D 12077 (Pages : 3) Name.............................

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FIFTH SEMESTER B.TECH. (ENGINEERING) [14 SCHEME] DEGREE EXAMINATION, NOVEMBER 2016

ME 14 506—COMPUTATIONAL METHODS IN ENGINEERING

Time : Three Hours Maximum : 100 Marks

Part A

Answer any **eight** *questions.*

1. Find an approximate root of $x\log_{10} x - 1.2 = 0$ by false-position method.

2. Find the root of the equation $2x^3 - 3x + 6 = 0$, that lies between – 2 and – 1 correct to four decimal places, using Chebyshev's method.

3. Solve the following system of equations by Gauss-Jordan elimination method

   $x + 2y + z = 3\,;\, 2x + 3y + 3z = 10\,;\, 3x - y + 2z = 13.$

4. Find the numerically largest eigen value of $A = \begin{bmatrix} 1 & 6 & 1 \\ 1 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix}$ and the corresponding eigen vector.

5. Solve by Gauss-Seidel method, the following system :

   $28x + 4y - z = 32\,;\, x + 3y + 10z = 24\,;\, 2x + 17y + 4z = 35.$

6. Apply Lagrange's formula, to find y (2) to the data given below :

x	:	0	1	3	4	5
y	:	0	1	81	256	625

7. Express $f(x) = x^4 - 5x^3 + 3x + 4$ in terms of factorial polynomial taking $h = 2$ and obtain

   $\Delta f(x), \Delta^2 f(x), \Delta^3 f(x),$.........

8. Using Stirling's formula, find y (1.22) from the following table :

x	:	1.0	1.1	1.2	1.3	1.4
y	:	0.84147	0.89121	0.93204	0.96356	0.98545

9. Using Taylor series method to find y (0.2), given $y' = x^2 + y^2$ and $y(0) = 1$.

10. Solve and get $y(2)$ given $\frac{dy}{dx} = \frac{(x+y)}{2}$, $y(0) = 2, y(0.5) = 2.636, y(1) = 3.595, y(1.5) = 4.968$ by Milne's predictor-corrector method.

(8 × 5 = 40 marks)

Turn over

Part B

Answer **all** *the questions.*

11. (a) Find all the roots of the equation $x^4 - 10x^3 + 35x^2 - 50x + 24 = 0$ by Graeffe's root squaring method.

Or

(b) Find all the roots of the polynomial $x^4 - 3x^3 + 20x^2 + 44x + 54$ using Bairstow method and assuming that $r = s = -1$ (Perform 3 iterations).

12. (a) By Crout's method, solve the system :

$$\begin{aligned} x + 2y + 3z + 4w &= 20 \\ 3x - 2y + 8z + 4w &= 26 \\ 2x + y - 4z + 7w &= 10 \\ 4x + 2y - 8z - 4w &= 2. \end{aligned}$$

Or

(b) Solve the equations $x^2 + y^2 = 16$ and $x^2 - y^2 = 4$ given that the starting approximate solution is $\left(2\sqrt{2}, 2\sqrt{2}\right)$.

13. (a) Find the cubic spline valid in the interval [3, 4] for the function given by the following table under the conditions $M(1) = 0, M(4) = 0$:

x	...	1	2	3	4
y	...	3	10	29	65

Or

(b) Evaluate $\int_0^2 \frac{dx}{1 + x + x^2}$ by (i) Trapezoidal rule ; (ii) Simpson's one-third rule ; (iii) Simpson's three-eighth rule ; (iv) Two-point Gaussian quadrature and also check up the results by actual integration.

14. (a) Solve the initial value problem $\frac{dy}{dx} = yx^2 - y$ with $y(0) = 1$ from $x = 0$ to $x = 1$ with a step size 0.25. Use the following methods to predict the start up values of y at :

   (a) $x = 0.25$ by Euler method.

   (b) $x = 0.5$ by Heun's method.

   (c) $x = 0.75$ by Runge-Kutta method of second order.

   (d) $x = 1$ by Milne's method.

Or

(b) Solve $u_{xx} + u_{yy} = 0$ over the square mesh of side 4 units satisfying the following boundary conditions.

   (i) $u(0, y) = 0$ for $0 \leq y \leq 4$.

   (ii) $u(4, y) = 12 + y$ for $0 \leq y \leq 4$.

   (iii) $u(x, 0) = 3x$ for $0 \leq x \leq 4$.

   (iv) $u(x, 4) = x^2$ for $0 \leq x \leq 4$.

(4 × 15 = 60 marks)