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 3101: 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) Find the modulus and argument of the complex numbers $Z = 2 + j3$ and express Z in polar form (3mks)

b) solve $\log(x-1) + \log(x+1) = 2\log(x+2)$ (4mks)

c) Given $y = \sqrt{x}^3 \ln 3x$, Find $\frac{dy}{dx}$ (3mks)

d) Differentiate $y = 3\tan^4 3x$ (4mks)

e) Determine from first principle the differential coefficient of $2x^2$ (3mks)

f) Evaluate in polar form $\frac{10 < \frac{\pi}{4} \times 12 < \frac{\pi}{2}}{6 < -\frac{\pi}{3}}$ (3mks)

QUESTION 2.

a) Using euler's formula, express $3+4j$ in the form re^{jx} (3mks)

b) Given $Z = 3e^{1-j}$. Find $\ln Z$ in polar form (6mks)

c) Evaluate $\frac{dy}{dx}$ correct to 4 significant figures
when $x = 0.5$ given that $y = 2e^{3x} \sin 2x$ (4mks)

d) Determine the differential coefficient of $y = \tan^{-1} \frac{x}{a}$ and show that the differential coefficient of $\tan^{-1} \frac{2x}{3}$ is $\frac{6}{9+4x^2}$ (7mks)

QUESTION 3.

a) Determine the magnitude and direction of the resultant of the three coplanar forces given below, when they act at a point

Force A – ION acting at 45^0 from positive horizontal axis
Force B – 8N acting at 120^0 from positive horizontal axis
Force C – 15N acting at 210^0 from positive horizontal axis (5mks)

b) Evaluate $j\left(\frac{1+j3}{1-j2}\right)^2$ (3mks)

c) Find the derivative of $y = \sec ax$ (6mks)

d) Given $y = 4 \sin 3x \cos 2t$, Find;

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

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

e) Find the second differential coefficient given f (x) = $2x^5 – 4x^3 + 3x – 5$ (2mks)

QUESTION 4.

a) Find the roots of $(-14 + j3)^{-2/5}$ in polar form (6mks)

b) Evaluate $\frac{1 – j}{1 + j}$ (3mks)

c) Given $y = xe^{2x}$ show that the $\frac{d^2y}{dx^2} - 4\frac{dy}{dx} + 4y = 0$ (6mks)

d) The pressure P, volume V and temperature T of a gas are related by PV = KT where K is a constant. Determine total differential dp in terms of P, V and T (5mks)

QUESTION 5.

a) Determine in polar form $(-2 + j3)^6$ (4mks)

b) Given $Z_1 = 2+j4$ and $Z2 = 3 – j$ determine $Z_1 – Z_2$ and represent the results on an argand diagram (4mks)

c) The displacement **S** cm of the end of a stiff spring at time t seconds is given by $s = ae^{-kt} \text{ Sin } 2\pi ft$. Determine the velocity of the end of, spring after 1 second given a=2, k = 0.9 and f = 5 (4mks)

d) Given $Z = 4x^2 y^3 – 2x^3 + 7y^2$, Find $\frac{\partial z^2}{\partial y \partial x}$ (2mks)

e) Show that if $Z = \frac{x}{y}$ 1ny then $\frac{\partial 2}{\partial y} = \frac{\partial x^2}{\partial y \partial x}$ (6mks)