



'समानो मन्त्रः समितिः समानी'

**UNIVERSITY OF NORTH BENGAL**

B.Sc. Honours 3rd Semester Examination, 2021

**SEC1-P1-MATHEMATICS**

Time Allotted: 2 Hours

Full Marks: 60

*The figures in the margin indicate full marks.  
All symbols are of usual significance.*

**The question paper contains SEC1A and SEC1B. Candidates are required to answer any *one* from the *two* SEC1 courses and they should mention it clearly on the Answer Book.**

**SEC1A**

**C++**

**GROUP-A**

1. Answer any **four** from the given questions: 3×4 = 12

(a) Write a loop statement to show the following output

```
6
6 4
6 4 2
6 4 2 0
6 4 2 0 -2
```

(b) Write a C++ program that displays first 30 odd numbers.

(c) Write a C++ algorithm to exchange the biggest and smallest digit of an input number.

(d) What will be the output of the following program?

```
# include <iostream>
using namespace std;
int main ( )
{
int arr[ ] = { 4, 5, 6, 7};
int * p = (arr + 1);
count << * arr + 10;
}
```

(e) What are the advantages of using templates in C++?

(f) Write a C++ program to swap two numbers using pointer.

**GROUP-B****Answer any four questions**

6×4 = 24

2. Write a C++ program to calculate root of quadratic equation by initializing the object using default constructor. 6
3. Write a C++ program to pick up the largest number from any 5 row by 5 column matrix. 6
4. Fix the compilation errors and find the output of the following program. 6

```
#include <iostream.h>
class test
{
    private
    int x;
    public;
    test (int x = 0) {this → x = x ;}
    void change (test * t) {this = t;}
    void print() {cout << "x =" << x << endl;}
};
void main( )
{
    test obj (5);
    test * ptr = new test (10);
    obj. change (ptr);
    obj print();
}
```

5. Give syntax and explain various functions related to ifstream and ofstream classes: skip(), get line(), hide(), tail(). 6
6. (i) State the difference between call by reference and call by value. 3+2+1  
(ii) Explain: Basic components of STL.  
(iii) What is copy constructor?

7. Consider the following function: 6

```
int test (int a, double b, char ch)
{
    int x;
    if ('A' <= ch && ch <= 'R')
        return (2 * a + static _cost < int > (b));
    else
        return (static _cost < int > (2 * b) - a);
}
```

What is the output of C++ statement?

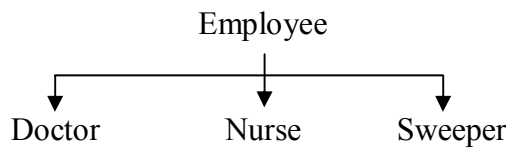
```
cout << 2 * test (6, 3.9, 'D') << endl;
```

**GROUP-C**

Answer any *two* questions

12×2 = 24

8. (a) A 7-digit positive number is entered through the key board. Write a C++ program to calculate sum of digits of 7-digit number: 8
- (i) without using recursion
- (ii) using recursion.
- (b) Write a C++ program that converts all lowercase characters in a given string to its equivalent uppercase characters. 4
9. (a) Write a C++ program to print all prime number from 1 to 500. 6
- (b) Write a program to apply multiple inheritance for the hospital employee payroll system. Calculate the salary in each category. 6



- 10.(a) Explain the call-by references concept with suitable example. 4+5+3
- (b) Discuss about the different types of inheritance in C++ with suitable example. Also show that the order in which the constructor and destructor are called in the inheritance hierarchy.
11. Write a program to define a class and access its members for a student database. 12

**SEC1B**

**LOGIC AND SETS**

**GROUP-A**

1. Answer any *four* questions: 3×4 = 12
- (a) Find  $\bigcup_{n=1}^{\infty} I_n$ , where  $I_n = \left\{ x \in \mathbb{R} : -1 + \frac{1}{n} \leq x \leq 2 - \frac{1}{n} \right\}$  3
- (b) If  $A_n = \left\{ x \mid 0 \leq x \leq \frac{1}{n} \right\}$  where  $n \in \mathbb{N}$ . Find  $\bigcup_{n \in \mathbb{N}} A_n$  and  $\bigcap_{n \in \mathbb{N}} A_n$ . 3
- (c) Show that  $A \times (B \cap C) = (A \times B) \cap (A \times C)$ . 3
- (d) Prove that if  $R_1$  and  $R_2$  are partial order relations then  $R_1 \cap R_2$  is also a partial order relation. 3
- (e) Prove that  $[0, 1]$  is not countable set. 3
- (f) Define Tautology. Check whether  $\sim (A \cap B) \cup A$  is a Tautology or not. 3

