TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Applied & Health Sciences

DEPARTMENT OF MATHEMATICS & PHYSICS

DIPLOMA IN MARINE ENGINEERING

AMA 2303: ENGINEERING MATHEMATICS V

SPECIAL/SUPPLEMENTARY EXAMINATION
SERIES: MARCH 2014
TIME: 2 HOURS

Instructions to Candidates:
You should have the following for this examination

- *Answer Booklet*
- *Scientific Calculator*
- *Mathematical Tables*

This paper consist of **FIVE** questions in **TWO** sections **A** & **B**
Answer question **ONE (COMPULSORY)** and any other **TWO** questions

Maximum marks for each part of a question are as shown

This paper consists of **THREE** printed pages

SECTION A (COMPULSORY)

Question One

a) Solve the following differential equations:

(i) $$\left(xy - x^2\right)\frac{dy}{dx} = y^2$$

(ii) $$\frac{d^2y}{dx^2} + 4\frac{dy}{dx} + 5y = 2e^{-2x}$$ **(16 marks)**

b) Use Maclaurin's theorem to obtain the three terms for the power series of the function $f(x) = \sin 2x$ **(7 marks)**

c) Use the Newton-Raphson iterative method to determine the root of the equation $3\sin x + 4x - 5 = 0$ taking the first approximation of x = 0.75, correct to four significant figures. **(7 marks)**

SECTION B (Answer any TWO questions from this section)

Question Two

a) Solve the following differential equation:

$$y^3\left(x^2 - 1\right) + x^2\frac{dy}{dx} = 0$$

(5 marks)

b) The motion of a particle in a resting medium is described by $\frac{dv}{dt} + kv^2 = 0$ where V is its velocity and k is a constant. Show that if $V = V_o$ when t = 0 then $V = \frac{V_o}{1 + ktv_o}$ **(6 marks)**

c) A function is defined by the data in Table 1. Use the Newton-Gregory backward difference interpolation formula to estimate f(3.8)

Table 1

x	0	1	2	3	4
f(x)	1.00	1.50	2.20	3.10	4.60

(9 marks)

Question Three

a) The cooling of a body is proportional to the excess temperature above that of the surrounding i.e. it follows Newtons-Law of cooling. If the room temperature is 20ºC, and taken ten minutes for its temperature to fall from 100ºC to 60º, determine the time taken for it temperature to reach 25º

(9 marks)

b) Use Taylor's theorem to obtain the first three terms for the power series of $\tan(x+h)$. Hence obtain the power series of $\pi/4 + h$ and use it to determine tan 46º correct to four decimal places.

(11 marks)

Question Four

a) Use Maclaurin's theorem to obtain the first three terms for the power series of the function $f(x) = (e^x + 1)$ in $\ln + x$

(12 marks)

b) Use the Taylors series to express the function $f(x) = x^4 + 2$ as a power series of x + 1

(8 marks)

Question Five

Solve the following differential equations

a) $x\frac{dy}{dx} + 2y = x^2$ **(4 marks)**

b) $2\frac{d^2q}{at^2} + 5\frac{dq}{dt} - 3q = 2\sin 3t$ given that when t = 0, q = 0, $\frac{dq}{dt} = 0$ **(16 marks)**