AALIM MUHAMMED SALEGH COLLEGE OF ENGINEERING
Department of Mathematics

MODEL EXAMINATION MARCH 2014

VI Semester B.E(ECE).

MA2264 – NUMERICAL METHODS

Time: 3 hours Max:100 Marks

Answer ALL Questions

Part-A (10 X 2 = 20)

1. Find an iterative formula to find $\sqrt[4]{N}$ where N ≠0 using Newton's method.
2. Using Gauss Jordan method find the inverse of the matrix $\begin{bmatrix} 1 & 2 \\ 2 & 3 \end{bmatrix}$.
3. State any two properties of divided difference.
4. State Newton's backward interpolation formula for equal intervals.
5. Evaluate $\int_{1}^{1.5} \frac{1}{x} dx$ by trapezoidal rule, dividing the range into 4 equal parts.
6. State three point Gaussian quadrature formula.
7. Using Euler's method find y(0.2) from y^1= x+y, y(0)=1 with h=0.2.
8. Write down Adams predictor, corrector formula.
9. Write down the finite difference formula for y^1 (x) and y^{11}(x).
10. State the finite difference scheme to solve the equation $y_{tt}=\alpha^2 y_{xx}$.

PART B(5X16=80)

11 (a)(i) Solve the equation xsinx+cosx=0 using newton-Raphson method.

(ii) Solve by Gauss Seidal iterative procedure the system
8x-3y+2z=20 , 6x+3y+12z=35 and 4x+11y-z=33.

(OR)

(b) (i) Find the real root the equation x3+x2-1=0 by iteration method.

(ii) Using power method find the largest eigen value and the corresponding eigen vector of the matrix $\begin{pmatrix} 1 & 6 & 1 \\ 1 & 2 & 0 \\ 0 & 0 & 3 \end{pmatrix}$.

12 (a) (i) Using Lagrange's interpolation formula find the value of y when x=10, if the values of x and y are given as below:

x	5	6	9	11
y	12	13	14	16

(ii) From the following table:

x	1	2	3
y	-8	-1	18

Compute y(1.5) and y^1(1) using cubic spline.

(OR)

(b) (i) Using Newton's divided differences formula determine f(3) from the data:

x	0	1	2	3	4

f(x)	1	14	15	5	6

(ii) From the data given below, find the number of students whose weight is between 60 and 70 lbs.

Wt. In lbs:	0-40	40-60	60-80	80-100	100-120
No. Of students:	250	120	100	70	50

13 (a) (i) Evaluate $\int_0^1 \frac{dx}{1+x^2}$ by using Romberg's method correct to 4 decimal places. Hence find the value of π

(ii) Evaluate $\int_0^{0.5}\int_0^{0.5} \frac{\sin(xy)}{1+xy}\, dxdy$ using Sampson's rule with h=k=0.25 .

(OR)

(b) (i) Find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at x=51, from the following data:

x	50	60	70	80	90
f(x)	19.96	36.65	58.81	77.21	94.61

(ii) Use4 Gaussian three point formula and evaluate $\int_1^5 \frac{1}{x} dx$.

14 (a) (i) Solve $y^{11}=xy^1-y$ given $y(0)=3, y^1(0)=0$ to find the value of y(0.1), using R-K method of order 4.

(ii)Using Adams method find y(1.4) given $y^1=x^2(1+y)$, y(1)=1, y(1.1)=1.233, y(1.2)=1.548 and y(1.3)=1.979.

(OR)

(b) (i) Using Taylor series method solve $\frac{dy}{dx}=x^2-y$, y(0)=1 at x=0.1,0.2,0.3. Also compare the values with the exact solution,

(ii) Given $\frac{dy}{dx}=\frac{1}{x+y}$, y(0)=2, y(0.2)=2.0933, y(0.4)=2.1755, y(0.6)=2.2493, find y(0.8) using Milne's method.

15 (a) (i) Solve, by finite difference method, the boundary value problem $y^{11}(x)-y(x)=0$, where y(0)=0 and y(1)=1. Taking h=0.25

(ii) Solve the Laplace equation $U_{xx}+U_{yy}=0$, over the square region, satisfying the boundary conditions. $U(0,y)=0$, $0\le y\le 3$

$U(3,y)=9+y$, $0\le y\le 3$

$U(x,0)= 3x$, $0\le x\le 3$

$U(x,3)=4x$, $0\le x\le 3$

(b)(i) Solve $\frac{\partial u}{\partial t}=\frac{1}{2}\frac{\partial^2 u}{\partial x^2}$ with the conditions u(0,t)=0=u(4,t), u(x,0)=x(4-x) taking h=1 employing Bender-Schmidt recurrence equation. Continue the solution through 10 time steps.