**GROUP-B**

**Answer any four from the given questions**

6×4 = 24

2. (a) Without using Venn diagram prove  $A \Delta (B \Delta C) = (A \Delta B) \Delta C$  3+3  
 (b) If  $A \subseteq B$  then prove that  $(A \times B) \cap (B \times A) = A^2$
3. Show that the number of different reflexive relation on a set of  $n$ -elements is  $2^{n(n-1)}$  also show that the number of different antisymmetric relation is  $2^n \cdot 3^{(n^2-n)/2}$  3+3
4. (a) Write the negation of the following conjugation: 3  
 “Barcelona is in Spain and London is in England”  
 (b) Show that empty set is a subset of all non-null set. 2  
 (c) Prove that  $A \times B = \phi$  if  $A = \phi$  or  $B = \phi$  1
5. (a) Prove that 3  

$$(A \cup B \cup C) \cap (A \cup B \cup C') \cap (A \cup B' \cup C) \cap (A' \cup B \cup C)$$

$$= (A \cup B) \cap (B \cup C) \cap (C \cup A)$$
  
 (b) Prove by direct method that for positive numbers  $x$  and  $y$  if  $x \leq y$  then  $\sqrt{x} \leq \sqrt{y}$ . 3
6. Prove that  $\neg(P \wedge Q) \rightarrow (\neg P \vee (\neg P \vee Q)) \Leftrightarrow (\neg P \vee Q)$  6
7. (a) Prove by the method of contradiction that  $\sqrt{2}$  is irrotational. 2  
 (b) Prove that a relation  $R$  on a set  $A$  is symmetric iff  $R^{-1} = R$  2  
 (c) Show that  $\sim q \Rightarrow \sim p \equiv p \Rightarrow q$  2

**GROUP-C**

**Answer any two questions**

12×2 = 24

8. (a) How many solutions does  $x_1 + x_2 + x_3 = 11$  have? Where  $x_1, x_2, x_3$  are nonnegative integers with  $x_1 \leq 3, x_2 \leq 4, x_3 \leq 6$ . 6  
 (b) Suppose that the function  $f: A \rightarrow B$  is a one to one correspondence. Let  $R = \{(a, f(a)) \mid a \in A\}$ . What is the inverse relation  $R^{-1}$ ? 3  
 (c) Construct a truth table for each of these compound proposition 3  
 (i)  $\sim p \rightarrow (q \rightarrow r)$  (ii)  $(p \rightarrow q) \vee (\neg p \rightarrow r)$
9. (a) Use quantifiers and predicates to express the fact that  $\lim_{x \rightarrow a} f(x)$  does not exist. 6  
 (b) Show that both implication and equivalence are transitive. 6

- 10.(a) Show that the premises “A student in this class has not read the book” and “Everyone in this class passed the first exam” imply the conclusion “Someone who passed the first exam has not read the book”. 6
- (b) Verify  $((P \rightarrow R) \wedge (Q \rightarrow R)) \rightarrow ((P \vee Q) \rightarrow R)$  is tautology or not. 6
- 11.(a) Let  $a$  and  $b$  be real numbers. If  $a$  and  $b$  are rationals (irrationals) prove that  $a + b$  is also rational (irrational). 4
- (b) Prove that the set  $X = \{n \in \mathbb{N} \mid n \leq \sqrt{7}\}$  is finite but  $Y = \{x \in \mathbb{Q} \mid x \leq \sqrt{7}\}$  is infinite. 2
- (c) Let  $A$  be some fixed 10-elements subset of  $\{1, 2, 3, \dots, 50\}$ . Show that  $A$  possesses two different 5 element subsets, the sum of whose elements are equal. 4
- (d) Prove that  $\overline{(A - B) - (B - C)} = \overline{A} \cup B$ . 2

—x—