Register Number: ………………

B.E. DEGREE EXAMINATIONS: NOV/DEC 2010

Fourth Semester

U07MA401: NUMERICAL METHODS

(Common to Aeronautical Engineering, Civil Engineering, Mechatronics Engineering and Mechanical Engineering)

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

Answer ALL Questions:-

PART A (10 x 1 = 10 Marks)

1. The formula for Method of false Position is

a) X = $\dfrac{bf(a)-bf(b)}{f(b)-f(a)}$ b) x = $\dfrac{af(b)-bf(a)}{f(b)-f(a)}$

c) x = $\dfrac{f(b)-f(a)}{f(a)-f(b)}$ d) x = $\dfrac{af(b)-af(a)}{f(b)-f(a)}$

2. The order of convergence of fixed point iteration x = g (x) is

a)1 b) 2 c) 3 d) 4

3. ______ is the Lagrange's formula to find y(x) if 2 sets of values (x_0, y_0) & (x_1, y_1) are given

a) $y(x)=\dfrac{(x-x_1)(x-x_3)}{(x_0-x_1)(x_2-x_0)}\ y_0 + \dfrac{(x-x_1)(x-x_3)}{(x_0-x_1)(x_2-x_2)}\ y_1$

b) $y(x)=\dfrac{(x-x_1)(x-x_2)}{(x_0-x_1)(x_0-x_2)}\ y_0 + \dfrac{(x-x_0)(x-x_2)}{(x_1-x_0)(x_1-x_2)}\ y_1$

c) $y(x)=\dfrac{(x-x_1)}{(x_0-x_1)}\ y_0 + \dfrac{(x-x_0)}{(x_1-x_0)}\ y_1$

d) $y(x)=\dfrac{(x-x_0)}{(x_1-x_0)}\ y_0 + \dfrac{(x-x_0)}{(x_1-x_0)}\ y_1$

4. The n^{th} divided differences of a polynomial of n^{th} degree are ___________

a) n b) n^2 c) Constant d) n^3

5. The order of error in Simpson's $\dfrac{1}{3}$ rule in Romberg's method is

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

6. If $I_1 = 0.775$ $I_2 = 0.7828$ the value of I is ________________

a) 0.6802 b) 0.7802 c) 0.8802 d) 0.5802

7. Given $\frac{dy}{dx}$ = x+y y(1) = 2 using Euler's method. The value of y (1.1) is

a) 2.3 b) 3.3 c) 2.4 d) 3.4

8. Milne's predictor formula is

a) $y_{n+1,p} = y_{n-3} + \frac{4h}{3}(2y'_{n-2} + y'_{n-1} + 2y'_{n})$ b) $y_{n+1,p} = y_{n-2} + \frac{4h}{3}(2y'_{n-2} + y'_{n-1} + 2y'_{n})$

c) $y_{n+1,p} = y_{n-3} + \frac{4h}{3}(2y'_{n-2} - y'_{n-1} + 2y'_{n})$ d) $y_{n+1,p} = y_{n-2} + \frac{4h}{3}(2y'_{n-2} + y'_{n-1} + 2y'_{n})$

9. The diagonal five point formula for Laplace equation $u_{xx} + u_{yy} = 0$ is

a) $u_{i,j} = \frac{1}{4}(u_{i,j} + u_{i+1,j} + u_{i,j-1} + u_{i-1,j})$ b) $u_{i,j} = \frac{1}{2}(u_{i,j} + u_{i+1,j} + u_{i,j-1} + u_{i-1,j})$

c) $u_{i,j} = \frac{1}{4}(u_{i,j} - u_{i+l,j} - u_{i,j-1} + u_{i-1,j})$ d) $u_{i,j} = \frac{1}{4}(u_{i,j} - u_{i+l,j} + u_{i+1,j} + u_{i-1,j})$

10. Explicit formula for one dimensional heat equation is

a) $u_{i,j} = \frac{1}{4}(u_{i,j} + u_{i+1,j} + u_{i-1,j-1} + u_{i,j+1})$ b) $u_{i,j+1} = \lambda u_{i+1,j} + (1-2\lambda)u_{i,j} + \lambda u_{i-1,j}$

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

PART B (10x2 = 20 Marks)