(ii) Find the pivotal values f the equation $\frac{1}{4}\frac{\partial^2 u}{\partial t^2} = \frac{\partial^2 u}{\partial x^2}$ with given conditions

u(0,t)=0=u(4,t), u(x,0)=x(4-x) and $\frac{\partial u}{\partial t}$(x,0)=0 by taking h=1 for 4 time steps.

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MODEL EXAMINATION MARCH 2014
VI Semester B.E(ECE).
MA2264 – NUMERICAL METHODS

Time: 3 hours Max:100 Marks

Answer ALL Questions

<u>Part-A (10 X 2 = 20)</u>

1. Give the order of convergence of the Newton-Raphson method.
2. What is the condition for convergence of Gauss-Seidal method of iteration?
3. What is the Lagrange's formula to find *y*, if three sets of values (x_0 , y_0), (x_1 , y_1), (x_2,y_2) are given.
4. Define Cubic Spline function.
5. Write down the Newton-Cote's formula for equidistant ordinates.
6. Give order of Error in the Simpson's 1/3rd rule.
7. Find y(0.2) for the equation $y' = y + e^x$, given that y(0)=0 by using Euler's method.
8. Give the error for Milne's Predictor formula.
9. Classify the Partial Differential Equation $u_{xx} + 2u_{xy} + 4u_{yy} = 0$, $x, y > 0$.
10. State the diagonal five point formula for solving Laplace equation.

<u>PART B(5X16=80)</u>

11. a(i) Using Newton's method, find the root between 0 and 1 of $x^3 = 6x-4$ correct to 2 decimals.

(ii) Using Gauss Jordan method, find the inverse of matrix $\begin{pmatrix} 1 & 2 & 6 \\ 2 & 5 & 15 \\ 6 & 15 & 46 \end{pmatrix}$

(OR)

b. (i) Solve the following system of equations using Gauss-Seidal method:

10x + 2y + z = 9; x+10y-z=-22; -2x+3y+10z=22.

(ii) Find all the eigen values and eigen vectors of the matrix $\begin{pmatrix} 1 & \sqrt{2} & 2 \\ \sqrt{2} & 3 & \sqrt{2} \\ 2 & \sqrt{2} & 1 \end{pmatrix}$ using Jacobi method.

12. a(i) Using Lagrange's formula, find the value of x when y=20 from the data:

x :	1	2	3	4
y=f(x):	1	8	27	64

(ii) Using Newton's divided differences formula, find f(x) from following data

and hence find f(4) .

x	0	1	2	5
f(x)	2	3	12	147

(Or)

b. (i) Find the values of y when x=5 using Newton's interpolating formula from the following table

x	4	6	8	10
y	1	3	8	16

(ii) Obtain the cubic spline for the following data to find y(0.5).

x	-1	0	1	2
y	-1	1	3	35

13. (a)(i) Find the first derivative of $(x)^{1/3}$ at x= 50 given the table below.

x	50	51	52	53	54	55	56
$x^{1/3}$	3.6840	3.7084	3.7325	3.7563	3.7798	3.8030	3.8259

(ii) By Trapezoidal rule, evaluate $\int_0^6 \frac{dx}{1+x}$ and check by direct integration.

(or)

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

Year x	1931	1941	1951	1961	1971
Population in thousands y	40.62	60.80	79.95	103.56	132.65

(ii) Using Gaussian 3 point formula, evaluate $\int_{-1}^{1}(3x^2+5x^4)dx$

14.(a)(i) Using Modified Euler's theorem, find y(4.1) and y(4.2) if $5x\frac{dy}{dx}+y^2-2=0$; y(4)=1.

(ii) Given that $\frac{dy}{dx}=1+y^2$; y(0.6) = 0.6841, y(0.4) = 0.4228, y(0.2) = 0.2027, y(0)= 0. Find y(-0.2) using Milne's method.

(or)

b(i) Using R-K fourth order method of fourth order, compute y(0.7) correct to 3 decimal places if $\frac{dy}{dx}=y-x^2$, y(0.6) = 1.7379.

(ii) Using Taylor series method, find y(1.1) correct to 4 decimal places given $\frac{dy}{dx}=xy^{1/3}$, and y(1)=1. Also compare the values with the exact solution.

15. a(i) Solve $y''-y=0$ with the boundary conditions y(0)=0 and y(1) = 1.

