TECHNICAL UNIVERSITY OF MOMBASA

A Centre of Excellence

Faculty of Applied & Health Sciences

DEPARTMENT OF MATHEMATICS AND PHYSICS

MAY 2016 SERIES EXAMINATION

UNIT CODE: AMA 4421 UNIT TITLE:NUMERICAL ANALYSIS II

MAIN EXAMINATION

TIME ALLOWED: 2HOURS

INSTRUCTIONTO CANDIDATES:

You should have the following for this examination

- Mathematical tables
- Scientific Calculator

This paper consists of **FIVE** questions

Answer question **ONE (COMPULSORY)** and any other **TWO** questions

Maximum marks for each part of a question are as shown

QUESTION ONE (30 MARKS) COMPULSORY

a. Consider the matrix A=$\begin{bmatrix} 4 & -1 \\ -4 & 4 \end{bmatrix}$,determine

      i. The characteristic equation of A   (2 marks)

     ii. The Eigen values of A   (2 marks)

    iii. The corresponding Eigen vectors   (2 marks)

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iv. Prove that the vectors in (iii) are linearly independent (2 marks)

b. Evaluate $\int_0^1 \frac{1}{1+x^2} dx$, using Romberg's method correct to 4d.p. Hence find an approximate value of π (7 marks)

c. Solve the following system of equations using Gaussian elimination method
$$2x + 3y - z = 5$$
$$4x + 4y - 3z = 3$$
$$-2x + 3y - z = 1 \qquad \text{(6 marks)}$$

d. Solve the hyperbolic equation
$U_{tt} = 4U_{xx}$ with boundary conditions $u(0,t) = 0 = U(4,t)$
$U_t(x,o) = 0 \ and \ U(x,0) = x(4-x)$ (9 marks)

QUESTION TWO (20 MARKS)

a. A rod is rotating in a plane about one of its ends. If the following table gives the angle θradius through which the rod has turned for different values of time t seconds, find its angular velocity and angular acceleration when t=0.7 seconds

t seconds	0	0.2	0.4	0.6	0.8	1
Θ radians	0	0.12	0.48	1.1	2	3.2

(6 marks)

b. Use Gauss Seidel iterative method to find x,y and z in the system below (6 marks)
$$8x - 3y + 2z = 20$$
$$6x + 3y + 12z = 35$$
$$4x + 11y - z = 33$$

c. Solve the parabolic equation
$$\frac{\partial u}{\partial t} = \frac{1}{2}\frac{\partial^2 u}{\partial x^2}$$

with conditions $u(0,t) = 0 = U(4,t) U(x,0) = x(4-x)$

taking h=1 and employing the Bender-Schmidt recurrence equation (use ten steps)
(8 marks)

QUESTION THREE (20 MARKS)

a. Solve by Jacobi iteration method the system (use four iterations)   (7 marks)
$$8x - 3y + 2z = 20$$
$$6x + 3y + 12z = 35$$
$$4x + 11y - z = 33$$

b. A slider in a machine moves along the straight rod. Its distance x cm along the rod is given by table below for various values of the time t seconds. Find the velocity and acceleration of the slider when t=0.3 seconds   (6 marks)

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

c. Maximize p= $4x + 3y$

subject to $-x + 2y \leq 4$
$$x + 2y \leq 14$$
$$2x + y \leq 16$$
$x, y \geq 0$ using Simplex method   (7 marks)

QUESTION FOUR (20 MARKS)

a. Evaluate $\int_0^1 \frac{dx}{1+x^2}$ using Weddle'srule taking $h = \frac{1}{6}$ hence compute an appropriate value of π   (6 marks)

b. Solve the elliptic equation using the Liebmann's iteration process
$U_{xx} + U_{yy} = 0$ in $0 \leq x \leq 4, \ 0 \leq y \leq 4$ given that $U(0, y) = 0 \ U(4, y) = 8 + 2y$

$U(x, 0) = \frac{x^2}{2}$ and $u(x, 4) = x^2$. Take $h = k = 1$and obtain the result correct to one decimal   (8 marks)

c. Solve by relaxation method, the equation   (6 marks)
$$10x - 2y - 2z = 6$$
$$-x + 10y - 2z = 35$$
$$-x - y + 10z = 33$$

QUESTION FIVE (20 MARKS)

a. Solve the following equations by Gauss-Jordan method

$$x + 2y + z - w = -2$$
$$2x + 3y - z + 3w = 7$$
$$x + y + 3z - 2w = -6$$
$$x + y + z + w = 2$$

(10 marks)

b. Solve by crouts' method

$$5x - 2y + z = 4$$

$$7x + y - 5z = 8$$
$$3x + 7y + 4z = 10$$

(10 marks)

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