ANNA UNIVERSITY COIMBATORE

B.E. / B.TECH. DEGREE EXAMINATIONS : DECEMBER 2009

REGULATIONS – 2007

FOURTH SEMESTER

070030010 - NUMERICAL METHODS

(COMMON TO EEE / EIE / ICE / MECHATRONICS / CIVIL ENGINEERING)

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

PART – A

(20 x 2 = 40 MARKS)

ANSWER ALL QUESTIONS

01. What is the condition for the convergence of the iteration method for solving $x = \varphi(x)$?

02. State the order of convergence and convergence condition for Newton's Raphson method.

03. State the condition for convergence of Guass-Seidel method.

04. Show that $\delta = E^{1/2} - E^{-1/2}$

05. State Lagrange's Interpolation formula

06. Show that $\underset{bcd}{\overset{3}{\Delta}}\left(\frac{1}{a}\right) = -\frac{1}{abcd}$

07. Form the divided difference table for the following data

x :	5	15	22
y :	7	36	160

08. State Newton's backward interpolation formula

09. Using Trapezoidal rule evaluate $\int_0^{\pi} \sin x \, dx$ by dividing the range into 6 equal parts.

10. State Simpson's $\frac{1}{3}^{rd}$ and $\frac{3}{8}^{th}$ rule.

11. State three point Gaussuian Quadrature formula

12. Given y' = x+y, y(0) = 1. Find y(0.1) = 1 by Taylor series method.

13. Find y(0.1) by Euler's method, given that $\frac{dy}{dx} = 1 - y, \; y(0) = 0$

14. Using modified Euler's method, find y(0.1) if $\frac{dy}{dx} = x^2 + y^2, \; y(0) = 1$

15. Write down the formula to solve second order differential equation using Runge-Kutta Method of 4th order.

16. Write Adam-Bashforth predictor-corrector formulae

17. Give an example of an elliptic equation

18. Classify the equation : $u_{xx} + 2uxy + u_{yy} = 0$

19. Write down the diagonal five point formula to solve the equation $u_{xx} + u_{yy} = 0$

20. State Bender-Schmidt finite difference explicit scheme to solve $\frac{\partial u}{\partial t} = \alpha^2 \frac{\partial^2 u}{\partial x^2}$

PART – B

(5 x 12 = 60 MARKS)

ANSWER ANY FIVE QUESTIONS

21a. Find a real root of the equation cosx = 3x-1 correct to 3 decimal places by using iteration method. (6)

b. Find by Newton – Raphson method, the real root of $x^3 - 6x + 4 = 0$ (6)

22a. Solve by Gauss – elimination method, the equation (6)

$2x + y + 4z = 12$

$8x - 3y + 2z = 20$

$4x + 11y - z = 33$

b. Using Gauss – Jordan method, find the inverse of the matrix (6)

$$\begin{bmatrix} 1 & 1 & 3 \\ 1 & 3 & -3 \\ -2 & -4 & -4 \end{bmatrix}$$

23a. Using suitable interpolation formula find f(1.5) from the following data (6)

x	0	1	2	3	4
f(x)	558.3	869.6	880.9	892.3	903.6

b. Use Newton's divided difference formula, fit a polynominal to the data (6)

x	-1	0	2	3
y	-8	3	1	12

and hence find y when x = 1

24a. Use Lagrange's interpolation formula to find the value of y at x = 6, given the data (6)

x	3	7	9	10
y	168	120	72	63

b. Find the value of sec 31° using the following data (6)

x°	31	32	33	34
tan x	0.6008	0.6249	0.6494	0.6748

25a. Evaluate $\int_0^1 \frac{\sin x}{x} dx$, by dividing the range into six equal parts using Simpson's rule (6)

b. Evaluate $\int_{0.2}^{1.5} e^{-x^2}$ using three-point Gaussian formula (6)

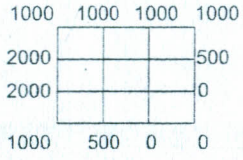
26a. Solve $y^2 = y^2 + x$; $y(0) = 1$ using Taylor series method and compute y(0.1) and y(0.2) (6)

b. Solve $\frac{dy}{dx} = x^2 - y$, $y(0) = 1$ modified Euler method for x = 0.2 & 0.4 in steps of 0.2 each. (6)

27a. Given that $\frac{dy}{dx} = \frac{y^2 - 2x}{y^2 + x}$ and y = 1 when x = 0. Find y(0.2) using R-K fourth order method taking h = 0.2 (6)

b. Solve $\frac{d^2y}{dx^2} + xy = 1$, $y(0) = 0$, $y'(1) = 1$ with n = 2 (take h = 0.5) by finite difference method (6)

28a. Solve the Laplace equation $u_{xx} + u_{yy} = 0$ for the following square mesh with boundary values as shown (6)



b. Solve the Poisson equation $\nabla^2 u = -10(x^2 + y^2 + 10)$ = over the square mesh with sides x = 0, y = 0, x = 3, y = 3 and u = 0 on the boundary. Assume mesh length h = 1 unit (6)