11. By Gauss elimination method solve x + y = 2, 2x + 3y = 5.

12. Find an approximate value of the root x^3 -3x -5 =0 by the method of false Position. The root lying between 2 and 3.

13. Obtain the divided difference table for the following data.

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

14. If f(3) = 5 and f (5) = 3 what is the form of f (x) by Lagrange's formula?

15. Evaluate $\int_0^1 \frac{dx}{1+x^2}$ by Trapezoidal rule with h = 0.5.

16. Evaluate $\int_{-1}^{1}$ Cos x d x using two point Gaussian formula.

17. In the derivation of fourth order Runge – Kutta formula, why it is called fourth order

18. State Adams – Bash forth predictor and corrector formula.

19. Obtain the finite difference scheme for the difference equation $2\frac{d^2y}{dx^2}$ + y = 5.

20. Write down the Bender – Schmidt formula for one dimensional heat equation.

PART C (5 x 14 = 70 Marks)

21. a) (i) Find the smallest positive root of the equation $x^3 -2x+0.5$ = using Newton's Method. (7)

(ii) Using Gauss elimination method solve 2x+ y + 4z = 12, 8 x- 3y + 2z = 20, 4x+ 11y –z = 33. (7)

(OR)

b) (i) Solve for positive root of x - Cos x = 0 by Regular Falsi method. (7)

(ii) Solve the following system of equations using Gauss – seidel method.

8x- 3y + 2z =20, 4x+11y-z = 33, 6x+ 3y +12z = 35 (7)

22. a) (i) Using Lagranges interpolation formula, Find y (10) . (7)

x :	5	6	9	11
f(x) :	12	13	14	16

(ii) Using Newtons forward interpolation formula find the value of sin52 given that sin45 = 0.7071 sin50 = 0.7660 sin55 = 0.8192sin60=0.8660. (7)

(OR)

b) (i) Evaluate y(1.5) using cubic spline for the following values of x & y given $M_0 = M_3 = 0$.(7)

X	1	2	3	4
Y	1	2	5	11

(ii) Using Newton's divided difference formula, find the value of f(8) given the following data. (7)

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

23. a) (i) The population of a certain town is given below. Find the rate of growth of the Population in 1931.

Year	1931	1941	1951	1961	1971
Population	40.62	60.80	79.95	103.56	132.65

(7)

(ii) Evaluate $\int_0^1\int_0^1 e^{x+y}\, dx$ dy using Simpson's rule by taking h = k = 0.5. (7)

(OR)

b) (i) Find $\int_0^1 \frac{dx}{1+x^2}$ by using Simpson's $\frac{1}{3}$ and $\frac{3}{8}$ rule.

(ii) Using Trapezoidal rule evaluate $\int_1^2\int_1^2 \frac{1}{x+y} dx$ dy taking 4 subintervals. (7)

24. a) Using R.K method of order 4, find y for $x = 0.1, 0.2, 0.3$ given that

$\frac{dy}{dx} = xy + y^2$, y (0) = 1 and also find the solution at $x = 0.4$ using Milne's method.

(OR)

b) (i) Using Taylor series method find y at $x = 0.1$ if (7)

$\frac{dy}{dx} = x^2 y - 1$, y (0) = 1.

(ii) Given that $\frac{dy}{dx} = x^2(1+y)$, y(1) = 1, y(1.1) = 1.233, y(1.2) = 1.5485,

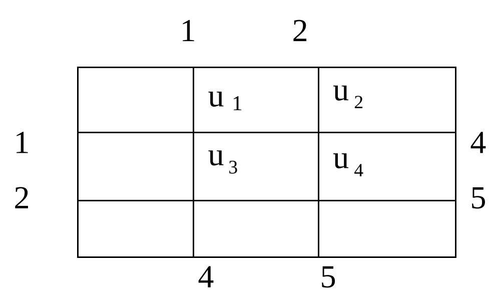
y (1.3) = 1.9789 find y(1.4) by Adam's method. (7)

25.a) (i) Solve the boundary value problem y''- 64y + 10 =0, with y(0) = y(1) = 0 by the finite difference method. (7)

(ii) Solve $u_{xx} = 2u_t$ when u (0,t) = 0, u(4,t) = 0 and with initial condition U (x ,0) = x (4-x) up to t = 5 sec. assuming Δx = h= 1. (7)

(OR)

b) (i) Solve $u_{xx} + u_{yy} = 0$ for the following square mesh with boundary values as Shown in the following figure. (7)



(ii) Solve by crank – Nicholson's implicit scheme $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$, $0 \angle x \angle 5$, t >0 subject to u(x ,0) = 20, u(0,t) = 0 and u(5,t) = 100 taking h = 1, compute u for one time step. (7)

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