TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Applied & Health Sciences

DEPARTMENT OF MATHEMATICS & PHYSISCS

DIPLOMA IN MARINE ENGINEERING (DMAE 6)

AMA 2311: ENGINEERING MATHEMATICS VI

END OF SEMESTER EXAMINATION
SERIES: DECEMBER 2014
TIME ALLOWED: 2 HOURS

Instructions to Candidates:

You should have the following for this examination

- *Answer Booklet*

This paper consist of **FIVE** questions
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

Question One (Compulsory)

a) (i) Given $\underset{\sim}{A} = 2i + 3j + 4k,\ \underset{\sim}{B} = 4i - 3j + 2k$ determine the direction cosines of $\underset{\sim}{A}$ and $\underset{\sim}{B}$ hence the angle between them. **(6 marks)**

(ii) Given $\underset{\sim}{A} = 2i + 4j + 3k,\ \underset{\sim}{B} = i + 5j - 2k$ determine $\underset{\sim}{A} \times \underset{\sim}{B}$ **(4 marks)**

b) Use Maclaurin's theorem to obtain the power series for $f(x) = \dfrac{1}{1-x}$ up to the term in x^4 **(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 4 decimal places **(6 marks)**

d) Determine the Newton-Gregory difference interpolating polynomial for data in table 1. Hence determine f(2.5) **(7 marks)**

Table 1

X	0	1	2	3	4
F(x)	3	6	11	18	27

(7 marks)

e) (i) Use Maclaurin's series to obtain the first three terms of the power series for $\dfrac{d^2y}{dt^2} + 4\dfrac{dy}{dt} + 5y = 6\sin t$

se Maclaurin's theorem to obtain the power series for $f(x) = \cos 2x$ **(5 marks)**

(ii) Use Taylor's series to express the function $f(x) = x^4 + 2$ as a power series of x + 1 **(8 marks)**

f) Determine the Newton-Gregory forward difference interpolating polynomial for the data below. Hence evaluate f(25) **(6 marks)**

x	0	1	2	3	4
f(x)	1	7	23	55	109

Question Two

a) Use Taylor's theorem to express $f(x) = \ln x$ as a power series of x – 1 **(8 marks)**

b) Obtain using Maclaurin's series the power series $f(x) = \dfrac{\cos x}{1+x}$ up to the term x^3 **(12 marks)**

Question Three

$e^{2x} - 25x + 10 = 0$

a) Use the Newton-Raphson iterative method to determine the root of the equation taking the first root to be x = 1.65 correct to 4 decimal places. **(8 marks)**

b) Table 2 is data that defines a function:

x	0	1	2	3	4
f(x)	1	5	31	121	341

(i) Use the Newton-Gregory forward difference formula to evaluate f(0.75)
(ii) Use the Newton-Gregory backward difference formula to determine f(3.4) **(12 marks)**

Question Four

$\underset{\sim}{F} = 3ui + u^2 j + (u+2)k \qquad \underset{\sim}{V} = 2ui - 3uj + (u-2)k$

a) Given and determine:

$\int_0^2 \left(\underset{\sim}{F} \times \underset{\sim}{V} \right) du$

$\phi = x^2 yz^3 + xy^2 z^2$

b) (i) Given determine grad ϕ at point (1, 3,2) **(4 marks)**

$\underset{\sim}{V} = xy^2 i + 2xy^2 j - 3yz^2 k$

(ii) Given determine curl V at point (1, -1, 1) **(8 marks)**

Question Five

Solve following second order differential equations:

$$\frac{d^2y}{dt^2} + 4\frac{dy}{dt} + 5y = 6\sin t$$

a) **(9 marks)**

$$\frac{d^2y}{dx^2} + \frac{dy}{dx} - 2y = x^2$$

b) given that when x = 0, y = 1 and $\frac{dy}{dt} = 1/2$ **(11 marks)**