TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Applied & Health Sciences

DEPARTMENT OF MATHEMATICS & PHYSISCS

DIPLOMA IN BUILDING & CIVIL ENGINEERING (DBCE 12)

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)

$$\lim_{x\to 0} \frac{\sin x}{x}$$

a) (i) Use Taylors series to find **(10 marks)**

$f(z) = \bar{z}$

(ii) Use the definition to find the derivation of **,** if it exists **(5 marks)**

b) (i) Use the trapezoidal rule with n = 8 to estimate:

$\int_1^5 \sqrt{1+x^2}\,dx$

(7 marks)

$\oint_C y^3 dx - x^3 dy$

(ii) Evaluate where C is positively oriented circle of radius 2 centred at the origin **(8 marks)**

Question Two

a) Use Newton-Raphson's method to find the only real root of the equation $x^3 - x - 1 = 0$ correct to 9 decimal places **(10 marks)**

b) Find the first three non-zero terms in the Taylor series for $f(x) = e^x \cos x$ about x = 0 **(10 marks)**

Question Three

a) (i) Determine the Jacobian of x and y, given that $x = r\cos\theta$ $y = r\sin\theta$ and **(5 marks)**

$$\sum_{j=1}^{\infty} \frac{(3+2)i}{(5+1)^5}$$

(ii) Show that the series converges **(5 marks)**

$$\lim_{x\to 0}\left\{\frac{1}{\sin x} = \frac{1}{x}\right\}$$

b) Use Maclaurin series to find **(10 marks)**

Question Four

a) The vertical distance covered by a rocket from t = 8 to t = 30 seconds is given by:

$$x = \int_8^{30} \left\{2000 \ln\left[\frac{140{,}000}{140{,}000 - 2100t}\right] - 9.8t\right\} dt$$

(i) Use the single segment trapezoidal rule to find the distance covered for t = 8 to t = 30 seconds. **(5 marks)**

(ii) Use Green's theorem to evaluate $\int_c y^3 dx - x^3 dy$ where C is the positively oriented circle of radius 2 **(7 marks)**

b) Use the Lagrange multiplier method to find the greatest and least distances from the point (2, 1, 2) to the sphere with the equation $x^2 + y^2 + z^2 = 1$ **(8 marks)**

Question Five

a) Find the maximum and minimum of $f(x, y) = 5x - 3y$ subject to the constraint $x^2 + y^2 = 136$

(10 marks)

b) Use Maclaurin series to evaluate $\lim_{x \to 0} \frac{\ln \cos x}{x^2}$ **(5 marks)**

c) If $f = f(x, y)$ and $x = u^2$ and $y = u / v$ find the Jacobian transformation of f **(5 marks)**