

GREAT ZIMBABWE UNIVERSITY

AIWE 121

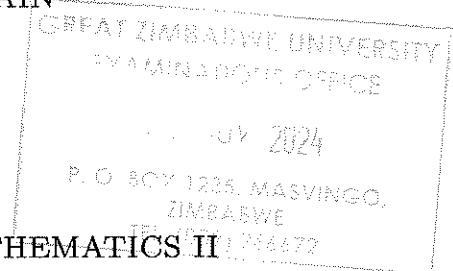
GARY MAGADZIRE SCHOOL OF AGRICULTURE

DEPARTMENT OF SOIL AND PLANT SCIENCE

BSc HONOURS DEGREE IN AGRICULTURE

EXAMINATION: MAIN

AIWE 121: ENGINEERING MATHEMATICS II



DATE: NOVEMBER 2024

Time : hours

Candidates should attempt **ALL** questions in Section A and **ANY TWO** questions from Section B

SECTION A

- A1.** (a) Define an exponential function. [2]
(b) State three different cases of an exponential function and explain what happens in those cases. [6]

A2. Plot the graph of

$$f(x) = 3^x, \text{ for } -4 \leq x \leq 4.$$

[8]

A3. Consider the function

$$f(x) = b^x.$$

What the effect of varying b , for $b > 1$? [6]

A4. State and analyse two important properties of the graphs of the functions of the form

$$f(x) = b^x.$$

[5]

A5. What is the relationship between

$$f(x) = b^{-x} \text{ and } f(x) = b^x?$$

[2]

A6. (a) Define a logarithmic function. [2]

(b) What does

$$f(x) = \log_b x$$

mean? [2]

(c) Plot the graph of

$$f(x) = \log_2 x, \text{ for } 0 \leq x \leq 4.$$

[7]

A7. (a) Consider the function

$$f(x) = \log_b x.$$

(i) What does this mean? [2]

(ii) Find the values of the function for $x = 1, 2, 4, 0.5, 0.25$ and $b = 0.5$. [5]

(iii) What is the effect of varying b ? [3]

(b) Analyse the relationship between the exponential function $f(x) = e^x$ and the logarithmic function $f(x) = \ln x$ by sketching their graphs. [5]

(c) Sketch, on the same axes, the graph of the function $f(x) = b^x$ for $b = 3, 6, 1, \frac{1}{3}, \frac{1}{6}$. [10]

(d) Briefly explain the importance of the exponential function and the logarithmic function. [5]

- A8. (a) Find the Taylor series for

$$f(x) = \ln x \text{ at } b = 0.$$

[5]

- (b) Represent

$$f(x) = \sin x$$

by a Maclaurin series.

[6]

- (c) (i) Define a Binomial series.

[2]

(ii) Find a power series representation for $\sqrt{1+x}$.

[6]

(iii) Expand $(3x+4)^6$.

[6]

(iv) Complete the square for $x^2 + 25x$.

[5]

- A9. (a) Sketch, on the same axes, the graph of the function $f(x) = \log_b x$ for $a = 3, 6, \frac{1}{3}, \frac{1}{6}$.

[10]

- (b) For each of the following pairs of functions, state whether the graphs are related by a reflection in the x -axis, a reflection in the $f(x)$ -axis, a reflection in the line $f(x) = x$, a reflection in the line $f(x) = -x$, or that the graphs are not related by any of these reflections.

(i) $f(x) = 3^x$ and $f(x) = (\frac{1}{3})^x$.

[2]

(ii) $f(x) = \log_6 x$ and $f(x) = 6^x$.

[2]

(iii) $f(x) = \log 6x$ and $f(x) = (\frac{1}{6})^x$.

[2]

(iv) $f(x) = \log_{\frac{1}{3}} x$ and $f(x) = \log_3 x$.

[2]

(v) $f(x) = (\frac{1}{3})^x$ and $f(x) = (\frac{1}{6})^x$.

[2]

- (c) Outline all the features of an exponential function and a logarithmic function.

[10]

END OF QUESTION PAPER