



MURANG'A UNIVERSITY COLLEGE
(A constituent college of Jomo Kenyatta University of Agriculture and Technology)

SCHOOL OF PURE AND APPLIED SCIENCES
UNIVERSITY EXAMINATIONS 2015/2016 ACADEMIC YEAR
SEB 1101 ENGINEERING MATHEMATICS I

DATE: 10TH DECEMBER, 2015

TIME- 2HOURS

QUESTION ONE:

a) $\sqrt{54} + \sqrt{150} - \sqrt{24}$ (3 marks)

b) Solve for x and y the equations:

$$xy = 80$$

$$\log x - 2 \log y = 1$$
 (4 marks)

c) Find the remainder when $x^3 - 3x^2 + 6x + 5$ is divided by $x - 2$ (5 marks)

d) Divide:

i) $3x^2 + x - 3$ by $x - 1$ (3 marks)

ii) $2x^2 + x^2 + 3x + 5$ by $x + 1$ (3 marks)

e) Rationalize and simplify the denomination of the following surds:

$$\frac{3 - \sqrt{5}}{1 + 3\sqrt{5}}$$
 (3 marks)

f) Solve the simultaneous equations:

$$7x + 2y = 11$$

$$4x + y = 7$$

(3 marks)

g) Solve the simultaneous equations:

$$3x + 2y - Z = 19$$

$$4x - y + 2Z = 4$$

$$2x + 4y - 5Z = 32$$

(5 marks)

h) Solve the quadratic equation:

$$x^2 + 5x - 6 = 0$$

(3 marks)

QUESTION TWO:

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 nth 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 THREE:

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 FOUR:

- 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) 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)
- d) 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)

QUESTION FIVE:

- a) Solve the equation: $2x^2 - 3x - 4 = 0$ (3 marks)
- b) Solve the equations:
 $5x - 3y - 22 = 31$
 $2x + 6y + 32 = 4$
 $4x + 2y - 2 = 30$ (5 marks)
- c) The length of a rectangular room is 4 metres longer than its width. If the area is $12m^2$, find its dimensions. (5 marks)
- d) Factorize completely: $x^4 - 3x^3 + 4x^2 - 8$ (4 marks)
- e) Solve: $x^2 + 8x + 5 = 0$ by method and completing square. (3 marks)