(ii) Solve $\frac{\partial^2 u}{\partial t^2}=\frac{\partial^2 u}{\partial x^2}$ 0 < x < 1; t > 0 given that *u (x,0) =0* ; $\frac{\partial u}{\partial t}(x,0)=0$

u (0,t) = 0 and *u(1,t)* = $\frac{1}{2}\sin \pi t$. Compute *u(x,t)* for 4 time-steps by taking $h=\frac{1}{2}$

(or)

b. Solve the Poisson equation ,$u_{xx}+u_{yy} = -10(x^2+y^2+10)$ over the square mesh with sides x=0, y=0, x=3 and y=3 with u=0 on boundary and mesh length 1 unit.

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Department of Mathematics

Model Examination MARCH 2013

(COMMON TO V1 SEMESTER ECE IV SEMESTER EEE, CIVIL)

MA 2264 –Numerical Methods

Time:3.00 hours Answer **ALL** questions

Max.Marks: 100

Part A (10 X 2=20 Marks)

1. What is the order of convergence of Newton-Raphson method.?
2. State the convergence criteria for Gauss-Seidel iterative method?
3. Write down the Lagrange formula for $(x_1, y_1), (x_2, y_2), (x_3, y_3)$.
4. State Newton's backward difference formula.
5. State the Simpson's 3/8 rd rule.
6. State the three point Gaussian quadrature formula.
7. Write the Runge –Kutta formula for second order differential equation.
8. State Milne's predictor- corrector formula and its Error.
9. State the finite difference formula to find second order derivative with error terms.
10. State standard five point difference formula for solving $u_{xx} + u_{yy} = 0$.

PART-B (5 x 16 = 80 marks)

11.a) By Newton's method, find the positive root of $x^3-x^2-2=0$ correct to three decimal places.

b) By Gauss – elimination method, Solve

$$3x - y + 2z = 12 ,\ x + 2y + 3z = 11 ,\ 2x - 2y - z = 2.$$

(OR)

c) By Gauss-Jordan method, find the inverse of the matrix

$$A= \begin{pmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{pmatrix}$$

d) Find the numerically largest eigen value of $A=\begin{pmatrix} 25 & 1 & 2 \\ 1 & 3 & 0 \\ 2 & 0 & -4 \end{pmatrix}$

by power method and the corresponding eigen vector (correct to three decimal places)

12.a) Using Newton's formula , find y when x=27, from the following data:

x:	10	15	20	25	30
y:	35.4	32.2	29.1	26.0	23.1

b) Using Lagrange's formula, find the value of y when x=35 from the data:

x :	25	30	40	50
y:	52	67.3	84.1	94.4

(OR)

c) Fit a natural cubic spline for the following data

x :	0	1	2	3
f(x) :	1	2	33	244

and compute y(2.5)

13.a) Using Numerical differentiation , find the value of $\sec 31^\circ$ from the data:

θ:	31	32	33	34
tanθ:	0.6008	0.6249	0.6494	0.6745

b) By Simpson's rule , evaluatye $\int_0^2 \frac{dx}{1+x^3}$ by dividing (0,2) into 8 equal parts.

(OR)

c)Evaluate $\int_0^1\int_0^1 \frac{2xy}{(1+x^2)(1+y^2)}\,dydx$ with h=k=0.25 using

(i) the trapezoidal rule (ii) the Simpson's rule

14. a) Using Taylor's series method, obtain y(0.2) and y(0.4) if y(x) satisfies

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

b) Given $\frac{dy}{dx} = x^2$ - y with

x :	0	0.2	0.4	0.6
y :	0	0.02	0.0795	0.1762

using Euler's method compute y(0.8) and Milne's Predictor –corrector method y(1.0).

(OR)

c) Using R-K fourth order method, compute y(0.1) and y(0.2) if y(x) satisfies

$\frac{dy}{dx} = x + yx^2$ y(0)=1

d) Given $\frac{dy}{dx} = x^2 - y$ with

x:	0	0.1	0.2	0.3
y:	1	0.90516	0.82127	0.74918

. Find y(0.4) using Adam's method.

15. a) Solve the Poisson equation $u_{xx} + u_{yy} = -81xy$, $0 < x < 1$; $0 < y < 1$ given that

u (0, y) = 0 ; u (x,0) = 0 ; u (1, y)= 100 ; u (x,1)= 100 and h = 1/3

b) 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)

c) Solve xy" +y =0, y(1)=1,y(2)=2 with h=0.25 by using finite difference method .

d) Solve the $u_{xx} + u_{yy} = 0$ the square $0 \le x , y \le 4$ and the boundary conditions being given as, u=0 at x=0 , u= 8+ 2y at x=4 ,u = $x^2/2$ at y = 0 and u = x^2 at y= 4. with h=k=1.