



DEDAN KIMATHI UNIVERSITY OF TECHNOLOGY

UNIVERSITY EXAMINATIONS 2021/2022

FIRST YEAR FIRST SEMESTER SUPPLEMENTARY EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN CIVIL ENGINEERING / BACHELOR OF SCIENCE IN MECHATRONIC ENGINEERING / BACHELOR OF SCIENCE IN INDUSTRIAL CHEMISTRY/ BACHELOR OF SCIENCE IN MECHANICAL ENGINEERING / BACHELOR OF SCIENCE IN ELECTRICAL & ELECTRONIC ENGINEERING / BACHELOR OF EDUCATION TECHNOLOGY IN ELECTRICAL & ELECTRONIC ENGINEERING , BACHELOR OF EDUCATION TECHNOLOGY IN MECHANICAL ENGINEERING , BACHELOR OF EDUCATION TECHNOLOGY IN CIVIL ENGINEERING, BACHELOR OF SCIENCE COMPUTER SCIENCE, BACHELOR OF SCIENCE INFORMATION TECHNOLOGY, BACHELOR OF SCIENCE CHEMICAL ENGINEERING, BACHELOR OF SCIENCE TELECOMMUNICATION AND INFORMATION ENGINEERING, BACHELOR OF SCIENCE IN MATHEMATICS AND MODELLING PROCESSES, BACHELOR OF TECHNOLOGY IN BUILDING & CONSTRUCTION / BACHELOR OF SCIENCE IN GEOMATICS AND GEOSPATIAL INFORMATION SYSTEMS/ BACHELOR OF SCIENCE IN GEOSPATIAL INFORMATION SCIENCE AND REMOTE SENSING, BACHELOR OF SCIENCE IN INDUSTRIAL CHEMISTRY, BACHELOR OF SCIENCE IN POLYMER CHEMISTRY

SMA 1108: ALGEBRA

DATE: 14/10/2021

TIME: 2.00pm-4.00pm

INSTRUCTIONS: Answer QUESTION one and any other two questions.

QUESTION ONE (30 MARKS)

- a) A committee of five is to be formed from four men and six women. Determine the number of ways that this can be done if the number of women in the committee must exceed the number of men. [4 marks]
- b) Find the constant term and coefficient of the term x^6 in the expansion of $\left(2x + \frac{1}{4x}\right)^{10}$ [5 marks]
- c) The second term of a G.P. is 1 while the sum to infinity is 4. Find the first term and the common difference of the G.P. [5 marks]

- d) Use the principle of mathematical induction to prove that $n^2 + 3n$ is divisible by 2 for all positive integers n . [5 marks]
- e) Write the complex number $z = \frac{2+i}{i}$ in polar form. [4 marks]
- f) Determine the set of values of x for which $12 - x - x^2 > 0$ [3marks]
- g) The polynomial $ax^2 + bx + c$ is divisible by x and also by $x + 1$. Find the values of a, b and c . [4 marks]

QUESTION TWO (20 MARKS)

- a) Show that $\log_8 x = \frac{1}{3} \log_2 x$. Hence without using tables or calculator, solve the equation $\log_2(3x+1) + \log_8(x-1)^3 = 6$ for $x > 0$ [8 marks]
- b) Simplify $\frac{\sqrt[3]{18} \times \sqrt{48}}{\sqrt[4]{216}}$ [5 marks]
- c) The root of the equation $2x^2 - 4x + 1 = 0$ are r and s . Find the equation with integral coefficients whose roots are $r - 2$ and $s - 2$. [7 marks]

QUESTION THREE (20 MARKS)

- a) Find the remainder when $f(x) = 3x^3 - 8x^2 - 5x + 2$ is divided by $(x - 4)$. [4 marks]
- b) A theater has 60 seats in the first row, 68 seats in the second row, 76 seats in the third row, and so on in the same increasing pattern. If the theater has 20 rows of seats, determine how many seats there are in the theater. [4 marks]
- c) In a G.P, the sum of the second and third terms is 6, and the sum of the third and fourth terms is -12 . Find the first term, the common ratio and the sum of the first ten terms. [4 marks]
- d) A polynomial has a remainder of 9 when divided by $(x - 3)$ and remainder of -5 when divided by $2x + 1$. Find the remainder when divided by $(x - 3)(2x + 1)$. [5 marks]
- e) A student wants to invite 10 friends but there is only room for 5 students. Find how many ways that the student can choose whom to invite if two of them are sisters and must not be separated. [3 marks]

QUESTION FOUR (20 MARKS)

- a) Prove by mathematical induction that $1^2 + 2^2 + 3^2 \dots + n^2 = \frac{n(n+1)(2n+1)}{6}$ for all positive integers n . [8 marks]
- b) Use binomial theorem to expand $(4 + 3x)^{-1}$ up to the term in x^4 . [6 marks]
- c) Solve the equation $z^5 = -32$ for complex numbers z . [6 marks]

QUESTION FIVE (20 MARKS)

- a) Solve the equation $ax^2 + bx + c = 0$ by method of completing square. [3 marks]
- b) How many five digit odd numbers greater than 60000 can be formed from the digits 1, 2,3,4,5,6,7 and 8 if repetition are not allowed. [5 marks]
- c) Determine the line of symmetry, minimum or maximum value, x and y intercepts of $f(x) = -2x^2 - 8x - 2$. Hence sketch the curve. [5 marks]
- d) Show that $\tan 4\theta = \frac{4 \tan \theta - 4 \tan^3 \theta}{1 - 6 \tan^2 \theta + \tan^4 \theta}$ [7marks]