ANNA UNIVERSITY COIMBATORE

B.E. / B.TECH. DEGREE EXAMINATIONS : MAY / JUNE 2010

REGULATIONS : 2007

SIXTH SEMESTER

070230054 - NUMERICAL METHODS

(COMMON TO CSE / IT)

TIME : 3 Hours **Max. Marks :100**

PART – A

(20 x 2 = 40 MARKS)

ANSWER ALL QUESTIONS

1. State the order of convergence and convergence condition for Newton's Raphson method.
2. Write the iterative formula for finding square root of N, where N is a real number, by Newton's method.
3. State any two differences between direct and iterative methods for solving a system of equations.
4. Write the sufficient conditions for convergence of Gauss Jacobi method.
5. State Newton's forward interpolation formula. When is it used?
6. In cubic spline interpolation from the following data, the value of M_1 is _, if M_0 = 0 & M_2 = 0.

X	1	2	3
Y	-8	-1	18

7. Give the Lagrange's formula for inverse interpolation.
8. From the table, the polynomial of f(x) is

x	2	4	5	10
f (x)	3	7	9	19

9. Using Newton's backward difference formula, write the formulae for the first and second order derivatives at the end value $x = x_n$
10. State Simpson's 3/8 rule and 1/3 rule

11. Evaluate $\int_1^4 f(x)dx$ from the table by Simpson's 3/8 rule

x	1	2	3	4
f(x)	1	8	27	64

12. How many basic values are required for Milne's predictor – corrector method?
13. Given $y' = x^2 + y^2$ and y (0) = 1, find $y(0.1)$ by Taylor series.
14. Find $y(0.1)$ given $y' = \frac{1}{2}(x+y)$, $y(0)=1$ by improved Euler method.
15. Write down the algorithm of Runge – Kutta method of fourth order.
16. a Write Milne's predictor – corrector formula.
    b How many basic values are required for Milne's predictor – corrector method.
17. Write down the Leibmann's iterative formula for solving the Laplace equation.
18. Write down the finite difference scheme for the solution of the Poisson's equation $\nabla^2 u = f(x, y)$
19. a Write down the Bender – Schmidt recurrence relation for one dimensional heat equation.
    b For what value of λ, is the Bender Schmidt method of solving the one dimensional heat equation $U_{xx} = aU_t$ stable.
20. In solving the wave equation, how will you express the initial condition $u_t(x, 0) = 0$.

PART – B

(5 x 12 = 60 MARKS)

ANSWER ANY FIVE QUESTIONS

21. a) Solve the system of equations by Gauss Jordan method 6

$x - y + z = 1$

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

$2x - 5y + 4z = 5$

b) Solve the system of equations by Gauss-Seidel method correct to 4 decimal places 6

$28x + 4y - z = 32$

$x + 3y + 10z = 24$

$2x + 17y + 4z = 35$

22. a) Find the dominant eigen value and the corresponding eigen vector of A = 8

$\begin{pmatrix} 1 & 6 & 1 \\ 1 & 2 & 0 \\ 0 & 0 & 3 \end{pmatrix}$ by power method.

b) Find an approximate root of $x \log_{10} x - 1.2 = 0$ by false position method. 4

23. Find the cubic spline for the data in [2 , 3].

x	1	2	3
y	1	5	11

Assume M(0) = M(2) = 0, hence obtain $y(2.5)$.

24. a) Using Lagrange's interpolation formula, find y (10) from the following table 6

x	:	5	6	9	11
y	:	12	13	14	16

24. b) Find a cubic polynomial of x, using divided difference method given 6

x	:	0	1	2	5
y	:	2	3	12	147

25. a) 6

Evaluate $\int_0^1 \frac{dx}{1+x^2}$ using Romberg's rule.

b) 6

Using Gaussian three point formula, evaluate $\int_2^3 \frac{dt}{1+t}$

26. Given $y' = 2y + 3e^x$, y (0) = 0, i) find y (0.1) by Euler method,

ii) y (0.2) by Taylor method,

iii) y (0.3) by Runge -Kutta method,

iv) y (0.4) by Adam's Predictor – corrector method

27. a) Using finite differences, solve $y'' - 3y' + 2y = 0$, given y (0) = 2 , y (1) = 10.1 6

b) 6

Solve by Crank – Nicholson method the equation $\frac{\partial^2 u}{\partial x^2} = \frac{\partial u}{\partial t}$ subject to

$u(x,0) = 0,\ u(0,t) = 0$ & $u(l,t) = t$ take h = 0.25, for one time steps.

28. Solve $\nabla^2 u = -10(x^2 + y^2 + 10)$ over the squares mesh bounded by x = 0; y = 0; x = 3; y = 3 with u = 0 on the boundary and mesh length is 1 unit.

*****THE END*****