9. A binary operation * on a non-empty set S is associative if $(a * b) * c = a * (b * c)$, $\forall a, b, c \in S$. Is the binary operation * defined by $a * b = a - b + 5$ associative on Z ?

Section–C   2×16=32

(Long Answer Type Questions)

Note :– Answer any *two* questions. You have to delimit your each answer maximum up to **500** words. Each question carries 16 marks.

10. Let $D_{30} = \{1, 2, 3, 5, 6, 10, 15, 30\}$ be the set of all divisors of 30 and let + and . be two operations on B as defined below :

$a + b$ = LCM of a and b

$a \cdot b$ = GCD of a and b

Also, for each $a \in B$, let us defined $A' = 30/a$. Then, show that $(D_{30}, +, ., ')$ is a Boolean algebra.

11. How many words of 5 letters can be constructed using 2 vowels and 3 consonants of the letter of word 'INVOLUTE' ?

12. Explain the principle of inclusion-exclusion.

13. Define the binary operation with suitable example.

December – Examination 2022

MCA Examination

DISCRETE MATHEMATICS

Paper : MCA-09

Time : 3 Hours]   [*Maximum Marks : 80*

Note :– The question paper is divided into three Sections A, B and C. Write answers as per the given instructions.

Section–A   8×2=16

(Very Short Answer Type Questions)

Note :– Answer all questions. As per the nature of the question delimit your answer in one word, one sentence or maximum up to **30** words. Each question carries 2 marks.

1. (i)   If :

U = {–5, –4, –3, –2, –1, 0, 1, 2, 3, 4, 5}

A = {–5, –2, 1, 2, 4}

B = {–2, –3, 0, 2, 4, 5}

C = {1, 0, 2, 3, 4, 5}

then find A ∪ B and A ∩ C.

(ii) Give the definition of Group.

(iii) Write the negation of the following statements :

Bangalore is the capital of Karnataka.

(iv) Verify the validity of the following arguments :

(a) Tigers are dangerous animals.

(b) There are Tigers.

(c) Therefore there are dangerous animals.

(v) Define the commutative binary operation.

(vi) Let A be a finite set having 4 elements. What is the number of binary operations on A ?

(vii) Let A, B be two finite sets, and $n(A) = 4$, $n(B) = 3$. How many relations are there from A to B ?

(viii) Let A be a finite set such that $n(A) = 5$. Write down the number of relations on A.

Section–B   4×8=32

(Short Answer Type Questions)

Note :– Answer any *four* questions. Each answer should not exceed **200** words. Each question carries 8 marks.

2. Let Q be the set of rational numbers and $f : Q \to Q$ be a function defined by $f(x) = 4x + 5$. Examine if f is bijective.

3. Construct the truth value for each of the following :

(i) $(P \wedge Q) \to (P \vee Q)$

(ii) $(P \wedge Q) \to {}^{\sim}P$

(iii) $(P \to Q) \leftrightarrow ({}^{\sim}P \vee Q)$

4. Write the components statements of the following compound statements and check the compound statement is true or false :

(i) 50 is a multiple of both 2 and 5.

(ii) All living things have two legs and two eyes.

5. Examine the validity of the argument (S1, S2, S3), where :

S1 : All scholars are absent minded.

S2 : John is a scholar.

S3 : John is absent minded.

6. What is Boolean algebra ?

7. Construct the truth tables for the following formulas :

(i) $\sim(\sim P \wedge \sim Q)$

(ii) $(\sim P \vee Q) \wedge (\sim Q \vee P)$

8. A person throws a dice and then tosses a coin. The combined outcomes of the dice and the coin are recorded. How many such possible outcomes are there ? Write all such possible outcomes.