This question paper contains 4 printed pages]

Roll No. | | | | | | | | | | | |

S. No. of Question Paper : **1383**

Unique Paper Code : **2221504** **F-7**

Name of the Paper : **Computer Programming and Numerical Analysis**

Name of the Course : **B.Sc. (Hons) Physics Erstwhile FYUP**

Semester : **V**

Duration : **3 Hours** Maximum Marks : **75**

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

Non-programmable scientific calculators are allowed.

Question No. **1** is compulsory.

Attempt any *one* from Section A the and all *three* from Section B.

Attempt *five* questions in all.

1. Answer any *five* of the following : 5×3=15

(*a*) Find the relative error in $x = 0.003444$, if its value is truncated to three decimal places.

(*b*) Write the following expression in C/C++ :

$$3.5 \log_e x + \cos\theta - |x^2 + y^2| + \sqrt{2xy} + e^{-k}$$

(*c*) Show that the rate of convergence of Secant method is approximately 1.62.

(*d*) Explain the differene between if and if ..... else and switch statements in C/C++ with *one* examples of each.

(*e*) Find the largest Eigen value for the matrix using Iterative method (Power Method) :

$$\begin{bmatrix} 1 & 3 & -1 \\ 3 & 2 & 4 \\ -1 & 4 & 10 \end{bmatrix}$$

P.T.O.

(*f*) Find the minimum number to iterations required to attain an accuracy of 0.001 in the interval [1, 2] using bisection methods.

Section A

2. (*a*) What are the different types of data supported by C/C++ ?

(*b*) What is function prototype ?

(*c*) Write a C/C++ program to solve a Quadratic equation of the form $ax^2 + bx + c = 0$ for real, imaginary and equal roots. 5,2,8

3. (*a*) Bring out the difference between 'while' and 'do while' loops with the help of appropriate flow-charts.

(*b*) Write a C/C++ program to write the first 20 natural numbers along with their square-roots using :

(*i*) while/do-while loop and

(*ii*) for loop. 3,12

Section B

4. (*a*) Using Newton Backward difference formula, compute $f(x)$ and $f(4.5)$ from the following set of data :

x	y
1	14
2	27
3	40
4	55
5	68

(*b*) Derive the normal equations in corresponding to the least square fitting for a quadratic curve.

(*c*) Linearly fit the following data :

x	y
1	1.1
1.5	1.3
2	1.6
2.5	2.0
3.0	2.7
3.5	3.4
4.0	4.1

5,5,5

5. (*a*) Use Simpson's rule to compute the integral :

$$I = \int_5^{13} \frac{dx}{x} \text{ with } n = 4$$

(*b*) Solve $y^2 = 1 + y^2$, $h =$ (y at $x = 0.150$) using modified Euler's method at $y = 1.5$ with $h = 0.5$.

(*c*) Find first and second derivative of $f(x)$ at $x = 1.5$ from the following tabulated values :

x	$f(x)$
1	3.23
1.5	3.19
2	3.0
2.5	2.91
3	2.81

5,5,5

Compute the result up to two places of decimal.

6. (*a*) Evaluate $\int_0^1 \frac{dx}{1+x}$ using Gauss Legendre's three point formula given below :

$$\int_{-1}^{1} f(x)dx = \frac{1}{9}\left[5f\left(-\sqrt{3}/5\right)+8f(0)+5f\left(\sqrt{3}/5\right)\right]$$

(*b*) Using Euler's method obtain the solution of the differential equation in the interval [0, 1] :

$$\frac{dy}{dx} = x + y + xy;\ y(0) = 1\ (h = 0.25).$$ 7,8