



MURANG'A UNIVERSITY COLLEGE

A Constituent College of Jomo Kenyatta University of Agriculture and Technology

School of Pure and Applied Science

SUPPLEMENTARY EXAMINATION

ELECTRICAL DEPARTMENT

SEE 1101, ENGINEERING MATHEMATICS I

Date: 28th JUNE, 2016

TIME 2HRS

Instructions: Answer question **one** and any other **two**

QUESTION ONE:

- i) Simplify: $\left(\frac{125}{27}\right)^{-2/3}$ (3 marks)
- ii) Rationalize and simplify the denominator of the following surds:
 $\frac{3-\sqrt{5}}{1+3\sqrt{5}}$ (3 marks)
- iii) Solve for x and y the equations:
 $xy = 80$
 $\log x - 2 \log y = 1$ (4 marks)
- iv) Find the remainder when $x^3 - 3x^2 + 6x + 5$ is divided by $x - 2$. (3 marks)
- v) Divide:
i) $3x^2 + x - 3$ by $x - 1$ (3 marks)
ii) $2x^2 + x^2 + 3x + 5$ by $x + 1$ (3 marks)
- vi) Solve the following complex equations:
i) $5(a + 2b) = 9 - 2i$ (3 marks)
ii) $(2 + i)(-2 + i) = x + iy$ (3 marks)

vii) A student is to answer 8 out of 10 questions in an exam.

- i) Find the number of ways in which the student can answer 8 of the ten questions. (3 marks)
- ii) Find the number of ways in which the student can answer 8 out of 10 questions if he must answer the first three questions. (3 marks)
- iii) Simplify: $(2 - 3\sqrt{3})(3 + 2\sqrt{3})$ (marks)

QUESTION TWO:

- a) Obtain the first four terms of the expansion $(1 + \frac{1}{2}x)^{10}$ in ascending powers of x . Hence, find the value of $(1.005)^{10}$ correct to four decimal places. (5 marks)
- b) Simplify the following by rationalizing the denominator:
- i) $\frac{1}{\sqrt{5}-2} + \frac{1}{\sqrt{5}+2}$ (3 marks)
- ii) $\frac{2}{\sqrt{7}-\sqrt{3}} + \frac{3}{\sqrt{7}+\sqrt{3}}$ (4 marks)
- c) Solve the equation: $2^x + 3(2^x) - 4 = 0$ (4 marks)
- d) Express: $\frac{x^2-3}{(x-1)(x^2+1)}$ in partial fractions (4 marks)

QUESTION THREE:

- a) The 8th term of an AP is 11 and the 15th term is 21. Find the common difference, the first term of series and the 17th term. (5 marks)
- b) The 6th term of a GP is 16 and the 3rd term is 2. Find the 1st term, the common ratio and the nth term. (5 marks)
- c) In a geometric progression, the sum of the second and third term is 6 and the sum of the third and fourth terms is -12. Find the first term and the common ratio. (5 marks)
- d) The sum of a number at consecutive terms of an arithmetical progression is $-19\frac{1}{2}$, the first term is $16\frac{1}{2}$, and the common difference is -3. Find the number of terms. (5 marks)

QUESTION FOUR:

- a) Express the following complex number $\frac{1}{5-3i}$ in a form of having a real number. (5 marks)
- b) Given that $Z_1 = 2 + 9i$ and $Z_2 = 5 + 2i$, express in the form $a + ib$, where $a, b \in \mathbb{R}$, the complex numbers:
- i) $Z_1 Z_2$ (3 marks)
- ii) Z_1 / Z_2 (3 marks)
- iii) $Z_1^2 - Z_2^2$ and find the modulus (3 marks)
- c) Given that $Z_1 = 3 - i$ and $Z_2 = -2 + 5i$, represent on an Argand diagram the complex numbers $Z_1, Z_2, Z_1 + Z_2, Z_1 - Z_2$ and find the modulus of $Z_1 + Z_2$ and $Z_1 - Z_2$. (7 marks)

QUESTION FIVE:

- a) Prove by induction that $1^3 + 2^3 + \dots + n^3 = \frac{1}{4}n^2(n+1)^2$ (6 marks)
- b) What is the smallest number of terms of the geometrical progression, $8 + 24 + 72 + \dots$ that will give a total greater than 6,000,000? (6 marks)
- c) In an arithmetic progression, the 13th term is 27 and the 7th term is three times the second term. Find the 1st term, the common difference and the sum of the first ten terms. (4 marks)
- d) The sum of the first eight terms of an arithmetic progression (AP) is 220. If the third term is 17, find the sum of the first six terms. (6 marks)