TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Applied & Health Sciences

DEPARTMENT OF MATHEMATICS & PHYSISCS

CERTIFICATE IN:
BUILDING & CIVIL ENGINEERING
MECHANICAL ENGINEERING
ELECTRICAL & ELECTRONIC ENGINEERING

AMA 1151: ENGINEERING MATHEMATICS II

SPECIAL/SUPPLEMENTARY EXAMINATION
SERIES: JUNE/JULY 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 **FOUR** printed pages

Question One (Compulsory)

a) (i) Convert the angle 45° 36' 18" to decimal degree formal. **(2 marks)**
(ii) Convert 18.48 to degree minutes and seconds **(2 marks)**

b) (i) A rod of length $7\sqrt{2}$ cm is inclined to the horizontal at an angle of $\pi/4$ radians. A shadow is cast immediately below it from a lamp directly overhead. What is the length of the shadow?

(ii) What is the new length of the of the rods inclination is changed to $\pi/3$ to the vertical. **(4 marks)**

(iii) Verify the identity $\frac{1-\sin\theta\tan\theta}{1+\sec\theta}=\cos\theta$ **(3 marks)**

c) Simplify:

(i) $(3+j4)(2+j5)$ **(2 marks)**

(ii) $\frac{4-j5}{2-j}$ **(3 marks)**

d) (i) Express in polar form z = -4 + j2 with aid of a diagram **(3 marks)**

(ii) If $z=x+jy$ find the equation of the locus $|z-1|=5$ **(4 marks)**

e) Find $\tanh^{-1} x$ in log form **(4 marks)**

f) If $y=2x^4-3x^3+4x-x+5$ obtain an expression for $\frac{dy}{dx}$ and hence calculate the value of $\frac{dy}{dx}$ at x = -3 **(3 marks)**

Question Two

a) Find the derivative of $y-3x^2-7x$ from first principle **(6 marks)**

b) (i) Find the gradient of $y=2x^2+3x-5$ at the point (2 , 9) **(3 marks)**
(ii) Offer 't' seconds a particle has travelled (2 + 3 +7t)m. Find the speed of the particles after 8 seconds **(3 marks)**

c) Find the maximum and minimum of the function $y=x^3+6x^2-36x+5$ **(6 marks)**

Question Three

a) Simplify:

(i) $(3+j4)(3-j4)$ **(2 marks)**

(ii) $(2+j3)^{2^3}$ **(2 marks)**

b) Given that $z = 3+j4$ and $w = 12+j5$ write down the moduli and arguments with aid of a diagram of:

(i) z

(ii) w

(iii) $\frac{1}{2}$ **(6 marks)**

$$(ejt)^n = ej^{(ne)}$$

c) By definition Demoivres theorem is expressed for all n. Use the theorem to:

(i) Obtain expansion of $\cos 3\theta$ and $\sin 3\theta$ in terms of power $\cos\theta$ and $\sin\theta$ **(4 marks)**

(ii) the speed (in km/h) at the instant the breaks are applied

Question Four

a) Given $\sec\theta = 1.4723$ where θ is an acute angle. Determine: **(6 marks)**

(i) $\cos ec\theta$

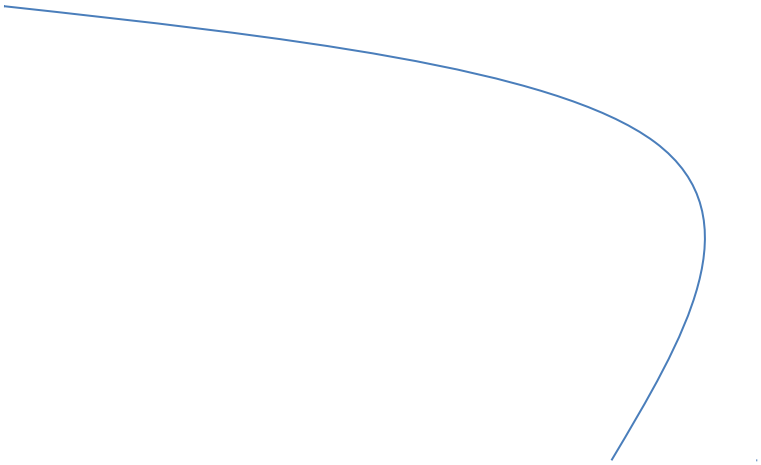
(ii) $\cot\theta$

b) Prove the following trigonometric identities:

(i) $\cos\theta \sin\theta = \frac{\sin 2\theta}{\tan\theta}$

(ii) $\frac{(\cos ec\theta + \cot\theta) + \tan\theta}{\tan\theta + \sec\theta} = \frac{\cos\theta + 1}{\sin\theta + 1}$ (4 marks)

c) (i) Find the angle labeled θ in figure 1 below: **(3 marks)**



(ii) An aerial of height 4.1m is the erected on a slope of 15°. It will be secured by two cables each making 35° with the aerial as shown in figure 2 below. Find the length of the longer cable. **(2 marks)**

Figure 2

(iii) Given $|z| = 10$ and arg z = 120° write down z **(3 marks)**

Question Five

Express in partial fractions, the following:

(i) $\dfrac{x^2 + 3x - 10}{x^2 - 2x - 3}$ **(6 marks)**

(ii) $\dfrac{15x^2 - x + 2}{(x-5)(3x^2 + 4x - 2)}$ **(8 marks)**

(iii) $\dfrac{8x^2 - 14x - 10}{x^3 - 4x^2 + x + 6}$ **(6 marks)**