Name:_____ Index No.:_____

2521/102
2601/103
2602/103
2603/103
ENGINEERING MATHEMATICS I
June/July 2015
Time: 3 hours

Candidate's Signature:_____

Date:_____

THE KENYA NATIONAL EXAMINATIONS COUNCIL

DIPLOMA IN ELECTRICAL AND ELECTRONIC ENGINEERING
(POWER OPTION)
(TELECOMMUNICATION OPTION)
(INSTRUMENTATION OPTION)
MODULE I

ENGINEERING MATHEMATICS I

3 hours

INSTRUCTIONS TO CANDIDATES

Write your name and index number in the spaces provided above.
Sign and write the date of the examination in the spaces provided above.
You should have Mathematical tables / Scientific calculator for this examination.
*This paper consists of **EIGHT** questions.*
*Answer any **FIVE** questions in the spaces provided in this question paper.*
All questions carry equal marks.
Maximum marks to each part of a question are as shown.
*Do **NOT** remove any pages from this booklet.*
Candidates should answer the questions in English.

For Examiner's Use Only

Question	1	2	3	4	5	6	7	8	TOTAL SCORE
Candidate's Score									

This paper consists of 20 printed pages.

Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.

1. (a) Prove the identities:

(i) $\tanh 2x = \dfrac{2\tanh x}{1+\tanh^2 x}$;

(ii) $\cosh 3x = 4\cosh^3 x - 3\cosh x$. (7 marks)

(b) (i) Express $\text{sech}^{-1} x$ in logarithmic form;

(ii) Given that $\sinh^{-1} x = \ln\left(x + \sqrt{x^2+1}\right)$, find the real root of the equation $\text{sech}^{-1} x = \sinh^{-1} x$. (13 marks)

2. (a) Prove the identity:

$$\frac{1-\cos\theta}{\sin\theta} = \frac{1}{\text{cosec}\,\theta + \cot\theta}$$ (4 marks)

(b) Given that A, B and C are angles of a triangle, prove that

$\sin 2A + \sin 2B + \sin 2C = 4\sin A \sin B \sin C$ (7 marks)

(c) (i) Express $5\sin\theta - 12\cos\theta$ in the form $R\sin(\theta - \alpha)$, where $R > 0$ and $0 \le \alpha \le 90°$;

(ii) Hence, solve the equation $5\sin\theta - 12\cos\theta = 6$ for $0 \le \theta \le 360°$. (9 marks)

3. (a) Solve the equation $2x^2 + 9x + 9 = 0$, by factorization. (5 marks)

(b) The roots of the equation $x^2 + 6x + q = 0$ are α and $\alpha - 1$. Determine the value of q. (5 marks)

(c) The roots of the equation $x^2 + 7x + 3 = 0$ are α and β. Without solving the equation, form an equation whose roots are $\dfrac{1}{\alpha^2}$ and $\dfrac{1}{\beta^2}$. (10 marks)

4. (a) Find the middle term in the binomial expansion of $(2x+3)^8$, and determine its value when $x = \dfrac{1}{12}$. (6 marks)

(b) Expand $(1-3x)^{-\frac{1}{2}}$ as far as the term in x^3 and determine the range of values of x for which the expansion is valid. (4 marks)

(c) (i) If x is so small that its fourth and higher powers may be neglected, show that $\sqrt[4]{(1+x)} + \sqrt[4]{(1-x)} = a - bx^2$, and determine the values of a and b;

(ii) Hence, by putting $x = \dfrac{1}{16}$ in the result in (c) (i) above, prove that $17^{\frac{1}{4}} + 15^{\frac{1}{4}} = 3.9985$ approximately. (10 marks)