This question paper contains 4+1 printed pages]

Your Roll No. .....

9657

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

MATHEMATICS——Unit VIII

(Numerical Analysis and Computer Programming)

Time : 2 *Hours* *Maximum Marks* : 30

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

All questions are compulsory.

Choice is given within the question.

Use of Scientific Calculator is allowed.

1. (*a*) Write the character set of FORTRAN 77. 1

(*b*) Write expression in FORTRAN 77 corresponding to the following mathematical expression : 1½

$$2.5 \log_{10} x + \cos 32^\circ + |x^2 - y^2| + \sqrt{2xy}.$$

P.T.O.

(*c*) Which of the following are invalid DO statements ? Give reasons : 2

(*i*) DO 25 J = 2, M, N + 5

(*ii*) DO 30 I = 15

(*iii*) DO 50 K = 0, 10.3

(*d*) Given the marks of 50 students in a class, write a program in FORTRAN to find the highest marks. 3

Or

Write a subroutine subprogram to calculate $n!$ where n is a natural number. Also write a main program which calculates 5!. 3

(*e*) Evaluate :

T. AND..NOT. F. OR. I. GE. 2 * J. AND. I ** 2. E Q.J

when 1½

T = . TRUE.

F = . FALSE.

I = 3

J = 2.

2. (*a*) Define rate of convergence of an iterative method to obtain a root of the equation $f(x) = 0$. Find the rate of convergence of the Newton-Raphson method.

Or

Find a root of the equation :

$$x^4 - x - 10 = 0$$

in the interval [1, 2] using the bisection method. Do 3 iterations. Write the corresponding program in FORTRAN 77. 4

(*b*) Apply Newton-Raphson method to find $N^{\frac{1}{3}}$, for N = 18. Perform 3 iterations. 3

3. (*a*) Solve the system of equations :

$$4x + y + z = 4$$

$$x + 4y - 2z = 4$$

$$3x + 2y - 4z = 6$$

by Gaussian Elimination method with partial pivoting. 3

(*b*) Find the inverse of the coefficient matrix of the system :

$$\begin{bmatrix} 1 & 1 & 1 \\ 4 & 3 & -1 \\ 3 & 5 & 3 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 1 \\ 6 \\ 4 \end{bmatrix}$$

by the Gauss-Jordan method with partial pivoting and hence solve the system.

Or

Solve the system of equations :

$$4x_1 + x_2 + x_3 = 2$$

$$x_1 + 5x_2 + 2x_3 = -6$$

$$x_1 + 2x_2 + 4x_3 = -4$$

using Gauss-Jacobi method. Perform four iterations taking initial approximation as : $x_1^{(0)} = x_2^{(0)} = x_3^{(0)} = 0$. 4

4. (*a*) Obtain the Newton's divided difference interpolating polynomial for the following data :

x	0	2	3	5
$f(x)$	7	9	25	117

and hence find $f(4)$. 4

(*b*) Determine an appropriate step size to be used in the construction of a table of $f(x) = (1 + x)^6$ on $[0, 1]$. The truncation error for linear interpolation is to be bounded by 5×10^{-5}.

Or

(*i*) If $f(x) = \frac{1}{x}$, find $f[x_0, x_1, x_2, x_3]$

(*ii*) Prove :

$$\sum_{k=0}^{n-1} \Delta^2 f_k = \Delta f_n - \Delta f_0$$ 3