D 27111 (Pages : 2) Name..............................

Reg. No..............................

FIFTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION, DECEMBER 2006

ME/IAM 04 501—COMPUTATIONAL METHODS IN ENGINEERING

(2004 Admissions)

Time : Three Hours Maximum : 100 Marks

Answer **all** *questions.*

1. (a) Obtain a root of the equation $x^3 - 9x + 1 = 0$ by using Bisection method.

   (b) Using Newton-Raphson method, find the root of $x^3 - 2x - 5 = 0$ correct to three decimal places.

   (c) Solve by Gauss elimination method $2x + y + 4y = 12$; $8x - 3y + 2y = 20$; $4x + 11y - z = 33$.

   (d) Explain relaxation method of solving system of equations.

   (e) Using Newton's formula, compute $f(1.5)$ from the data :

x	:	0	1	2	3	4
$f(x)$	:	858.3	869.6	880.9	892.3	903.6

   (f) Using Trapezoidal rule, evaluate $\int_0^1 \frac{dx}{1 + x^2}$ by dividing (0, 1) into 8 equal parts.

   (g) Using Taylor series method, solve numerically $\frac{dy}{dx} = x^2 - y$, $y(0) = 1$. Compute $y(0.1)$ and $y(0.2)$.

   (h) Given $\frac{dy}{dx} = y + x^2$ with $y(0) = 1$ using Euler's modified method, compute $y(0.05)$ and $y(0.1)$.

(8 × 5 = 40 marks)

2. (a) By using Graeffe's root squaring method, find all the roots of $x^3 - 4x^2 + 5x - 2 = 0$.

(15 marks)

Or

   (b) Using Bairstow's method, obtain the quadratic factors of $x^4 - 1.1x^3 + 2.3x^2 + 0.5x + 3.3 = 0$ starting with the factor $(x^2 + x + 1)$.

(15 marks)

3. (a) By using Gauss-Seidal iteration method, solve the equations :

$$\begin{aligned} 19.2x + 8.3y + z &= 35.2 \\ 5.3x + 16.1y + 4.7z &= 31.6 \\ 1.2x + 2.1y + 4.2z &= 9.9 \end{aligned}$$

   Correct to three decimal places.

(15 marks)

Or

Turn over

(b) By using the power method, find the dominant eigenvalue and the corresponding eigen-vector of the matrix $A = \begin{pmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{pmatrix}$.

(15 marks)

4. (a) Using Lagrange's formula, obtain the value of y when $x = 10$ from the following data :—

x	:	2	5	8	14
y	:	94.8	87.9	81.3	68.7

(8 marks)

(b) Construct a table of divided difference for the following data :—

x	:	0	1	4	5
$f(x)$	:	8	11	78	123

(7 marks)

Or

(c) Obtain the cubic spline approximation for the function given in the tubular form :

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

and M (0) = 0, M (3) = 0.

(8 marks)

(d) Using numerical differentiation, find the value of sec 31° from the following data :—

$\theta°$	:	31	32	33	34
$\tan\theta$	:	0.6008	0.6249	0.6494	0.6745

(7 marks)

5. (a) Using Runge-Kutta fourth order method, compute $y(0.1)$ and $y(0.2)$ if $y(x)$ satisfies $\frac{dy}{dx} = x + yx^2$, with $y(0) = 1$.

(7 marks)

(b) Using Milne's predictor and corrector formulae, compute $y(4.4)$ and $y(4.5)$ if $y(x)$ satisfies $\frac{dy}{dx} = \frac{2 - y^2}{5x}$ with the values :

x	:	4	4.1	4.2	4.3
y	:	1	1.0049	1.0097	1.0143

(8 marks)

Or

(c) Solve the Laplace's equation over the square region $R = \{(x, y)/0 \le x \le 1, 0 \le y \le 1\}$ by dividing the region into squares of size $\frac{1}{3}$. It is given that $u(x, y) = 27(x^2 + y^2)$ on the boundary of R.

(15 marks)