K–320

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BCA–05

Bachelor of Computer Application B.C.A. IInd Semester Examination Dec., 2023

DISCRETE MATHEMATICS

Time : 2 Hours] [**Max. Marks :** 70

Note* :–** This paper is of Seventy (70) marks divided into two (02) Sections 'A' and 'B'. Attempt the questions contained in these Sections according to the detailed instructions given there in. ***Candidates should limit their answers to the questions on the given answer sheet. No additional (B) answer sheet will be issued.

Section–A

Long Answer Type Questions 2×19=38

***Note* :–** Section 'A' contains Five (05) Long-answer type questions of Nineteen (19) marks each. Learners are required to answer any *two* (02) questions only.

1. (a) Define the following sets with the help of suitable examples : (10)

(i) Empty set

(ii) Finite set

(iii) Infinte set

(iv) Powerset

(v) Complement of a set

(b) Let A = {, 2, 3} and Let B = { 3, 4,}. Find the following : (9)

(i) $A \times B$

(ii) $B \times A$

(iii) $A \times A$

(iv) $B \times B$

2. (a) Let $\int : R \rightarrow R$ and $g : R \rightarrow R$ are two functions. Then, define the composition *fog* and *gof*. If $f(x) = 3x - 5$ and $g(x) = x^2$, then find $fog(x)$ and $gof(x)$. (10)

(b) Write the truth tables for the following propositions : (9)

(i) $(P \vee Q) \rightarrow \sim R$

(ii) $P \rightarrow \sim (Q \wedge R)$

3. (a) Prove that the set of integers is a group with respect to addition. (10)

(b) Define the following :

(i) Venn diagram

(ii) Truth tables

(iii) The pige on hole principle (9)

4. (a) Solve the following linear system of equations using Cramer's rule : (10)

$$x + y + z = 9$$

$$2x - 3y + 2z = 3$$

$$2x - y + z = 6$$

(b) Find the rank of the following matrix : (9)

$$\begin{bmatrix} 3 & 2 & 5 \\ 2 & 4 & 3 \\ 1 & -2 & 3 \end{bmatrix}$$

5. (a) $(A \rightarrow B) \leftrightarrow$ Convert the stalement into basic connectors. (10)

(b) In how many ways a comittee of 3 students can be formed from a group of 3 boys and 2 girls if : (9)

(i) The committee contains 2 boys and 1 girls.

(ii) The committee always includes a particular students.

(iii) The committee always excludes a particular students.

Section–B

Short Answer Type Questions 4×8=32

***Note* :–** Section 'B' contains Eight (08) Short-answer type questions of Eight (08) marks each. Learners are required to answer any *four* (04) questions only.

1. Let X and Y be two sets, then prove that :

$$\overline{X \cap Y} = \bar{X} \cup \bar{Y}$$

2. Let $X = \{2, 3, 6, 12, 18, 24, 36\}$ and $R = \{(x, y) : x \mid y, \forall\, x, y, \in X\}$ be a partial order relation on X. Draw the Hasse diagram of the relation R.

3. Define a constradiction. Check whether the proposition $\sim(((P \to Q) \wedge P) \to Q)$ is a contradiction ?

4. Let R be a relation defined on a set of positive integers such that for all $x, y \in Z$, x R y if and only if $x - y$ is divisible by 5. Prove that R is an equivalence relation.

5. Let $f : R \to R$ be a function defined as $f = 4x - 6$. Show that f is one-one onto function.

6. Show that the set of al positive rational numbers forms an abelian group under the composition :

$$a * b = \frac{ab}{2}$$

7. Define a ring with the help of suitable examples.

8. Let P : | play chess, Q : | walk and R : | study. Write sentences for the following propositions :

   (a) $P \rightarrow Q$

   (b) $\sim P \rightarrow Q$

   (c) $(P \wedge Q) \rightarrow R$

   (d) $P \rightarrow (Q \wedge R)$

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