

**U.G. 4th Semester Examinations 2022****MATHEMATICS (General)****Paper Code : SEC-02****Discrete Mathematics****[CBCS]**

Full Marks : 32

Time : Two Hours

*The figures in the margin indicate full marks.**Candidates are required to give their answers in their own words as far as practicable.*

Notations and symbols have their usual meanings.

**Group - A**1. Answer any **four** questions :

1×4=4

(a) What is quantifier?

(b) If  $A = \{1, 2, 3\}$  and  $B = \{3, 4, 5, 6\}$ , then find  $A \times B$ .(c) If  $S = \{2, 3, 6, 7\}$  and  $T = \{5, 6, 7, 8, 9\}$ , then find the symmetric difference between  $S$  and  $T$ .

(d) Define transitive relation on a set.

(e) What is the negation of the statement  $\forall x^2 > x$ ?

(f) Give the contra positive of the statement "if it is raining then I get wet."

(g) Is the set  $S = \{x \in \mathbb{R} : x + 4 = 4\}$  empty?**Group - B**Answer any **two** questions.

5×2=10

2. Show that  $\neg(p \vee q)$  and  $\neg p \wedge \neg q$  are logically equivalent.3. Draw the Hasse diagram for the partial ordering  $\{(A, B) : A \subseteq B\}$  on the power set  $P(S)$ , where  $S = \{a, b, c\}$ .

[P.T.O.]

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4. Let  $\mathbb{Z}$  be the set of all integers and  $\rho$  be the relation on  $\mathbb{Z}$  defined by

$$\rho = \{(a, b) \in \mathbb{Z} \times \mathbb{Z} : a - b \text{ is divisible by } 7\}$$

Show that  $\rho$  is an equivalence relation.

5. If  $A$ ,  $B$  and  $C$  be any three sets, prove that  $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$ .

### Group - C

Answer any *two* questions.

9×2=18

6. (a) Let  $S$  be a set. Determine whether there is a greatest element and a least element in the poset  $(P(S), \subseteq)$ , where  $P(S)$  denotes the power of  $S$ . 4

(b) If  $S_n$  is the set of all positive divisors of the positive integer  $n$  and  $D$  is the relation of 'division', prove that  $(S_{30}, D)$  is a lattice. 5

7. (a) In a college, 200 students are randomly selected. 140 students like tea, 120 students like coffee and 80 students like both tea and coffee. How many students like neither tea nor coffee? Also find the number of students who like at least one of tea or coffee. 3+3

(b) What does mean by a partition of a non-empty set? Give a partition of the set  $\{1, 2, 0, 5, 4\}$ . 2+1

8. (a) Construct the truth table of the compound proposition  $(p \wedge q) \vee (\neg p \wedge \neg q)$ . 5

(b) An integer  $m$  is said to be related to another integer  $n$  if  $m$  is multiple of  $n$ . Check if the relation is reflexive, symmetric and transitive. 4

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