TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Applied & Health Sciences

DEPARTMENT OF MATHEMATICS & PHYSISCS

DIPLOMA IN MEDICAL ENGINEERING

AMA 2351: ENGINEERING MATHEMATICS VI

END OF SEMESTER EXAMINATION
SERIES: APRIL 2015
TIME ALLOWED: 2 HOURS

Instructions to Candidates:

You should have the following for this examination

- *Answer Booklet*
- *Mathematical Table*

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) Use Maclaurins series to expand $f(x) = \sin x$ into power series in x.

(ii) Use the series of $f(x)$ to show that $g(x) = jshx = \sin jx$ **(7 marks)**

b) Write the polynomial $fx = x^4 - 5x^3 + x^2 - 3x + 4$ in ascending power of x – 4 **(6 marks)**

c) Given that

$x_n = 1.2345,\ x_{n+1} = 1.2447,\ x_{n+2} = 1.3124\ \ x_{n+3} = 1.3233$

$f_{(xn)} = 12.5674,\ \ f_{(xn+2)} = 13.9831$

Use Linear interpolation and extrapolation to determine $f(x_{n+1})$ and $f(x_{n+3})$ correct to 5 d.p **(6 marks)**

d) A polynomial function is defined by the following set of functions:

x	2	4	6	8	10
f (x)	-7	9	97	305	681

Use Newton-Gregory formula to evaluate f (4.8) **(5 marks)**

e) Evaluate the following integrals.

(i) $\int_0^2 \int_0^1 (x^2 + y^2)\,dydx$ **(3 marks)**

(ii) $\int_0^3 \int_0^{\ln x} dydx$ **(3 marks)**

Question Two

a) Use Maclaurian theorem to derive the power series of $f(x) = \sinh x$ **(5 marks)**

b) (i) Given that $f(x) = \ln\left\{\frac{1+x}{1-x}\right\}$. Use Maclaurin theorem to determine the power series of upto x^7

(ii) Use your expansion to determine the value of ln 3 and ln 1.5 correct to 4 s.f. Hence deduce the value of ln 2 **(15 marks)**

Question Three

$$\int_0^3 \int_0^{\sqrt{9-x^2}} x^2 y \, dydx$$

a) Evaluate the integral **(6 marks)**

b) Use triple integral to find the volume of the solid bounded by the planes z = 0, x = 1, x = 2, y = 0 , y = 2 and the surface $z = 2x^2 + y^2$ **(6 marks)**

c) Use double integral to find the area enclosed by the parabola $y = 6x - x^2$ and the line y = x **(8 marks)**

Question Four

a) (i) Given that x_n is an approximation to the root of the equation $x^3 - 6x^2 + 6x - 8 = 0$, show using Newton-Raphson method that a better approximation xn+1 is given by:

$$x_{n+1} = \frac{2x_n{}^3 - 6x_n{}^2 + 8}{3x_n{}^2 - 12x_n + 6}$$

(ii) Hence by taking $x_o = 5$ find the root of the equation correct to 3 d.p **(9 marks)**

b) A function f(x) is defined b:

x	0	1	2	3	4	5	6
f(x)	-1	2	11	38	95	194	347

Use Newton-Gregory forward difference formula to determine the poly nomial that fits the data hence estimate:

(i) $f(4.8)$

(ii) $f(6.4)$ **(11 marks)**

Question Five

a) State the Maclaurin series

$$y = \sin^{-1}\left(\frac{x}{2}\right)$$

(i) Obtain the Maclaurian series for up to the term x5.

(ii) Use the series to approximate $si^{-1}\left(2/3\right)$ correct to 4 d.p.

$$\sin^{-1}\left(2/3\right) = 0.7297$$

(iii) Calculate the error in the approximate value if **(12 marks)**

b) Given the function $f(x) = e^{3x}\sin 3x$, use Maclaurin series to expand f(x) up to x^3 evaluate $\int_0^1 e^3 x \sin 3x$ **(8 marks)**