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

SUPPLIMENTARY 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. Find the first, second and third derivatives of the function tabled below, at the point x=1.5

X	1.5	2.0	2.5	3.0	3.5	4.0
F(x)	3.375	7.0	13.625	24	38.875	59

(5 marks)

---

b. Let $A = \begin{pmatrix} 12 & -15 \\ 4 & -4 \end{pmatrix}$ be a square matrix

    i. Write down the characteristic equation of A   (2 marks)

    ii. Calculate the eigen values of A   (2 marks)

    iii. Determine the eigen vectors of A   (2 marks)

c. Solve the elliptic equation for the following square mesh with boundary values as shown
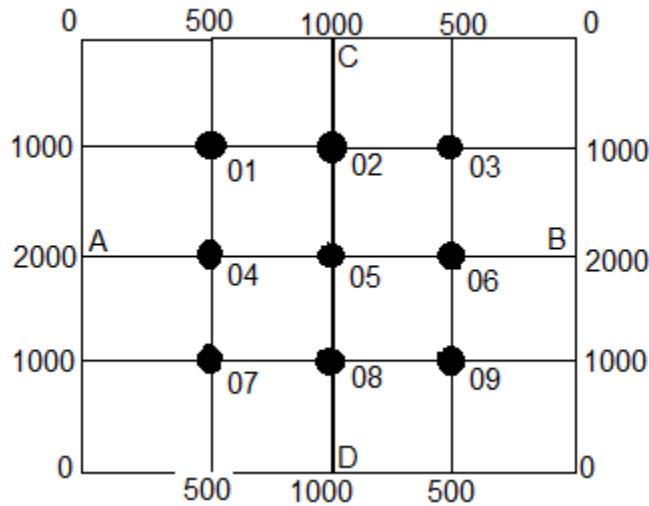
(8 marks)

d. The speed, v meter per second of a car, t seconds after it starts is shown in the following table.

T	0	12	24	36	48	60	72	84	96	108	120
v	0	3.6	10.08	18.9	21.6	18.54	10.26	5.4	4.5	5.4	9

Using Simpson's $\frac{1}{3}$rule, find the distance travelled by the car in 2 minutes?   (5 marks)

e. Solve the system of equations by using Gauss-Jordan elimination method

$x + 2y + z = 8$

$2x + 3y + 4z = 20$

$4x + 3y + 2z = 16$

(6 marks)

QUESTION TWO (20 MARKS)

a. Use Trapezoidal rule to evaluate $\int_0^1 x^3 dx$ considering five sub intervals   (5 marks)

b. Using crank Nicholson's method, solve $U_{xx} = 16U_t$ $0 < x < 1$ $t > o$ $U(x,0) = 0, U(0.t) = 0$ and $U(1,t) = 50t.$ compute u for two steps in t direction taking $h = \frac{1}{4}$

(9 marks)

c. Use Gaussian elimination to solve

$x + y + z = 3$

$x + 2y + 3z = 4$

$x + 4y + 9z = 6$ (6 marks)

QUESTION THREE (20 MARKS)

a. Maximize $P = x + 4y$ subject to

$-x + 2y \leq 6$

$5x + 4y \leq 40$

$x, y \geq 0$ (5 marks)

b. By the methods of least squares, find the straight line that best fits the following data

X	1	2	3	4	5
y	14	27	40	55	68

(6 marks)

c. Solve the poisson equation

$\nabla^2 U = -10(x^2 + y^2 + 10)$

over the square mesh with sides $x = 0, y = 0, x = 3, y = 3 \ with \ u = 0$ on the boundary and mesh length=1 (9 marks)

QUESTION FOUR (20 MARKS)

a. Solve the Laplace equation $U_{xx} + U_{yy} = 0$ inside the square region bounded by the lines x=0, x=4, y=0, y=4 given that $U = x^2 y^2$ on the boundary. Use relaxation technique

(7 marks)

b. solve the system of equations

$x + y + z = 3$

$x + 2y + 3z = 4$

$x + 4y + 9z = 6$

by Crout's methods (8 marks)

c. find the orthogonal trajectories of the family of curves,

$$\frac{x^2}{a^2} + \frac{y^2}{b^2 + \lambda} = 1$$

Where λ is a parameter (5 marks)

QUESTION FIVE (20 MARKS)

a. Solve the following system, by the method of triangularisation

$2x - 3y + 10z = 3$

$-x + 4y + 2z = 20$

$5x + 2y + z = -12$ (8 marks)

b. Find the numerical value of the first derivative at x=0.4 of the function f(x) defined below

X	0.1	0.2	0.3	0.4
F(x)	1.10517	1.22140	1.34986	1.49182

(7 marks)

c. Evaluate $\int_0^1 \frac{dx}{1+x^2}$ using Simpson's $^3/_8$ rule taking h= $^1/_6$ (5 marks)

THIS IS THE LAST PRINTED PAGE