INDIAN INSTITUTE OF INFORMATION TECHNOLOGY, SRI CITY

TERM-I EXAMINATION – MONSOON 2024

DSMA

CSE/ECE:UG1 (IC) Date: 20-09-2024

Duration: 90 Mins (09:15-10:45 AM) **Max. Marks: 20**

Instructions: Roll No: _S20240010028_

1. Marks are indicated in [ ] after each question.
2. Rough Work should be done separately, not with the answers.
3. Answers should be reasoned and derived clearly, not a single-word answer.
4. Be short and precise. Provide the answer to exactly what is asked for.
5. The exam is not open book and student(s) are not allowed to bring Text book(s)/ Photocopies / Hand-written notes / laptops.
6. Follow the instructions mentioned in the questions. Answer all the questions.
7. Return the question paper and answer sheet before leaving the exam hall.

1	a) Find the sum of the series $\sum_{n=1}^{\infty} \frac{2n+1}{n^2(n+1)^2}$.	[2 Marks]
	b) If **A, B,** and **C** are sets, then prove that $$A - (B \cup C) = (A - B) \cap (A - C).$$	[2 Marks]
2	Let the function **f: (0,1) → R** defined by **f(x)= tan** $\left(\pi x - \frac{\pi}{2}\right)$.	[3 Marks]
	a) Show that the function **f** is one-to-one and onto.	
	b) If **c**=cardinality of **R=|R|**, find the cardinality of **(0,1)**.	
	c) Further, check whether **(0,1)** is countable or uncountable.	
3	Construct a truth table for the compound proposition: $(\neg p \leftrightarrow \neg q) \leftrightarrow (q \leftrightarrow r)$.	[2 Marks]
4	Use a proof by contradiction to prove that the sum of an irrational number and a rational number is irrational.	[2 Marks]
5	Translate the statements below using predicate logic: a) "There is a student none of whose friends are also friends with each other." b) "Only cats and dogs are suitable pets"	[4 Marks]
6	Use rules of inference to show that if $\forall x\, (P(x) \vee Q(x))$, $\forall x(\neg Q(x) \vee S(x))$, $\forall x(R(x) \rightarrow \neg S(x))$, and $\exists x \neg P(x)$ are true, then $\exists x \neg R(x)$ is true.	[3 Marks]
7	What is the truth value of the following compound proposition? Reason your answer. $\exists! x \neg P(x) \rightarrow \neg \forall x P(x)$	[2 Mark]

P(x) = T

F $\exists_x \sim P(x)$

T