



**TECHNICAL UNIVERSITY OF MOMBASA**  
**Faculty of Applied & Health**  
**Sciences**

DEPARTMENT OF MATHEMATICS & PHYSICS

**CERTIFICATE IN ELECTRICAL & ELECTRONIC ENGINEERING**  
**CERTIFICATE IN ELECTRICAL POWER ENGINEERING**  
**(CEEE/CEPE II)**

AMA 1102: ENGINEERING MATHEMATICS II

**SPECIAL/SUPPLEMENTARY EXAMINATION**

**SERIES: OCTOBER 2013**

**TIME: 2 HOURS**

**Instructions to Candidates:**

You should have the following for this examination

- *Answer Booklet*

This paper consist of **FIVE** questions in **TWO** sections **A & B**

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

**SECTION A (COMPULSORY)**

**Question One**

$$i = 20\sin(100\pi t + 0.2)$$

- a) An alternating current amperes at any time  $t$  seconds is given by  $i = 20\sin(100\pi t + 0.2)$  the angle being  $t$  radians. Find:
- (i) The value of  $i$  when  $t = 0$  and when  $t = 10\text{ms}$
  - (ii) One value of  $t$  at which  $i = 0$  and one at which  $i = 20\text{A}$  **(11 marks)**

- b) Express  $\frac{x^2 + 3x - 10}{x^2 - 2x - 3}$  in partial fractions **(6 marks)**

- c) Determine  $\frac{dy}{dx}$  in each of the following cases and find the value of  $\frac{dy}{dx}$  at the stated value of  $x$ :

(i)  $y = 6x^3 - 7x^2 + 4x + 5$  ( $x = 3$ ) **(2 marks)**

(ii)  $y = 3x^4 - 7x^3 + 4x^2 + 3x - 4$  ( $x = 2$ ) **(2 marks)**

- d) (i) If  $y = \tan(4x + 1)$  find  $\frac{dy}{dx}$  **(4 marks)**  
 (ii) The power absorbed by a certain resistor for various values of current is as follows:

Power (watts)	5	20	45	80	125	180
Current (amperes)	1	2	3	4	5	6

Plot the graph of power against the square of the current and hence determine the equation relating power and current for this resistor. **(5 marks)**

**SECTION B (Answer any TWO questions from this section)**

**Question Two**

- a) A survey of the number of vehicles passing Technical University of Mombasa in one hour was carried out by DEPE 2. The traffic was divided into six categories: bicycle, buses, private cars, vans and lorries, taxis and others. The results are shown below:

Bicycles	23
Buses	15
Private cars	156

Vans and Lorries	94
Taxis	12
Others	$\frac{6}{306}$

Draw the following types of diagram to illustrate the information:

- (i) Bar chart
- (ii) Pie chart
- (iii) Pictogram
- (iv) Frequency polygon (12 marks)**

b) Given the equation

$$x^2 + y^3 = 1$$

- (i) Transpose the equation to make y the subject of the transposed equation (1 mark)**  
 $-5 \leq x \leq 5$
- (ii) Construct ordered pairs of numbers corresponding to the integer values of x where (5 marks)**
- (iii) Plot the ordered pairs of numbers on a Cartesian graph and join the points plotted with a continuous curve (2 marks)**

### Question Three

a) (i) Verify the following:

$$1 - \frac{\sin \theta \tan \theta}{1 + \sec \theta} = \cos \theta$$

**(4 marks)**

- (ii) An automatic garden water spray gives out a spray to a distance of 2m and revolves through an angle  $\alpha$  which can be varied. If the described spray catchment area is to be  $3\text{m}^2$ , to what should angle  $\alpha$  be set (correct to the nearest degrees)? **(3 marks)**

b) (I) Evaluate the following showing the working:

- (i)  $\sec 49^\circ$  (2 marks)**
- (ii)  $\operatorname{cosec} 17.92^\circ$  (2 marks)**
- (iii)  $\cot 83^\circ 16'$  (2 marks)**

(II) In a triangle ABC figure 1  $A = 53^\circ$ ,  $B = 61^\circ$  and the length  $a = 12.60\text{cm}$ . Find the unknown sides and angle:

(III) If  $\tan \theta = 1$  find the value of  $\sec^2 \theta$  without using tables (show your working) **(3 marks)**

### Question Four

a) (I) Differentiate with respect to x:

(i)  $e^{3x} \sin 4x$  (3 marks)

(ii)  $\frac{\sin 2x}{2x+5}$  (3 marks)

(II) If  $x^2 + y^2 - 2x - 6y + 5 = 0$  find  $\frac{dy}{dx}$  and  $\frac{d^2y}{dx^2}$  at  $x = 3, y = 2$  (6 marks)

b) Obtain the differential coefficient of:

$y = \frac{3}{5}x^3 - \frac{2}{x^2} + 5\sqrt{x^7} + 5$   
(i) (4 marks)

$y = \ln(3 - 4\cos x)$   
(ii) (4 marks)

### Question Five

a) (I) Express in partial fractions:

(i)  $\frac{32x^2 - 28x - 5}{(4x - 3)^3}$  (4 marks)

(ii)  $\frac{9x^2 + 48x + 18}{(2x + 1)(x^2 + 8x + 3)}$  (4 marks)

(II) (i) If A, B and C are the angles of a triangle deduce that

$$\frac{\sin A + \sin B}{\cos A + \cos B} = \cot \frac{C}{2}$$

(3 marks)

(ii)  $\sin A + \sin B + \sin C = 4 \cos \frac{A}{2} \cos \frac{B}{2} \cos \frac{C}{2}$  (6 marks)

b) Find the length of arc or a circle of radius 5cm when the angle subtended at the centre is 1.6 radians (3 marks)