Kalinga Institute of Industrial Technology
Deemed to be University, Bhubaneswar
Spring Mid semester Examination-2020
Discrete Mathematics [MA-2013]

Full Marks: 20 **Time: 1.5 hours**

Answer any five questions including question no. 1 which is compulsory.

1. Answer all the following questions. **[1×4]**

(a) What is the negation of the proposition "Anyone living in Los Angeles who has blue eyes will win the lottery and will take their retirement before the age of 50."

(b) Translate the proposition "Not everyone is perfect" into a logical expression.

(c) State which rule of inference is used in the argument: "If it snows today, the university will close. The university is not closed today. Therefore, it did not snow today."

(d) Let p: I bought a lottery ticket this week; q: I won the million dollar jackpot on Friday. Express $\neg p \vee (p \wedge q)$ as an English sentence.

2. Show that $(p \to r) \wedge (q \to r)$ and $(p \vee q) \to r$ are logically equivalent. **[4]**

3. (a) Show that $(p \wedge q) \to (p \vee q)$ is a tautology by developing a series of logical equivalences. **[2]**

(b) Derive relevant conclusion(s) from the following premises using rules of inference: "If I eat spicy foods, then I have strange dreams." "I have strange dreams if there is thunder while I sleep." "I did not have strange dreams." **[2]**

4. Use rules of inference to show that the hypotheses "If it does not rain or if it is not foggy, then the sailing race will be held and the lifesaving demonstration will go on", "If the sailing race is held, then the trophy will be awarded", and "The trophy was not awarded" imply the conclusion "It rained". **[4]**

5. Using method of induction, prove that 21 divides $4^{n+1} + 5^{2n-1}$ whenever n is a positive integer. **[4]**

6. (a) There are 2504 computer science students at a school. Of these, 1876 have taken a course in PASCAL, 999 have taken a course in FORTRAN, and 345 have taken a course in C. Further, 876 have taken courses in both PASCAL and FORTRAN, 231 have taken courses in both FORTRAN and C, and 290 have taken courses in both PASCAL and C. If 189 of these students have taken all three courses, how many of them have not taken a course in any of these three subjects? **[2]**

(b) Using method of induction, prove that **[2]**

$$1 + 2 + 3 + \cdots + n = \frac{n(n+1)}{2}$$

whenever n is a positive integer.

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