[This question paper contains 7 printed pages.]

2135 *Your Roll No.* .....

B.Sc. (Hons.) / II **C**

MATHEMATICS – Paper VI

C++ Programming and Numerical Methods

(Admissions of 2009 and onwards)

Time: 3 Hours *Maximum Marks: 50*

(Write your Roll No. on the top immediately on receipt of this question paper.)

All the **five** *questions are compulsory, marks are indicated against each question. Choice is given within the question. Use of Scientific Calculator is allowed.*

1. Attempt any **four** parts :

   (a) Let x = 5, y = 6, z = 4 and w = 3.5. Evaluate each of the following statements, if possible and justify your answers.

P.T.O.

(i) (y + w) % x

(ii) (x % y) % z (2)

(b) Write a short note on arithmetic operators and operator precedence ? (2)

(c) Evaluate the expression

3*7 – 6 + 2*5/4 + 6. (2)

(d) Which of the following are correct C++ statements :

(i) cout << "Hello there. "<<endl:

(ii) cout << "Hello.":

<<"there" << endl:

(iii) cout << "Hello"

<< "there" << endl:

(iv) cout << 'Hello there' << endl: (2)

(e) What is the output of the following statements ? Let a and b are int variables and c is double variable and a = 13. b = 5 and c= 17.5.

(i) cout << 15/2 - c << endl;

(ii) cout << a static_cast<double>(b) - 2*c << endl; (2)

2. Attempt any **four** parts :

(a) Define one dimensional array ? What is stored in list after the following C++ code executes ?

```
list[0]=5;
for(i= 1; i<6; i--)
{
    list[i] = i*list[i - 1] + 5;
}
```
(2)

(b) Write a c++ program to calculate n!, where n is a natural number. (2)

(c) Suppose that the input is 50, 40, 30, 20 and -2. What is the output of the following code ? Assume all variables are properly declared.

```
cin >> num ;

sum = num ;

while ( num!= -2)


    cin >> sum ;

    sum = sum + num ;

}

cout << "sum " << sum << endl:
```

(2)

(d) Write a while loop and do-while loop that have the same output in the following statement.

```
for (number =1: number<=10: number++)

cout << setw(3) << number:
```

(2)

(e) How do you declare a pointer variable ? (2)

3. Attempt any **two** parts :

(a) Construct an algorithm for the method of false position. Use this algorithm to determine the

third approximation of the root of the equation $x^3 + 2x^2 - 3x - 1 = 0$ on the interval (1.2). (6)

(b) Obtain Newton's formula to determine $\frac{1}{n}$, where n is a natural number. Use it to obtain $\frac{1}{37}$ starling with $x_0 = 0.02$. Do 3 iterations. (6)

(c) Define triangular matrix. Solve the system of equations by Cholesky method.

$$x_1 + 2x_2 - 3x_3 = 5$$

$$2x_1 - 8x_2 + 22x_3 = 6$$

$$3x_1 + 22x_2 - 82x_3 = 10$$ (6)

4. Attempt any **two** parts :

(a) Set up the Gauss Jacobi iteration scheme to solve the system of equations.

$$5x_1 + x_2 + x_3 = 10$$

$$2x_1 + 8x_2 - x_3 = 11$$

$$x_1 + x_2 + 4x_3 = 3$$

Take the initial approximation $X^{(0)} = [0, 0, 0]^T$. Do three iterations. (5)

(b) If $f(x) = \frac{1}{x}$, then evaluate Newton Divided difference f[a, b, c, d]. (5)

(c) Find the forward difference polynomial that fits the data.

x	0.1	0.2	0.3	0.4	0.5
f(x)	1.40	1.56	1.76	2.00	2.28

Hence interpolate at $x = 0.25$. (5)

5. Attempt any **two** parts :

(a) Define the forward difference operator (Δ) and average operator(μ). Prove that Newton Divided difference $f[x_0, x_1, x_2, \ldots, x_n] = \frac{1}{n!h^n} \Delta^n f_0$. (6)

(b) Apply Euler's method to approximate the solution of the initial value problem

$\frac{dy}{dx} = \frac{y-x}{y+x}$, $y(0) = 1$ using step size 0.02. Do 5 steps. (6)

(c) Evaluate $\int \frac{dx}{\cdot - x}$ using

(i) Simpson's one third Rule

(ii) Trapezoidal Rule (6)