TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY IN CONJUCTION WITH KENYA INSTITUTE OF HIGHWAYS AND BUILIDNG TECHNOLOGY (KIHBT)

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

UNIVERSITY EXAMINATION FOR:

HIGHER DIPLOMA IN BUILDING ECONOMICS

EBE 3105: MATHEMATICS I A

END OF SEMESTER EXAMINATIONS
SERIES: OCTOBER 2016

TIME: 2HOURS

Instruction to candidates

You should have the following for this examination

- Answer booklet
- Pocket Calculator

This paper consist of five question.
Answer any three questions of the five questions
All question carry equal marks
Maximum marks for each part of a question are as shown
This paper consist of two printed pages

QUESTION 1.

a) Solve $2^{x+1} = 3^{2x-5}$ Correct to 2 decimal places (4mks)

b) Determine in polar form $(-2 + j3)^6$ Using De moivres theorem (4mks)

c) Evaluate $\frac{dz}{dt}$ Correct to 4 significant figures (4mks)
when t = 0.5 given that $Z = 2e^{3t} \sin 2t$

d) Given $Z = 4e\, j^{1.3}$, determine in $\ln Z$ in Cartesian form (4mks)

e) Evaluate in polar form $(-7 - j5)^4$ (4mks)

QUESTION 2.

a) The time of oscillation t of a pendulum is given by $t = 2\pi\sqrt{\frac{l}{g}}$ where l is the length of the pendulum and g the free fall acceleration due to gravity.
Determine $\frac{\partial t}{\partial g}$ (3mks)

b) If $Z = f(U,V,W)$ and $Z = 3u^2 - 2V + 4w^3 v^2$
Find the total differential, dZ (4mks)

c) Evaluate

i) $\frac{1}{1 + j}$ (2mks)

ii) $(1 + j2)(-2 + j3)$ (2mks)

d) Express $-3 - j4$ in polar form and represent it on argand diagram (6mks)

e) using euler formula express $4.2\, e^{-7.5i}$ in the form a + bi (3mks)

QUESTION 3

a) Given $Z = 1 - j3$, $Z_2 = 2 + j5$ and $Z_3 = -3 - j4$, Determine (5mks)

(i) $Z_1 Z_2$

(ii) $\frac{Z_1}{Z_3}$

b) Differentiate the following functions

(i) $y = \frac{x^2}{\sqrt{x+1}}$ (5mks)

(ii) $y = x^{\frac{1}{2}} \sin 3x$ (3mks)

c) Given $y = 2xe^{-3x}$ show that (5mks)

$$\frac{d^2y}{dx^2} + 6\frac{dy}{dx} + 9y = 0$$

d) Given $y = \frac{2x^3}{5} - \frac{4}{x^3} + 4\sqrt{x}^5 + 7$. Find $\frac{dy}{dx}$ (2mks)

QUESTION 4.

a) Evaluate $\frac{Z_1 Z_2}{Z_1 + Z_2}$ given $Z_1 = 1 + j2$ and $Z_2 = -2 + j3$ (5mks)

b) Find the derivative of $y = \frac{5}{\sqrt[3]{x^4}}$ (3mks)

c) i) Show that if $y = \cos^{-1} x$ then $\frac{dy}{dx} = \frac{1}{\sqrt{1-x^2}}$ (3mks)

ii) Hence find the differential coefficient of
$y = \text{Cos}^{-1}(1 - 2x^2)$ (5mks)

d) Given $Z = 5x^4 + 2x^3y^2 - 3y$ Find

i) $\frac{\partial z}{\partial x}$ (2mks)

ii) $\frac{\partial z}{\partial y}$ (2mks)

QUESTION 5.

a) The second moment of area of a rectangle is given by $I = \frac{bl^3}{3}$ If b and l are measured as 40mm and 90mm respectively and measurement errors are -5mm in b and +8mm in l. Find the approximate error in the calculated value of I (4mks)

b) Given $y = 2x^3$, determine from first principle the differential coefficient (3mks)

c) Find the derivative of y= tan x (3mks)

d) Show that $-\frac{25}{2}\left(\frac{1+j2}{3+j4} - \frac{2-j5}{-j}\right) = 57 + j24$ (4mks)

e) Evaluate in polar form $2\angle 30^0 + 5\angle -45^0 - 4\angle 120^0$ (6mks)