JUNE 2008

Code: AE07
Subject: NUMERICAL ANALYSIS & COMPUTER PROGRAMMING
Time: 3 Hours
Max. Marks: 100

NOTE: There are 9 Questions in all.

- **Question 1 is compulsory and carries 20 marks. Answer to Q. 1. must be written in the space provided for it in the answer book supplied and nowhere else.**
- **Out of the remaining EIGHT Questions answer any FIVE Questions. Each question carries 16 marks.**
- **Any required data not explicitly given, may be suitably assumed and stated.**

Q.1 Choose the correct or best alternative in the following: (2x10)

a. What does the following declarations means

(i) int *ptr[10];
(ii) int (*ptr) [10];

(A) (i) Array of 10 pointers
(ii) Same as (i)

(B) (i) Pointers to the array of 10 elements
(ii) Array of 10 integer pointers

(C) (i) Array of 10 integer pointers
(ii) Pointers to the array of 10 elements

(D) (i) Pointers to the array of 10 elements
(ii) Same as (i)

b. What is the output of the following program.

```
#include<stdio.h>
void main( )
   {
      int i=0;
      for(i=0; i<=4; i++);
      printf("Welcome");
   }
```

(A) Welcome will be printed only once
(B) Welcome will be printed 5 times
(C) Error as there should not be **;** at the end of for loop
(D) None of these

c. The convergence of Bisection Method is

(A) linear **(B)** quadratic
(C) cubic **(D)** None of the above

d. If Δ is the Forward Difference operator then the value of $\Delta \log f(x)$ equals to

(A) $\log \Delta f(x)$ **(B)** $\log\left[1+\frac{\Delta f(x)}{f(x)}\right]$
(C) $\log\left[f(x)+\frac{1}{\Delta f(x)}\right]$ **(D)** None of the above

e. The value of $\Delta^2\left(\frac{5x+12}{x^2+5x+6}\right)$ is

(A) $\frac{2(5x+16)}{(x+2)(x+3)(x+4)(x+5)}$ **(B)** $\frac{5x+8}{(x+2)(x+3)}$
(C) $\frac{8}{(x+2)(x+3)(x+4)}$ **(D)** $\frac{2x+5}{(x+2)(x+3)(x+4)}$

f. After Rounding off 865250 to four significant figures, the absolute error will be

(A) 50 **(B)** 86
(C) 6.71×10^{-5} **(D)** None of the above

g. For Trapezoidal Rule, the interpolating polynomial is a

(A) straight line **(B)** parabola
(C) hyperbola **(D)** None of the above

h. Which interpolation method is used for unequal intervals

(A) Langrange's interpolation formulae
(B) Bessel's formulae
(C) Taylor's formulae
(D) None of the above

i. The approximate value of

$$I=\int_0^1 \frac{\sin x}{x}dx$$

by using Two-Point open type rule is

(A) 0.7325 **(B)** 0.9546
(C) 0.6537 **(D)** None of the above

j. Which of the method is not used for finding a solution for differential equation

(A) Runge-Kutta method **(B)** Euler's method
(C) Trapezoidal method **(D)** Taylor's series method

Answer any FIVE Questions out of EIGHT Questions.
Each question carries 16 marks.

Q.2 a. Find a root of the equation $x^3 + x - 1 = 0$, by using Newton-Raphson method. Correct to three decimal places **(8)**

b. Find a real root of the equation $x \log_{10} x = 1.2$ by Regula-Falsi Method correct to 3 decimal places. **(8)**

Q.3 a. Consider the system of equations

$$\begin{bmatrix} 1 & -a \\ -a & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} b_1 \\ b_2 \end{bmatrix}$$ where a is a real constant. Find the values of a for which, the Jacobi and Gauss Seidal Methods converge. **(8)**

b. Show that LU Decomposition method fails to solve the system of equations

$$\begin{bmatrix} 1 & 1 & -1 \\ 2 & 2 & 5 \\ 3 & 2 & -3 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 2 \\ -3 \\ 6 \end{bmatrix}$$

(8)

Q.4 a. Given the data **(8)**

x	0	1	2	3
f(x)	1	2	33	244

Fit Quadratic Splines with $M(0) = f''(0) = 0.$ Hence find f(2.5).

b. Write a program in C to implement Lagrange's Interpolation formula. **(8)**

Q.5 a. The velocity v (km / min) of a vehicle which starts from rest, is given at fined intervals of time t (min) as follows:

t:	2	4	6	8	10	12	14	16	18	20
v:	10	18	25	29	32	20	11	5	2	0

Estimate approximately the distance covered in 20 minutes. **(8)**

b. Evaluate the integral $I=\int_0^{\infty} \frac{dx}{x^2+2x+2}$ using Gauss-Laguerre two point formulae. **(8)**

Q.6 a. Evaluate the integral $I=\int_0^{1} \frac{dx}{1+x}$ using Gauss-Legendre three point formulae.

(8)

b. Find the values of y at x = 0.1 and x = 0.2 to five places of decimals from $dy/dx = x^2y - 1, y(0) = 1,$ by Taylor's series. **(8)**

Q.7 a. Prove with the usual notations, that

(i) $\left(E^{1/2}+E^{-1/2}\right)(1+\Delta)^{1/2} = 2+\Delta$

(ii) $\Delta = \frac{1}{2}\delta^2 + \delta\sqrt{1+\delta^2/4}$

Where E = Shift operator

Δ = Forward difference operator

δ = Central difference operator

(8)

b. Using Runge-Kutta method of 4th order, Solve $\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2}$ with y(0) = 1 at x = 0.2. **(8)**

Q.8 a. Write a C program to solve a system of equations using Gauss-Seidel iteration method. **(10)**

b. Evaluate $\int_0^{6} \frac{dx}{1+x^2}$ by using Trapezoidal Rule. **(6)**

Q.9 a. Compute the middle value of the numbers a = 4.568, b = 6.762 using the four digit arithmetic. **(6)**

b. Write notes of the following
   (i) Storage classes in C programming.
   (ii) Preprocessor in C programming. **(10)**