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B.E DEGREE EXAMINATIONS: NOV / DEC 2014

(Regulation 2009)

Sixth Semester

COMPUTER SCIENCE ENGINEERING

MAT108: Numerical Methods

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

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. The order of convergence of fixed point iteration method is

   a) 1.861 b) 1.816

   c) 1.618 d) 1.168

2. One of the real roots of the equation $x^2 - \log_e x - 12 = 0$ lies between

   a) 3 and 4 b) 2 and 3

   c) 1 and 2 d) 4 and 5

3. We can use Lagrange's interpolation method for

   a) Equal intervals only b) unequal intervals only

   c) both equal and unequal intervals d) None of the above

4. If only 2 values of y, namely y_0 & y_1, corresponding to $x = x_0$ & x_1 are given then Newton forward interpolation formula gives a polynomial of degree

   a) 1 b) 2

   c) 3 d) 4

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

   a) h b) h^2

   c) h^3 d) h^4

6. The value of $\int_0^1 \frac{dx}{1+x}$ is 0.6931 and hence the value of $\log_e 2$ is

   a) 1.6931 b) 1.3862

   c) 0.6931 d) 0.3010

7. The improved Euler method is based on the averages of ______________

a) Points b) Slopes

c) tangents d) Normal

8. If $\frac{dy}{dx} = x + y$, given y(1)=0, then the value of y_0'' is

a) 2 b) 1

c) 0 d) -2

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. If u satisfies Laplace equation and u =100 on the boundary of a square then the value of u at an interior grid point is

a) 10 b) 0

c) 1000 d) 100

PART B (10 x 2 = 20 Marks)

11. What is the condition for the convergence to solve cosx = 3x – 2 by iteration method.

12. Say true or false and justify

The convergence in the Gauss Seidal method is twice as fast as in Jacobi's method.

13. Given $y_3 = 2, y_4 = -6, y_5 = 8, y_6 = 9, y_7 = 17.$ Find $\Delta^2 y_3$.

14. Obtain the divided difference table for the following data:

X	-1	0	2	3
f(x)	-8	3	1	12

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

16. Compare trapezoidal rule and Simpson's 1/3 rule evaluating numerical integration.

17. Outline the merits and demerits of Taylor's series method to solve the differential equation numerically.

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

19. Write down the Bender – Schmidt recurrence relation for one dimensional heat equation.

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) Using Newton Raphson methods establish the formula $x_{n+1} = \frac{1}{2}\left(x_n + \frac{N}{x_n}\right)$ to calculate the square root of N, hence find the square root of 5 correct to four decimal places.

(ii) Find the inverse of the given matrix by Gauss – Jordan method

$$A = \begin{bmatrix} 2 & 6 & 6 \\ 2 & 8 & 6 \\ 2 & 6 & 8 \end{bmatrix}$$

(OR)

b) (i) Find the root of the equation $xe^x = \cos x$ using the Regula Falsi method correct to four decimal places.

(ii) Solve the system of equations by Gauss-Seidel method correct to three decimal places.

x + y +54z = 110

$27x + 6y - z = 85$

$6x + 15y + 2z = 72$

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

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

(ii) Given the following table, find y(35), by using Stirling's formula

x	:	20	30	40	50
y	:	512	439	346	243

(OR)

b) (i) Find the equation of the cubic curve y = f(x) that passes through the points (0,2), (1, 3), (2, 12), and (3, 147) using Newton's divided difference formula. Hence find y when x = 3 and x = 4.

(ii) Obtain the root of f (x) = 0 by Lagrange's inverse interpolation formula given that $f(30) = -30,\ f(34) = -13,\ f(38) = 3,\ f(42) = 18$.

23. a) (i) A slider in a machine moves along a fixed straight rod. Its distance x cm along the rod is given below for various values of the time t seconds. Find the velocity of the slider when t = 0.3 sec

t	0	0.1	0.2	0.3	0.4	0.5	0.6
x	30.13	31.62	32.87	33.64	33.95	33.81	33.24

(ii) Evaluate $I = \int_0^6 \frac{dx}{1+x^2}$ by trapezoidal rule , Simpson's $\frac{1}{3}rd$ rule and Simpson's $\frac{3}{8}th$ rule with h = 1

(OR)

b) (i) Find the gradient of the road at x = 450, 1700 & 900 from the data given below:

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

(ii) 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) (i) Given $\frac{dy}{dx}=x^3+y,\ y(0)=2$. Compute y (0.2), y (0.4) and y (0.6) by Runge – Kutta method of fourth order.

(ii) Given $y'=x^2+y^2,\ y(0)=1, y(-0.1)=0.9088, y(0.1)=1.1115,\ \ y(0.2)=1.2530$

Compute $y(0.3)$, $y(0.4)$ by Milne's method.

(OR)

b) (i) Solve $5x\frac{dy}{dx}+y^2-2=0,\ y(4)=1$ for $y(4.1)$, $y(4.2)$ using i) Euler's method ii) Improved Euler's method.

(ii) By using Taylor's Series method find y (0.1) & y (0.2) given that $y'=2y+3e^x$, y (0) = 0.

25. a) (i) Solve $\frac{\partial^2 u}{\partial x^2}=2\frac{\partial u}{\partial t}$ given $u(0,t)=0,\ u(4,t)=0,\ u(x,0)=x(4-x)$, taking $\Delta x=1$ $and\ \Delta t=1$. Find the value of u upto t = 3 using Bender – Schmidt's explicit finite difference scheme.

(ii) Solve $\frac{\partial u}{\partial t}=\frac{\partial^2 u}{\partial x^2}$ in $0<x<5;\ t>0$ given that $u(x,0)=20, u(0,t)=0, u(5,t)=100$, compute u for one time step with $h=1$, by Crank – Nicholson method.

(OR)

b) Solve the elliptic equation $\nabla^2 u=0$ over the square region of side 4, satisfying the boundary conditions: $u(0,y)=0$ for $0\le y\le 4$, $u(4,y)=12+y$ for $0\le y\le 4$, $u(x,0)=3x$ For $0\le x\le 4$, & $u(x,4)=x^2$ for $0\le x\le 4$. Obtain solution correct to two decimal places. Take h = 1 = k.

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