THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A Constituent College of JKUAT)
Ukunda Campus

Faculty of Engineering and Technology

DEPARTMENT OF ELECTRICAL & ELECTRONIC ENGINEERING

CERTIFICATE IN TECHNOLOGY –ELECTRICAL POWER ENGINEERING

EEE 1102: ENGINEERING MATHEMATICS

END OF SEMESTER EXAMINATION
SERIES: APRIL 2012
TIME: 2 HOURS

Instructions to Candidates:
This paper consists of **FIVE** questions
- _Answer Booklet_
Answer question **ONE (COMPULSORY)** and any other **TWO** questions
Marks are indicated for each part of the question
This paper consists of **FOUR** printed pages

Question One

a) If α and β are the roots of the equation $2x^2 + 8x + 7 = 0$. Determine the values of the following without solving the equation

(i) $x^2 + \beta^2$

(ii) $a^2 - \beta^2$ hence form an equation whose roots are $\frac{1}{\alpha^2}$ and $\frac{1}{\beta^2}$ (9 marks)

b) (i) Plot a graph of $y = 2x^2 - 7 + 12x$ to range of $x < 7 \le x \le 1$. Use the graph to solve the equation $2x^2 - 7 + 12x = 0$

(7 marks)

(iii) Use Heron's formular to find the area of a triangle whose sides are 9cm, 12cm and 15cm respectively (4 marks)

(iv) Prove that $\dfrac{\cos ecA}{CotA + TanA} = CosA$ (5 marks)

(v) Determine the radius of a circle in which an arc of 12cm substends an angle of 20° at the centre (5 marks)

Question Two

a) Differentiate the following from first principle

(i) $y = x^2 + 2x$ (3 marks)

(ii) $y = \frac{1}{x}$ (3 marks)

(iii) $z = x^3$ (3 marks)

b) (i) A straight line AB passes through P(3, -2) and has a gradient of $\frac{-1}{2}$. Find its equation and the equation of the line through the same point which is I to AB (6 marks)

(ii) The displacement S of a body in a time interval t seconds is $S = t^s - 3t^2 + 4t$. Find the velocity and acceleration of the body in three seconds (5 marks)

Question Three

a) Prove that

$$\frac{\cos\theta}{1-\sin\theta}+\frac{\cos\theta}{1+\sin\theta}=2\sec\theta$$

(i)

$$\cot 2x=\frac{1-\tan^{2}x}{2\tan x}$$

(ii)   (6 marks)

b) A triangular metal template is in the shape shown in figure (1)

Figure 1

Determine

$$B\hat{A}C$$

(i)   The angle   (6 marks)
(ii)   The area of the tamplate

c) Solve the equation $7\cos x-9\sin x-7.6=0$ by expressing it in the form $R\sin(x+a)$ for values of x between 0º and 360º   (8 marks)

Question Four

a) A triangle has a perimeter of 12cm and area of 6cm². Given that the length of two sides are 3cm and 5cm. Determine the length of the remaining side   (5 marks)

b) Determine the area of the figure shown below   (9 marks)

Figure 2

c) Determine the radius and co-ordinates of the centre of a circle $x^2 + y^2 + 5x - 6y = 5$ (6 marks)

Question Five

a) (i) Given that $f = p\left[1 + \dfrac{CL^2}{K^2}\right]$, express C in terms of other quantities

   (ii) Solve $5x^2 - 7x - 6 = 0$ by method of completing square   (8 marks)

b) Use elimination method to solve the simultaneous equation.
$$\frac{2x-1}{5} - \frac{1-4y}{2} = \frac{5}{2}, \quad \frac{1-3x}{7} + \frac{2y-3}{5} + \frac{32}{35} = 0$$

(5 marks)

c) Prove that $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ (4 marks)

d) Given that $\log_{10} 2 = 0.301$ and $\log_{10} 3 = 0.4771$
   Evaluate

   (i) $\log_{10} 7.5$

   (ii) $\log_{10} 13.5$ (3 marks)