



# NATIONAL INSTITUTE OF TECHNOLOGY GOA

Farmagudi, Ponda, Goa, 403401

Programme Name: B.Tech.

Mid Semester Examinations, October-2022

Course Name: Discrete Mathematics

Course Code: CS 203

Date: 17th October

Time: 9.30 AM

Duration: 1 Hour 30 Minutes

Max. Marks: 50

## ANSWER ALL QUESTIONS

- Q1.** Express the below specifications into logical expression (5 M)
- Getting elected follows from knowing the right people  $P \rightarrow Q$
  - You can access the website iff you have paid the subscription fee  $P \leftrightarrow Q$
  - A sufficient condition for the warranty to be good is that you bought the computer less than a year ago.  $Q \rightarrow P$
  - Winds from the south imply a spring thaw
  - Carol gets seasick only if she is on a boat
- Q2.** State the converse, contrapositive and inverse of each of these conditional statements (5 M)
- I will go to beach whenever it is a sunny day
  - When I stay up late, it is necessary that I sleep until noon
- Q3.** Express the predicate logic of the below specifications (10 M)
- None of my friend is perfect, (Hint: X is a person, F(x) is your friend, P(x) represents) perfect
- $$\neg \exists x (F(x) \wedge P(x))$$
- Q4.** Prove using method of induction that 7 divides  $2^{(4n+2)} + 3^{(2n+1)}$  for all nonnegative integers n. (5 M)
- Q5.** (5 M)
- Let  $U = \{1, 2, \dots, n\}$ . Let  $A = \{\langle X, X \rangle \mid X \in U, X \subseteq U\}$ . Find the  $|A|$ ?
  - How many number of elements in the power set  $P(S)$  if  $S = \{\emptyset, 1, 2, 3, \{1, 2\}\}$ ? Give your answer with justification.
- Q6.** Use quantifiers to express the below statements: (10 M)
- If a person is female and is a parent, then this person is someone's mother. (Hint: Quantifiers with a domain consisting of all people, and logical connectives)
  - Everyone has exactly one best friend. (Hint: Domain consisting of all people)
  - Everyone in your class with an internet connection has chatted over the internet with at least one other student in your class. (Hint: Domain consisting of all student of your class)
- Q7.** Find the POSET for the divisibility for the given set  $(\{3, 4, 12, 24, 48, 72\}, /)$  and draw the Hasse diagram (5 M)
- Q8.** In a group of 100 students, 72 students can speak English and 43 students can speak Hindi. Based on these data, answer the following questions: (5 M)
- Find the number of students who can speak English only.
  - Find the number of students who can speak Hindi only.
  - Find the number of students who can speak both English and Hindi.