



मोतीलाल नेहरू राष्ट्रीय प्रौद्योगिकी संस्थान इलाहाबाद  
प्रयागराज -211004 भारत  
Motilal Nehru National Institute of Technology Allahabad  
Prayagraj-211004 [India]

Mid Semester (Odd) Examination, 2022-23

Programme Name: B. Tech

Course Code: CSN11XXX

Branch: CS

Duration: 1 Hour and 30 Minutes

Semester: I

Course Name: Discrete Mathematics

Student Reg. No.:

2 0 2 2 3 0 3 5

Max. Marks: 25

Instructions: (1) All questions are compulsory.

(2) Figures to the right indicate the full marks.

		Marks
Q 1.	<p>a) Define propositions. Select correct propositions from the following:</p> <p>(i) <math>1 + 1 = 3</math></p> <p>(ii) <math>x + 4 &lt; 13</math></p> <p>(iii) This statement is false.</p> <p>(iv) Bring a glass of water.</p> <p>b) Find the negation of the following predicate:</p> <p><math>\forall x \forall y [(x &gt; y) \rightarrow (x - y &gt; 0)]</math>.</p> <p>c) Write the statement "Good food is not cheap" in propositional form.</p> <p>d) Show the converse, inverse, contrapositive, and negation of the following statement.</p> <p>"If Sandra finishes her work, she will go to the basketball game."</p>	[2+1+1+2]
Q 2.	<p>Let <math>L(x, y)</math> be the statement "<math>x</math> loves <math>y</math>," where the domain for both <math>x</math> and <math>y</math> consists of all people in the world. Use quantifiers to express each of these statements.</p> <p>a) Everybody loves Jerry.</p> <p>b) Everybody loves somebody.</p> <p>c) There is somebody whom everybody loves.</p> <p>d) Nobody loves everybody.</p> <p>e) There is somebody whom Lydia does not love.</p> <p>f) There is somebody whom no one loves.</p> <p>g) There is exactly one person whom everybody loves.</p> <p>h) There are exactly two people whom Lynn loves.</p>	[2]
Q 3.	<p>a) Use rule of inference to show that <math>[p \rightarrow (q \vee r)] \Leftrightarrow [(p \wedge \neg q) \rightarrow r]</math></p> <p>b) Is <math>(p \rightarrow q) \wedge (q \rightarrow r) \rightarrow (p \rightarrow r)</math> a tautology? Justify.</p>	[2+2]
Q 4.	<p>Test the validity of the argument:</p> <p>a) If Vishnu received the wire, then he took the plane; and if he took the plane, then he will not be late for the meeting. If the telegram was incorrectly addressed, then Vishnu will be late for the meeting. Either Vishnu received the wire or the telegram was incorrectly addressed. Therefore, either Vishnu took the plane or he will be late for the meeting</p> <p>b) If it snows, Paul will miss class. Paul did not miss class. Therefore, it did not snow.</p>	[2+2+2]

	c) If the races are fixed or the casinos are crooked, then the tourist trade will decline. If the tourist trade decreases, then the police will be happy. The police force is never happy. Therefore, the races are not fixed."	
Q 5.	<p>Show that the premises imply following conclusion.</p> $(\neg p \vee q) \rightarrow r$ $r \rightarrow (s \vee t)$ $\neg s \wedge \neg u$ $\neg u \rightarrow \neg t$ <hr/> $\therefore p$	[3]
Q 6.	<p>a) Give a direct proof of the theorem "If <math>n</math> is an odd integer, then <math>n^2</math> is odd."</p> <p>b) Prove using Proof by Contraposition: if <math>n = ab</math>, where <math>a</math> and <math>b</math> are positive integers, then <math>a \leq \sqrt{n}</math> or <math>b \leq \sqrt{n}</math>.</p>	[4]