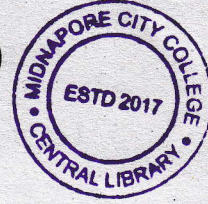


2023

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 : $2 \times 5 = 10$

1. Find the negation of the statement :

$$\forall x p(x) \vee \exists y q(y).$$

2. Let p, q be statements for which the implication $p \rightarrow q$ is false. Determine the truth values for the following :

(i) $p \vee q$

(ii) $\sim q \rightarrow \sim p$

3. Give an example of a relation which is reflexive but neither symmetric nor transitive.

P.T.O.

(2)

4. Find the truth value of the statement $\sim p$ if the statement p is:

(i) $5 + 7 = 12$

(ii) $\log_2 8 = 4$

5. Let $A = \{0, 1\}$. Find $P(P(A))$, where $P(A)$ denotes the power set of A .

6. Determine whether the following sentences are statement or not?

(i) 'Calcutta is in England'.

(ii) 'Where are you going?'.

7. If X be a binary relation defined as $X = \{(a, b) : a, b \in R \text{ and } a - b \leq 3\}$, then determine whether X is symmetric or transitive.

8. Construct a truth table for the following compound statement $\sim(p \vee \sim q) \rightarrow \sim p$, p, q being two statements.

Group - B

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

9. Examine if the relation ρ on the set $Z \times Z$ defined by " $(a, b) \rho (c, d)$ if and only if $ad = bc$ " for $(a, b), (c, d) \in Z \times Z$ if (i) reflexive, (ii) symmetric, (iii) transitive.

(3)

10. Define fallacy. Show that $(p \wedge q) \vee (\sim p \vee \sim q)$ is a fallacy.

11. (i) For the statements p and q , verify that $p \rightarrow [q \rightarrow (p \wedge q)]$ is a tautology.

(ii) Show that the usual inclusion relation ' \subseteq ' is a partial order relation on $\mathcal{P}(X)$, the power set of a set X . 2+3

12. If A, B and C be any three subsets of a set X , then show that $A \times (B \cup C) = (A \times B) \cup (A \times C)$.

13. Using mathematical induction, prove that $1^2 + 2^2 + 3^2 + \dots + n^2 = \frac{n(n+1)(2n+1)}{6}, n \geq 1$.

14. Write the negation for each of the following:

(i) For real number x , if $x > 3$ then $x^2 > 9$.

(ii) "The sum of any two integers is an even integer".

(iii) "For all positive integers x , we have $x + 2 > 8$ ".

(iv) $\exists x \in D, x + 4 \leq 10$ where $D = \{1, 2, 3, 4, 5, 6\}$.

(v) $\forall x \in D, x + 2 < 7$ where $D = \{3, 4, 5, 6, 7\}$.

(4)

Group - C

Answer any *one* question : 10×1=10

15. (i) Show that $p \rightarrow (q \vee r)$ and $(p \rightarrow q) \vee (p \rightarrow r)$ are logically equivalent.

(ii) Show that $r \rightarrow q$ is a valid conclusion from the premises : $p, (p \rightarrow q) \vee (p \wedge (r \rightarrow q))$.

(iii) Symbolize the following :

(I) The square of every real number is positive.

(II) A necessary condition for x to be prime is that either x is odd or $x = 2$. $4+4+2=10$

16. (i) A relation β is defined on by "x β y" if and only if $x^2 - y^2$ is divisible by 5" for $x, y \in \mathbb{Z}$. Prove that β is an equivalence relation on \mathbb{Z} . Show that there are three distinct equivalence classes.

(ii) Let S be a universal set and A be a fixed subset of S . If $A \cap B = B$ holds for all subsets B , prove that $A = S$. $(4+3)+3=10$

(5)

OR

(Object Oriented Programming in C++)

Group - A

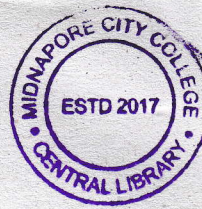
Answer any *five* questions : 2×5=10

1. What is Inline Function?
2. Write the difference between class and structure.
3. How you will declare 2-Dimensional Array in C++?
4. Define Encapsulation.
5. What are the applications of pointer variable?
6. What is a constructor?
7. Define Scope Resolution Operator.
8. Explain how destructor can work in a class.

Group - B

Answer any *four* questions : 5×4=20

9. Describe the different access specifiers in class.
10. Write the role of friend function in C++? Justify your answer with example.
11. Write a program to overload + operator.
12. How do you define member function outside the class? Give example.



13. List the features of oops.
14. Explain various types of constructor with example.

Group - C

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

15. Write the basic structure of C++. What is object? How it is different from class? List the basic difference in C and C++.
 $2+2+3+3=10$
 16. What do you mean by inheritance? Give the types of inheritance supported in C++. Write a program in C++ that showing the use of single inheritance. $2+3+5=10$
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