B.Sc. Semester-III Examination, 2022-23

MATHEMATICS [Honours]

Course ID : 32115 Course Code : SH/MTH/305/SEC-1

Course Title : Logic and Sets

OR

Programming using C (New)

Time : 2 Hours Full Marks : 40

The figures in the right-hand margin indicate marks.

Candidates are required to give their answers in their own words as far as practicable.

Notations and symbols have their usual meaning.

(Logic and Sets)

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

   a) Construct the truth table for the following compound proposition: $(p \wedge q) \vee (p \wedge r)$.

   b) Find the true value of $\forall x, P(x)$, where $P(x)$ is the statement "$x^2 < 20$" and the domain is the set $\{1,2,3,4\}$.

   c) Determine the truth value of the quantifier $\exists x \in \mathbb{R}$, $x^2 - 2x + 5 = 0$.

   d) For a set $A = \{a, b, c\}$ and $B = \{1,2\}$ verify that $A \times B \neq B \times A$.

   e) If $B \subset A$ then prove that $n(A - B) = n(A) - n(B)$.

   f) Give an example of a relation which is transitive and reflexive but not symmetric.

   g) If $\rho_1 = \{(4,2), (3,4), (1,2), (1,1)\}$ and $\rho_2 = \{(2,2), (4,4), (3,1), (2,1) (1,1)\}$ then find $\rho_1 \circ \rho_2$ and $\rho_2 \circ \rho_1$.

   h) Prove that if $A - B = A$ then $A \cap B = \phi$.

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

   a) i) Prove that the following equivalence: $\sim(p \rightarrow q) \equiv p \wedge \sim q$.

   ii) Find the truth value of $\forall x, \exists y P(x, y)$, where $P(x, y)$ states that "$x^2 + y^2 < 12$" and the domain is $\{1,2,3\}$. 3+2=5

   b) i) Show that $(p \vee q) \wedge (\sim p \wedge \sim q)$ is contradiction.

   ii) Write down the negative of the following statement:

   If the teacher is absent, then some students do not complete their home work. 3+2=5

   c) If $A = \{1,2\}$, $B = \{2,3\}$ and $C = \{3,4\}$ are three given sets then find

   i) $(A \times B) \cup (A \times C)$ and

   ii) $(A \times B) \cap (A \times C)$. 5

d) i) Using set theory find the *l.c.m* of 2, 3 and 4.

ii) Which of the following sets are empty?

$A = \{x: x^2 + 3 = 0 \text{ and } x \text{ is real}\}$,

$B = \{x: x + 10 = 10\}$ and

$C = (x: x \text{ is an integer and } 3 < x < 4)$.

2+3=5

e) Making investigation on 1003 families in a town it is observed that 63 families have no TV or Radio, 794 families have only Radio and 187 families have only TV. How many families have both TV and Radio.

f) R is a relation on the set of all integers $\mathbb{Z}$ defined as aRb iff ab is a perfect square. Examine whether R is an equivalence relation. 5

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

a) i) If A, B, C are subsets of universal set X, prove that

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

ii) Write down the negation of the proposition 'for every x there is a number y such that $y < x$. The domain is the real space $\mathbb{R}$. Hence find truth value of the proposition.

iii) A relation R is defined on the set of all straight lines in two-dimensional plane by aRb iff a is parallel to b. Examine whether R is an equivalence relation. 4+3+3=10

b) i) If R is a relation from A to B and S is a relation from B to C then show that $(R \circ S)^{-1} = S^{-1} \circ R^{-1}$.

ii) If the two propositions p and q are false find whether the proposition $(p \vee q) \wedge (\sim p) \vee (\sim q)$ is true or false.

iii) If $A = \{x \in \mathbb{R}: -1 \le x \le 6\}$ and $B = \{x \in \mathbb{R}: x > 3\}$ then find $(A \cup B)$ and $(A \cap B)$.

5+3+2=10

[Programming using C (New)]

1. Answer any **five** of the following questions: 2×5=10

a) Define main purpose of comments in a C Program.

b) Express the following expression as valid C-expression: $A=\dfrac{\dfrac{7.7(xy+a)}{c}-0.8+2b}{(x+a)(b-c)}$.

c) What is the difference between + + *m* and *m* + +?

d) Suppose *x* = 7, *y* = 5.5, *z* = '*w*'. What will be the result of the logical expression $(x>=6)\&\&(z==' w')$?

e) Write the syntax of the *if – else if* ladder.

f) Consider the statement:

int a[4][5]={1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20};

state the values of a[l][2] and a[3][4].

g) State the output of the following program segment:

```
int a=10, b=20;
b=+ + - -a; a= - - + + b;
printf("%d, %d",a,b);
```


h) Identify the flaws in the following C program, if any:

```
#include<stdio. h>
main()
{ int a= 25, b;
b=sqrt(a);
printf("%d",a);}
```

2. Answer any **four** of the following questions: 5×4=20

a) Write a C program that prints the even numbers from 1 to 100.

b) Write a C program to find the factorial value of any natural number entered through the keyboard.

c) Differentiate between 'High-level language' and 'Low-level language'.

d) Write a program to compute a^b using a user-defined function with function name compute_power, where *a* is of type *float* and *b* is a positive integer.

e) Write a C program to find the sum of the following series:

$$\frac{1}{1^3}-\frac{1}{2^3}+\frac{1}{3^3}-\frac{1}{4^3}+\ldots+\frac{1}{999^3}-\frac{1}{1000^3}$$

f) Write a C program to find the roots and their nature of the given quadratic equation $ax^2 + bx + c = 0$.

3. Answer any **one** of the following questions: 10×1=10

a) i) How many times the word "MATHEMATICS" will be printed by the following program?

```
#include<stdio.h>
int main()
{int a;
for(a=–1; a<=10; a++)
{ if(a<5)
      Continue;
else
      break;
printf("MATHEMATICS");}
}
```

ii) What are the merits and demerits of using array in a C program? Differentiate between one-dimensional and two-dimensional arrays with suitable examples.

iii) What is an identifier? Write down the rules for naming an identifier. What is the difference between an identifier and a variable? 2+(2+2)+(1+2+1)

b) i) Define an array.

ii) Write a program to initialize a two-dimensional array of size 3×4 with the inputs to be taken from the user, and then, print the array in matrix form.

iii) Write a C program to evaluate the power series:

$$e^x = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \ldots + \frac{x^n}{n!},\ 0 < x < 1$$

using if...else statement. 1+5+4

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