

2<sup>nd</sup> SEM. 2018



**UNIVERSITY OF SWAZILAND**

**Re-Sit 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) Evaluate the following, each correct to three (3) significant figures;
- i)  $4.7826 + 0.02713$  (2 marks)
  - ii)  $21.93 \times 0.012981$  (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)  $\frac{(x^2 y^{\frac{1}{2}})(\sqrt{x^3 y^2})}{(x^5 y^3)^{1/2}}$  (4 marks)
  - iii)  $\frac{1}{(\frac{4}{7} \times \frac{1}{4})} \div \left(\frac{1}{3} + \frac{1}{5}\right) + 2\frac{7}{24}$  (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) Find the quadratic equation whose roots are  $1/3$  and  $-2$ . (6 marks)
- (d) Solve the following equations
- i)  $X^2 - 6x + 9 = 0$  (4 marks)
- ii) Solve the following simultaneous equations  $3p = 2q$  and  $4p + q + 11 = 0$  with a method of your choice. (6 marks)

## QUESTION THREE

- (a) The Sag  $S$  at the center of a wire is given by the formula  $S = \sqrt{\frac{3d(l-d)}{8}}$ . Make  $l$  the subject of the formula and evaluate  $l$  when  $d = 1.75$ , and  $S = 0.80$ . (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<sup>2</sup> 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  $\int \left(4 + \frac{3}{7}X - 6X^2\right) dX$  (10 Marks)

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**QUESTION FOUR**

- (a) i) Using SURD form, evaluate  $\frac{3 \tan 60^\circ - 2 \cos 30^\circ}{\tan 30^\circ}$  (4 Marks)
- iii) Given a triangle ABC, find the length of the side BC given that  $B = 78^\circ$ ,  $AC = 22.31$  mm and  $AB = 17.92$  mm. Also find the Area of the triangle. (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)
- (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)