



'সমানো মন্ত্র: সমিতি: সমানী'

**UNIVERSITY OF NORTH BENGAL**

B.Sc. Honours 3rd Semester [Special] Examination, 2022

**SEC1-P1-MATHEMATICS**

Time Allotted: 2 Hours

Full Marks: 60

*The figures in the margin indicate full marks.*

**The question paper contains SEC-1A and SEC-1B. Candidates are required to answer any *one* from the *two* courses and they should mention it clearly on the Answer Book.**

**SEC-1A**

**LOGIC AND SETS**

**GROUP-A**

1. Answer any *four* questions: 3×4 = 12
- (a) Define fallacy with an example.
- (b) Write the differences between  
'0', {0},  $\phi$ ,  $\{\phi\}$
- (c) Write the converse, inverse and contrapositive statements of statements:  
 $p$ : Mr. X is a great man.  
 $q$ : Mr. X is awarded.
- (d) Test for logical equivalence of  
 $\sim (p \vee q) \equiv \sim p \wedge \sim q$
- (e) If  $A = \{x \mid 2 \cos^2 x + \sin x \leq 2\}$  and  
 $B = \{x \mid \pi/2 \leq x \leq 3\pi/2\}$   
then find  $A \cap B$ .
- (f) How many different relations can be defined on a set of  $n$  elements? How many of these are reflexive?

**GROUP-B**

2. Answer any *four* questions: 6×4 = 24
- (a) Show that  $t$  is a valid conclusion from the premises: 6  
 $p \rightarrow q, q \rightarrow r, r \rightarrow s, \sim s$  and  $p \vee t$ .

- (b) (i) Find the HCF and LCM of the numbers 16, 20 and 220 using set theory. 3  
 (ii) Find the cardinality of the power set of a set of cardinality  $n$ . 3
- (c) Using truth table show that the following two statements are equivalent: 6  
 (i) If Ram is 21 years old then he has right to vote.  
 (ii) Ram is not 21 years old then he has a right to vote.
- (d) A relation  $\rho$  defined on  $\mathbb{C} = \{x + iy \mid x, y \in \mathbb{R}\}$  by  $(a + ib) \rho (c + id)$  if and only if  $a \leq c$  and  $b \leq d$  for  $(a + ib), (c + id) \in \mathbb{C}$ . Show that  $\rho$  is a partial order relation. 6
- (e) Translate the following into symbols using quantifiers, variables and predicates: 6  
 (i) All birds can fly.  
 (ii) Not all birds can fly.  
 (iii) There is a student who likes Mathematics but not History.
- (f) Among a group of 300 student of a college, 40 study Mathematics, 70 Computer Science and 50 study Physics. If 20 study both Mathematics and Computer Science, 15 both Physics and Computer Science, 30 both Physics and Mathematics and 10 study all the three subjects. Find the number of students who are studying Physics, Computer Science or Mathematics. 6

**GROUP-C**

**Answer any two questions from the following**

12×2 = 24

3. (a) Prove that 6  

$$\{p \wedge (\sim p \vee q)\} \vee \{q \vee \sim (p \wedge q)\} \equiv q$$
 for three propositions  $p, q$  and  $r$ .
- (b) Show that the premises “A student in this class has not read the book” and “Everyone in this class passed the exam” imply the conclusion “Someone who passed the exam, has not read the book”. 6
4. (a) Define argument. Check the validity of the following arguments: 6  
 Premices:  
 If I enjoy studying then I will study;  
 I do my homework or I will not study;  
 I will not to do my homework;  
 Conclusion: ‘I do not enjoy studying’.
- (b) Construct the table for 4  

$$(a \vee b) \leftrightarrow [(\sim a) \wedge c] \rightarrow (b \wedge c)$$
- (c) If  $p$  and  $q$  are false, is  $(p \vee q) \wedge [(\sim p) \vee (\sim q)]$  true or false? 2
5. (a) For  $A = \{2, 3, 4\}$ ,  $B = \{4, 6, 8\}$  and  $C = \{3, 6, 9\}$ , show that 4  

$$A \times (B \cup C) = (A \times B) \cup (A \times C)$$

- (b) Find the cardinal number of the sets  $A = \{10, 11, 12, \dots\}$  2  
 and  $B = \{x \mid 0 < x < 2\}$
- (c) A relation  $\rho$  on  $\mathbb{Z}$  is defined by  $\rho = \{(a, b) \in \mathbb{Z} \times \mathbb{Z} : 13 \mid a - b\}$  6  
 Show that  $\rho$  is an equivalence relation and find all distinct equivalence classes.
6. (a) Define composition of two relations. If  $R_1$  and  $R_2$  be two symmetric relations on a set  $A$  then prove that  $R_1 \circ R_2$  is symmetric if and only if  $R_1 \circ R_2 = R_2 \circ R_1$  1+4
- (b) Find the inverse of the relation 3  

$$R = \{(x, y) \in \mathbb{R} \times \mathbb{R} \mid y = \frac{2x}{x-2}\}$$
- (c) Prove that the intersection of two equivalence relation is an equivalence relation, but the result fails for union. 4

### SEC-1B

#### C++

#### GROUP-A

1. Answer any **four** questions: 3×4 = 12
- (a) Write an inline function in C++ to find the square of a number.
- (b) What will  $i$  and  $j$  equal after the code below is executed? Explain

```
int i = 5;
int j = i++;
```

- (c) Write a C++ program to find the first 20 multiples of 5.
- (d) What is data type? What are the different data types supported by C++?
- (e) Write a C++ program to find the maximum of two input numbers.
- (f) What will be the output of the following?

```
#include <iostream >
using namespace std;
void main( )
{
    char *s = "C++";
    cout << s << " ";
    s++;
    cout << s << " ";
}
```

**GROUP-B**

Answer any *four* questions

6×4 = 24

2. Write a program in C++ to construct the following pyramid of digits.

```

      1
     2 3 2
    3 4 5 4 3
   4 5 6 7 6 5 4
  5 6 7 8 9 8 7 6 5
    
```

3. (a) What is the difference between equal to (==) and assignment operator (=) ? 3  
 (b) Explain function overloading and operator overloading. 3
4. Write a C++ program to convert Days into years, weeks into Days.
5. Write a C++ program to print all prime numbers between any two positive numbers.
6. Write a C++ program to generate Fibonacci series for *N* numbers.
7. Write a C++ program to find the roots of a quadratic equation.

**GROUP-C**

Answer any *two* questions

12×2 = 24

8. (a) Write a C++ program to reverse a given string. 4  
 (b) Write a C++ program to check a matrix is symmetric or not. 8
9. (a) Write a C++ program to perform addition of complex numbers without operator overloading. 8  
 (b) Write a C++ program to swap two numbers by values. 4
- 10.(a) Explain the difference between Malloc( ) and Calloc( ) with examples. 6  
 (b) Write down the syntax, uses and types of inheritance in C++. 6
- 11.(a) What is constructor in C++? Write a C++ program to demonstrate the use of copy constructor. 4  
 (b) Write a C++ program to exchange the biggest and the smallest digits of an input number. 4  
 (c) What is recursion in C++? Write down its syntax. What are the advantages and disadvantages of recursion? 4

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