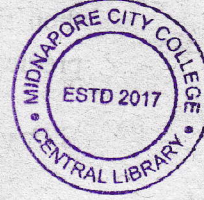# 2022

3rd Semester Examination

MATHEMATICS (Honours)

Paper : SEC 1-T

[CBCS]

Full Marks : 40   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.

(Logic and Sets)

Group - A

Answer any *five* questions :   2×5=10

1. If $A = \{x \in R : 0 \le x \le 1\}$, $B = \{x \in R : 1 \le x \le 2\}$, then find $A \times B$.

2. Define equivalence class of an element. Give an example.

3. Define partial order relation. Give an example.

4. Define power set of a set. Give an example.

5. Define valid argument.

6. What is negation of a predicate? Give an example.

P.T.O.

7. If $D_1 = \{2, 3, 4\}$, $D_2 = \{6, 7, 8\}$ and $D_3 = \{3, 4, 5\}$ are the domains of the variables x, y and z respectively, then find the truth value of the following quantified predicate.

$$\exists x \forall y \exists z \, p(x, y, z), \text{ where } p(x, y, z) : x^2 + y^2 < 3z^2.$$

8. Find the negation of the following statement.

$$(\forall x \in D)(x + 3 < 10), \text{ where } D = \{1, 2, 3, 4\}.$$

Group - B

Answer any *four* questions : $5 \times 4 = 20$

1. Prove that $p \to q, q \to r \models p \to r$.

2. Verify the statement, by truth table :

$$p \leftrightarrow q \equiv (p \to q) \land (q \to p).$$

3. Determine whether the following argument is correct :

If it rains in Spain, then Steffi will win and Gabriela will lose. If Gabriela loses, then Germany will become the team champion. If Steffi wins, then Jenifer will be disappointed. If it does not rain in Spain, then Monica will win. Therefore, either Jenifer will be disappointed and Germany will be the team champion or Monica will win.

4. Examine whether the following relation ρ defined on the set Z is an equivalence relation.

$$\rho = \{(a, b) \in Z \times Z : |a - b| \le 3\}$$

---

5. If ρ be an equivalence relation on a set S and $a, b \in S$. Then prove that $cl(a) = cl(b)$ iff $a\rho b$.

6. If A, B, C are subsets of a universal set S, then prove that $(A-B) \cup (B-C) \cup (C-A) = (A \cup B \cup C) - (A \cap B \cap C)$.

Group - C

Answer any *one* question : $10 \times 1 = 10$

1. (i) Define Cartesian product on n non-empty sets. If $O(A) = n$, and $O(B) = m$, then find $O(P(A \times B))$.   1+1

(ii) Let A, B be subsets of a universal set S. Then prove that $A = B$ iff $A \Delta B = \phi$.   3

(iii) If ρ be a relation defined on $N \times N$ such that "$(a, b) \, \rho \, (c, d)$ iff $ad = bc$" for (a, b), (c, d) $\in N \times N$, then check whether ρ is an equivalence relation?   5

2. (i) What is universal quantifier? Symbolize the following sentences using predicates and quantifiers :

(a) Everybody is not rich.

(b) Every integer is divisible by 6 iff it is divisible by both 2 and 3.   1+2

     P.T.O.

(4)

(ii) Test the logical validity of the following argument :

Some students work hard. All males work hard. Therefore some students are male.   3

(iii) Write down the De Morgan's laws and absorption laws in the set of statement formulas. After then prove any one of the De Morgan's laws and the absorption laws by truth table.   1+3

———

(5)

OR

(Object Oriented Programming in C++)

A. Answer any *five* questions :   2×5=10

(i) What is C++?

(ii) What are different data types in C++?

(iii) What is object in C++?

(iv) What do you mean by call by value and call by reference?

(v) Write the syntex in C++ to read data from keyboard.

(vi) What are member functions?

(vii) What is identifier?

(viii) Define inline function.

B. Answer any *four* questions :   5×4=20

(i) Write different C++ operators.

(ii) Why do we need friend function?
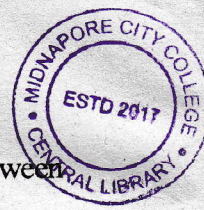
(iii) Write the basic structure of C++ program.

(iv) Write a program to display the following output using a single cout statement.

Maths = 79

Physics = 76

P.T.O.

(v) Write a program to find the larger value between two given numbers from the keyboard.

(vi) Explain copy constructor.

C. Answer any *one* question :　　　　　　10×1=10

　(i) How do we specify a class? Explain inheritance.

　(ii) Write a C++ program to read data of a student (Roll No, Name, Sub) from keyboard and display the data using class.

————————