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B.E / B.TECH DEGREE EXAMINATIONS: APRIL / MAY 2011

Sixth Semester

U07MA502: NUMERICAL METHODS

(Common to Computer Science and Engineering & Information Technology)

Time: Three Hours **Maximum Marks: 100**

Answer ALL Questions:-

PART A (10 x 1 = 10 Marks)

1. The iterative formula for Regula falsi method is

   (a) $\frac{af(b)-bf(a)}{f(b)-f(a)}$ (b) $\frac{af(b)+bf(a)}{b-a}$ (c) $\frac{f(b)+f(a)}{b}$ (d) $\frac{f(b)*f(a)}{b+a}$

2. The method in which the new value of the variable found is used immediately is

   (a) Gauss-Seidel (b) Gauss-Jacobi (c) Gauss-Jordan (d) Relaxation

3. The interpolation formula of finding the unknown where the data is unequally spaced is

   (a) Newton- forward (b) Newton-backward (c) Lagrange (d) Stirling

4. When the data are equally spaced the suitable interpolation method to find the unknown in the middle of the table is

   (a) Newton-forward formula (b) Newton-backward formula

   (c) Newton-divided difference formula (d) Stirling's formula

5. The method of integration in which number of intervals has to be multiple of 3 is

   (a) Trapezoidal (b) Simpson's $\frac{1}{3}$ (c) Simpson's $\frac{3}{8}$ (d) Romberg

6. The error in Trapezoidal rule is of order

   (a) h^2 (b) h^3 (c) h^4 (d) h^5

7. Given $\frac{dy}{dx} = y - \frac{2x}{y}, y(0) = 1, h = 0.1,$ the value of y(0,1), by Euler's method is

   (a) 0.9 (b) 1 (c) 1.1 (d) 1.2

8. In Runge-Kutta method formula , $y(x+h) = y(x) + \Delta y$, Δy is given by

   (a) $\Delta y = \frac{(k_1 + 2k_2 + 2k_3 + k_4)}{6}$ (b) $\Delta y = \frac{(k_1 + 2k_2 - 2k_3 + k_4)}{6}$

   (c) $\Delta y = \frac{(k_1 - 2k_2 + 2k_3 + k_4)}{6}$ (d) $\Delta y = \frac{(k_1 + 2k_2 + 2k_3 + k_4)}{8}$

9. The Bender-Schmidt formula is given by

(a) $u_{i,j+1} = \frac{(u_{i-1,j+1} + u_{i,j+1})}{2}$ (b) $u_{i,j+1} = \frac{(u_{i-1,j} + u_{i+1,j+1})}{2}$

(c) $u_{i,j+1} = \frac{(u_{i-1,j} + u_{i+1,j})}{2}$ (d) $u_{i,j+1} = \frac{(u_{i-1,j} + u_{i+1,j})}{6}$

10. The value of λ in the Crank-Nicolson's difference equation for the parabolic equation $u_t = \alpha^2 u_{xx}$ is given by

(a) $\frac{k\alpha^2}{h^2}$ (b) $\frac{k\alpha^2}{h}$ (c) $\frac{k\alpha^2}{h^3}$ (d) 0

PART B (10 x 2 = 20 Marks)

11. By Newton's method, find an iterative formula to find $\sqrt{N}$ (where N is a positive number).

12. Compare Gauss elimination method with Gauss Jordan method.

13. Write the down the Lagrange's formula for the set of points $(x_1, y_1), (x_2, y_2), (x_3, y_3)$

14. Define the terms interpolation and extrapolation.

15. Write Newton's forward difference formula for derivative at a general point x.

16. Evaluate $\int_0^{\frac{\pi}{2}} Sinx dx$ by Trapezoidal rule given.

x :	0	$\frac{\pi}{10}$	$\frac{2\pi}{10}$	$\frac{3\pi}{10}$	$\frac{4\pi}{10}$	$\frac{5\pi}{10}$
Sinx :	0	0.3090	0.5878	0.8090	0.9511	1

17. Using improved Euler's method find y(0.05) from $\frac{dy}{dx} = x + y$, y(0)=1 with h=0.05

18. Write down the Milne's predictor formula?

19. Name at least two numerical methods that are used to solve one dimensional heat equation.

20. State Liebmann's iterations process formula.

PARTC (5 x 14 = 70 Marks)

21. a) (i) Find a root of $x^3 = 6x - 4$ by Newton Raphson method correct to 2 decimal places. (7)

(ii) Using Gauss Seidel method, solve the following system.

$$4x + 2y + z = 14$$

$$x + 5y - z = 10$$

$x + y + 8z = 20$ (7)

(OR)

b) (i) Using Gauss-Jordan method, find the inverse of

$$\begin{bmatrix} 2 & 0 & 1 \\ 3 & 2 & 5 \\ 1 & -1 & 0 \end{bmatrix}$$ (7)

(ii) Find a real root of the equation cos x = 3x -1 correct to 4 decimal places by iteration method. (7)

22. a) (i) The following data are taken from the steam table (7)

Temp.	140	150	160	170	180
Pressure	3.685	4.854	6.302	8.076	10.225

Find the pressure of the steam for a temperature of $t = 142^o$.

(ii) Find the missing term in the following table using Lagrange's interpolation formula. (7)

x	0	1	2	3	4
$f(x)$	1	3	9	-	81

(OR)

b) (i) Find $f(8)$ by Newton's divided difference formulae for the data. (7)

x	4	5	7	10	11	13
$f(x)$	48	100	294	900	1210	2028

(ii) Use Stirling's formula to find tan 89° 26′ from the table

x :	89°21′	89°23′	89°25′	89°27′	89°29′
tan x :	88.14	92.91	98.22	104.17	110.90

23. a) (i) Obtain the value of $f'(0)$ and $f''(4)$ from the data. (7)

x	0	1	2	3	4
y	1	2.718	7.381	20.086	54.598

(ii) Evaluate $\int_0^6 \frac{dx}{1+x^2}$ using Simpsons 1/3rd rule and Simpson's 3/8th rule, taking h = 1.

(OR)

b) (i) Given the following table, find y′ (6)

x:	0	2	3	4	7	9
y:	4	26	58	112	466	922

(ii) Using Trapezoidal rule evaluate $\int_0^1\int_0^1 e^{x+y}$ dxdy taking h = 0.5.

24. a) Given $y'' + xy' + y = 0$, $y(0) = 1$, $y'(0) = 0$, find the value of $y(0.1)$ using Runge-Kutta method of fourth order. Use h=0.1

(OR)

b) Determine the value of $y(0.4)$ using Milne's Predictor and Corrector method given $y' = xy + y^2$, $y(0) = 1$. Use Taylor series method to get the values of $y(0.1)$, $y(0.2)$, $y(0.3)$.

25. a) (i) Solve $u_{xx} - 2u_t = 0$ given $u(0,t) = 0, u(4,t) = 0,\ u(x,0) = x(4 - x)$. Assume $h = 1$. Find the values of u up to $t = 5$. (7)

(ii) Solve $y_{tt} = y_{xx}$ up to $t = 0.5$ with a spacing of 0.1 subject to $y(0,t) = 0, y(1,t) = 0, y_t(x,0) = 0$ and $y(x,0) = 10 + x(1 - x)$ (7)

(OR)

b) Solve the Poisson's equation $\nabla^2 u = -10(x^2 + y^2 + 10)$ over the square mesh with sides $x = y = 0$; $x = y = 3$ with $u = 0$ on the boundary and mesh length 1 unit.

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