

2nd SEM. 2019



UNIVERSITY OF ESWATINI
FINAL EXAMINATION PAPER
2019

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) $7.90 \times 10^{-2} - 54.0 \times 10^{-3}$ (4 marks)

ii) $9.293 \times 10^2 + 1.3 \times 10^3$ (4 marks)

b) Find the value of the following;

i) $\frac{2^3 \times 3^5 \times (7^2)^2}{7^4 \times 2^4 \times 3^3}$ (5 marks)

ii) $\frac{4^{1.5} \times 8^{\frac{1}{3}}}{2^2 \times 32^{\frac{-2}{5}}}$ (5 marks)

c) 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) Three people, P, Q, and R contribute to a fund. P provides 3/5 of the total, Q provides 2/3 of the remainder, and R provides E8.00. Determine the following;

a) The total of the fund (4 marks)

b) The contributions of P and Q (6 marks)

d) Divide $4a^3 - 6a^2b + 5b^3$ by $2a - b$ (4 marks)

e) The total surface area of a closed cylindrical container is 20.0 m². Calculate the radius of the cylinder if its height is 2.80 m. (3 marks)

SECTION II: ANSWER ANY TWO QUESTIONS

QUESTION TWO

- (a) i) Divide the general expression $aX^3 + bX^2 + cX + d$ by $(X - p)$ (5 marks)
- ii) Determine the remainder when $(3x^3 - 2x^2 + x - 5)$ is divided by $(x + 2)$ (2 marks)
- (b) Resolve $\frac{5x^2 - 2x - 19}{(x+3)(x-1)^2}$ 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)
- f) Solve the equation; $\text{Log}(x - 1) + \text{Log}(x + 1) = 2 \text{Log}(x + 2)$ (6 marks)
- g) Applying the principle of moments to a beam results in the following equation; $F \times 3 = (5 - F) \times 7$. Determine the value of F. (2 marks)

QUESTION THREE

- (a) Expand $e^x(x^2 - 1)$ as far as the term in X^4 (8 Marks)
- (b) A formula relating the initial and final states of pressure, P_1 and P_2 , volumes V_1 and V_2 and absolute temperature, T_1 and T_2 , of an ideal gas is $\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$. Find the value of P_2 given $P_1 = 100 \times 10^3$, $V_1 = 1.0$, $V_2 = 0.266$, $T_1 = 423$ and $T_2 = 293$ K. (6 Marks)
- (c) Differentiate the following with respect to X;
 $Y = \frac{2}{5}X^3 - \frac{4}{X^3} + 4\sqrt{X^5} + 7$ (4 Marks)
- (d) Integrate the following equation $\int \left(4 + \frac{3}{7}X - 6X^2\right) dX$ (4 Marks)
- (e) The stress f in a material of a thick cylinder can be obtained from the equation $\frac{D}{d} = \sqrt{\frac{f+P}{f-P}}$. Calculate the stress given that $D = 21.5$, $d = 10.75$ and $P = 1800$. (8 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 m². (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)