Register Number: ………………..

B.E DEGREE EXAMINATIONS: MAY 2015

(Regulation 2009)

Sixth Semester

COMPUTER SCIENCE AND ENGINEERING

MAT108**:** Numerical Methods

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

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. If f(a) & f(x_1) are of same sign and f(x_1) & f(b) are of opposite signs, then the second approximate value of the root of f (x) = 0 in Regula falsi method is

a) $x_2 = \frac{af(x_1) - x_1 f(a)}{f(x_1) - f(a)}$ b) $x_2 = \frac{af(b) - bf(a)}{f(b) - f(a)}$

c) $x_2 = \frac{x_1 f(b) - bf(x_1)}{f(b) - f(x_1)}$ d) $x_2 = \frac{bf(b) - x_1 f(x_1)}{f(b) - f(x_1)}$

2. The sufficient condition for solving a system of equations by Gauss-Seidel method, is that the coefficient matrix should be

a) Diagonally dominant b) Diagonal matrix

c) With diagonal values unity d) With diagonal values are eigen values

3. From the table, the value of $\Delta^5 y_n$ is

X	2	2.5	3	3.5	4
Y	246.2	409.3	537.2	636.3	715.9

a) 1 b) 2.9

c) 0 d) 3

4. If $f(x) = \frac{1}{x}$ then f(a, b) is

a) $\frac{1}{ab}$ b) $\frac{1}{abcd}$

c) $\frac{ab}{b-a}$ d) $-\frac{1}{ab}$

5. If the derivative is required at a point nearer to the starting value of the table and the intervals are equally spaced then is used

a) Newton's forward difference formula
b) Newton's backward difference formula
c) Newton's central difference formula
d) Stirling's formula

6. The error in Simpson's 1/3 rule is of the order

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

7. Given $y' = -y$ and y (0) =1 then using Euler's formula, y at x = 0.01 is

a) 1.01
b) 0.99
c) 1
d) 1.1

8. If $\frac{dy}{dx} = x + y$, given $y(1) = 0$, then the value of $y(1.1)$ by Taylor's series method , correct to 3 decimal places is

a) 0.140
b) 0.130
c) 0.120
d) 0.110

9. Bender Schmidt recurrence scheme is useful to solve ----------- equation

a) one dimensional heat equation
b) two dimensional heat equation
c) Laplace equation
d) Poisson equation

10. The Crank – Nicholson formula reduces to $u_{i,j+1} = \frac{1}{4}\left[u_{i-1,j+1} + u_{i+1,j+1} + u_{i-1,j} + u_{i+1,j}\right]$ if ________

a) $k = ah^2$
b) k = ah
c) $k = ah^3$
d) $k = ah^4$

PART B (10 x 2 = 20 Marks)

11. Show that the iterative formula for finding the reciprocal of N is $x_{n+1} = x_n\left(2 - Nx_n\right)$.

12. Find the inverse of the matrix $A = \begin{pmatrix} 4 & 1 \\ 2 & -3 \end{pmatrix}$ by Gauss Jordon method.

13. Find the polynomial which takes the following values using Newton's formula

x	0	1	2
y	1	2	1

14. Show that the divided differences are symmetrical in their arguments.

15. What are the two types of errors involving in the numerical computation of derivatives?

16. A curve passes through (0, 1), (0.25, 0.9412), (0.5, 0.8) (0.75, 0.64) and (1.0, 0.5). Find the area between the curve, x – axis and x = 0, x = 1 by Trapezoidal rule.

17. Find the value of k_1, if $y'' + xy' + y = 0;\ y(0) = 1, y'(0) = 0$ is solved by Runge – Kutta method of 4^{th} order [h = 0.01].

18. What is a multistep method?

19. Write an implicit formula to solve $\frac{\partial u}{\partial t}=\frac{\partial^2 u}{\partial x^2}$ numerically.

20. Write the diagonal five – point formula to solve the Laplace equation $u_{xx}+u_{yy}=0$.

PART C (5 x 14 = 70 Marks)

21. a) (i) Find the real root of the equation $\cos x = 3x-1$ correct to 4 decimal places by iterative method. (7)

(ii) Using Newton Raphson method solve $x\log_{10} x = 12.34$ start with $x_0 = 10$. (7)

(OR)

b) (i) Using Gauss elimination method, solve (7)
2x+4y+4z = 12; 8x-3y+2z = 20; 4x+11y-z = 33

(ii) Find the inverse of the given matrix by Gauss – Jordan method $A=\begin{bmatrix} 2 & 6 & 6 \\ 2 & 8 & 6 \\ 2 & 6 & 8 \end{bmatrix}$ (7)

22. a) (i) From the following table, estimate the number of students who obtained marks between 40 and 45 (7)

Marks	30-40	40-50	50-60	60-70	70-80
No. of students	31	42	51	35	31

(ii) Find a polynomial of degree four which takes the values (7)

x :	2	4	6	8	10
y :	0	0	1	0	0

(OR)

b) (i) Use Stirling's formula to compute tan $89^o\,26'$, given the following table of values of tan x: (7)

x:	$89^o\,21'$	$89^o\,23'$	$89^o\,25'$	$89^o\,27'$	$89^o\,29'$
tan x:	88.14	92.91	98.22	104.17	110.90

(ii) Determine by Lagrange's method the number of patients over 40 years using the following data:

Age over (x) years:	30	35	45	55
Number (y) of patients:	148	96	68	34

23. a) Find the gradient of the road at x = 150, 1700 & 900 from the data given below:

x	0	300	600	900	1200	1500	1800
y(x)	135	149	157	183	201	205	193

(OR)

b) Using trapezoidal rule and Simpson's 1/3 rule evaluate $\int_0^1\int_0^1 \frac{1}{1+x+y}\,dx\,dy$ taking h = k = 0.25.

24. a) Consider the initial value problem $\frac{dy}{dx} = y - x^2 + 1,\ y(0) = 0.5.$

(i) Using the improved Euler method, find $y(0.2)$.

(ii) Using 4th order Runge – Kutta method, find $y(0.4)$

(iii) Using Taylor's method, find $y(0.6)$ and

(iv) Using Milne's Predictor – corrector method, find $y(0.8)$.

(OR)

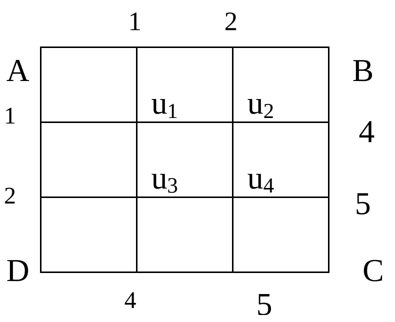
b) Given $\frac{dy}{dx} = xy + y^2, y(0) = 1, \quad y(0.1) = 1.1169, y(0.2) = 1.2773,$ find $y(0.3)$ by Runge-Kutta method of order four and $y(0.4)$ using Milne's predictor-corrector method.

25. a) 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.

(OR)

b) (i) Approximate the solution to the wave equation $\frac{\partial^2 u}{\partial x^2} = \frac{\partial^2 u}{\partial t^2}, \quad 0 \le x \le 1$ and, u(0,t)=0,u(1,t)=0,u(x,0)10x(1-x) $\frac{\partial u}{\partial t}(x,0) = 0,\ 0 \le x \le 1$ with $\Delta x = 0.25 \& \Delta t = 0.25$ for 3 time steps. (7)

(ii) Evaluate the function *u(x, y)* satisfying $\nabla^2 u = 0$ at the lattice points given the boundary values as follows. (7)



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