

2nd SEM. 2017



UNIVERSITY OF SWAZILAND

**FINAL EXAMINATION PAPER
2017**

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) Evaluate the following, each correct to three (3) significant figures;
- i) $4.7826 + 0.02713$ (2 marks)
 - ii) 21.93×0.012981 (2 marks)
 - iii) $631.7 - (6.21 + 2.95)^2$ (2 marks)
 - iv) $46.27^2 - 31.79^2$ (2 marks)
 - v) $3.72 e^{0.18}$ (2 marks)
 - vi) $53.2 e^{-1.4}$ (3 marks)
 - vii) $\frac{5}{122} e^7$ (2 marks)
- b) Evaluate the following, correct to three (3) decimal places;
- i) $\left(\frac{3.60}{1.92}\right)^2 + \left(\frac{5.40}{2.45}\right)^2$ (3 Marks)
 - ii) $\frac{15}{7.6^2 - 4.8^2}$ (3 Marks)
- c) Remove the brackets and simplify the following expressions;
- i) $2a - [3\{2(4a - b) - 5(a + 2b)\} + 4a]$ (3 marks)
 - ii) $\frac{(x^2 y^{\frac{1}{2}})(\sqrt{x^3 y^2})}{(x^5 y^3)^{1/2}}$ (3 marks)
 - iii) $\frac{1}{\left(\frac{4}{7} \times 2\frac{1}{4}\right)} \div \left(\frac{1}{3} + \frac{1}{5}\right) + 2\frac{7}{24}$ (3 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 (2 marks)
 - ii) The cross sectional area when the resistance is 4 ohms. (3 marks)
- e) Solve the following inequalities
- i) $|3x + 1| < 4$ (3 marks)
 - ii) $\frac{2x+3}{x+2} \leq 1$ (2 marks)

SECTION II: ANSWER ANY TWO QUESTIONS

QUESTION TWO

- (a) Use the remainder theorem to determine the remainder when $(3x^3 - 2x^2 + x - 5)$ is divided by $(x + 2)$ (7 marks)
- (b) Resolve $\frac{11-3x}{x^2+2x-3}$ into partial fractions. (7 Marks)
- (c) Solve the following equations
 - i) $\frac{1}{5}(2f - 3) + \frac{1}{6}(f - 4) + \frac{2}{15} = 0$ (6 marks)
 - ii) $X^2 - 6x + 9 = 0$ (4 marks)
 - iii) Solve the following simultaneous equations $3x - 2y = 12$ and $x + 3y = -17$ (6 marks)

QUESTION THREE

- (a) Transpose the formula $P = \frac{a^2X+a^2Y}{r}$ to make a the subject (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, $A = 0.1$ m² and $L = 1.4$ m. (6 Marks)
- (c) Differentiate the following with respect to X ;
 $Y = \frac{2}{3}X^3 - \frac{4}{X^3} + 4\sqrt{X^5} + 7$ (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) i) Solve the equation $3.72 = \ln \frac{5.14}{X}$ to find the value of X (6 Marks)
iii) Evaluate the following; $\log_3 9$ and $\log_{16} 8$ (4 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)
- (c) 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)