



**UNIVERSITY OF SWAZILAND**  
**FINAL EXAMINATION PAPER**  
**2018**

**PROGRAMME: BSC. ABE**

**COURSE CODE: ABE104**

**TITLE OF PAPER: ENGINEERING MATHEMATICS**

**TIME ALLOWED: TWO (2) HOURS**

**SPECIAL MATERIAL REQUIRED: CALCULATOR**

**INSTRUCTIONS: ANSWER QUESTION ONE AND ANY TWO OTHER QUESTIONS.**

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## SECTION ONE: COMPULSORY

## QUESTION ONE

- (a) Workout the following problems giving your answer in both **Standard form** and in **Engineering notation**;
- i)  $3.7 \times 10^2 + 9.81 \times 10^2$  (4 marks)
- ii)  $(4.5 \times 10^{-2})(3 \times 10^3)$  (4 marks)
- iii)  $\frac{(2.4 \times 10^3)(3 \times 10^{-2})}{(4.8 \times 10^4)}$  (6 marks)
- iv) 0.00054 A (4 marks)
- b) Without using a calculator, find the value of the following leaving your answer as a fraction where possible;
- i)  $\frac{1}{3} - \left(\frac{2}{5} + \frac{1}{4}\right) \div \left(\frac{3}{8} \times \frac{1}{3}\right)$  (5 Marks)
- ii)  $\frac{3^2 \times 5^5}{3^4 \times 5^4 + 3^3 \times 5^3}$  (6 Marks)
- c) If three people can complete a task in 4 hours, how long will it take 5 people to complete the same task assuming the rate of work remains constant? (5 marks)
- d) The electrical resistance R, of a piece of wire is inversely proportional to the cross-sectional area A. When  $A = 5 \text{ mm}^2$ ,  $R = 7.02 \text{ ohms}$ . Determine the following;
- i) The coefficient of proportionality (3 marks)
- ii) The cross sectional area when the resistance is 4 ohms. (3 marks)

SECTION II: ANSWER ANY TWO QUESTIONS

QUESTION TWO

- (a) Use the remainder theorem to determine the remainder when  $(x^3 - 6x^2 + x - 5)$  is divided by  $(x + 2)$  (7 marks)
- (b) Resolve  $\frac{x^3 - 2x^2 - 4x - 4}{x^2 + x - 2}$  into partial fractions. (7 Marks)
- (c) The distance travelled by a car S meters is given by the formula  $S = ut + 1/2at^2$ . Find the time taken by the car to stop in an emergency if the distance  $S = 17.25$  m,  $u = 9.50$ , and  $a = -2.50$ . (8 marks)
- e) Solve the equation;  $\text{Log}(x - 1) + \text{Log}(x + 1) = 2 \text{Log}(x + 2)$  (6 marks)
- f) Evaluate  $5.6 e^{-1}$  correct to 2 decimal places (2 marks)

QUESTION THREE

- (a) Expand  $e^x(x^2 - 1)$  as far as the term in  $X^4$  (6 Marks)
- (b) The extension X(m) of an aluminium tie bar of length L (m) and cross-sectional A ( $m^2$ ) when carrying a load of F Newtons is given by the modulus of elasticity  $E = \frac{F.L}{A.x}$ . Find the extension of the tie bar (in mm) when  $E = 70 \times 10^9$  N/m,  $F = 20 \times 10^6$  N,  $A = 0.1$   $m^2$  and  $L = 1.4$  m. (6 Marks)
- (c) Differentiate the following with respect to X;  
 $Y = \frac{2}{5}X^3 - \frac{4}{X^3} + 4\sqrt{X^5} + 7$  (8 Marks)
- (d) Integrate the following equation  $\int (4 + \frac{3}{7}X - 6X^2) dX$  (10 Marks)

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**QUESTION FOUR**

- a) Calculate the diameter of a solid cylinder which has a height of 82.0 cm and a total surface area of  $2.0 \text{ m}^2$ . (6 marks)
- b) Plot a graph of  $Y = 2X^2$  between the values of  $-3 < X < 3$  and hence solve the equation  $2X^2 - 8 = 0$  and  $2X^2 - X - 3 = 0$  (10 Marks)
- (d) Use the Newton – Raphson method to determine the positive roots of the quadratic equation  $5X^2 + 11X - 17 = 0$ , correct to 3 significant figures. Check the value of the roots by using the quadratic formula. (10 Marks)
- d) Evaluate  $\frac{\text{Log } 25 - \text{Log } 125 - \frac{1}{2} \text{Log } 625}{3 \text{Log } 5}$  (4 marks)