semester: I

Name of the Course: Discrete Structure and Combinatorics

Course Code: TMC 104

Time: 1:30 Hours

MM: 50

Note:

(I) Answer all the questions by choosing *any one of the sub questions*.

(II) Each question contains two parts (i) & (ii). Attempt any one part of choice from each question.

Q.1	(10 Marks)	
(i)	Let us assume that R be a relation on the set of ordered pairs of positive integers such that $((a, b), (c, d)) \in R$ if and only if $ad=bc$. Is R an equivalence relation?	CO1
	OR	
(ii)	Let $R=\{(1,2), (2,3), (3,1)\}$ and $A=\{1,2,3\}$ then find transitive closure of R.	CO1
Q.2	(10 Marks)	
(i)	Show that $p \vee (q \wedge r) \equiv (p \vee q) \wedge (p \vee r)$, using Truth table.	CO2
	OR	
(ii)	Show that $\sqrt{2}$ is irrational by giving a proof by contradiction.	CO2

Q.3	(10 Marks)	
(i)	If $f(x) = x^3$ and $g(x) = x^{1/3}$, for all $x \in \mathbb{R}$ then find $g \circ f$ and $f \circ g$.	CO1
	OR	
(ii)	Show that $\frac{1}{1.2} + \frac{1}{2.3} + \dots + \frac{1}{n(n+1)} = \frac{n}{n(n+1)}$ by mathematical induction.	CO2
Q.4	(10 Marks)	
(i)	Show that the function f defined by $f: \mathbb{R} \rightarrow \mathbb{R}$ such that $f(x) = 5x^3 - 1$ is invertible and also find its inverse.	CO1
	OR	
(ii)	Show that the set \mathbb{Z}^+ of all positive integers under divisibility relation forms a poset. Let $A = \{1, 2, 3, 4, 5, 6\}$ be partial ordered by the relation " x divides y " then draw the Hasse Diagram of (A, \wedge) .	CO1
Q.5	(10 Marks)	
(i)	a. Define Tautologies and prove that the proposition $p \vee \sim p$ is tautology. b. Define contradictions and verify that the proposition $p \wedge (q \wedge \sim p)$ is a contradiction.	CO2
	OR	
(ii)	Using rule of inference, determine whether the following inference pattern are valid or not $\begin{array}{c} \sim t \Rightarrow \sim r \\ \sim s \\ t \Rightarrow w \\ \hline \therefore \frac{(r \vee s)}{w} \end{array}$	CO2