



MACHAKOS UNIVERSITY

University Examinations 2019/2020

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS, STATISTICS AND ACTUARIAL SCIENCE

SECOND YEAR FIRST SEMESTER EXAMINATION FOR

DIPLOMA IN ELECTRICAL ENGINEERING (TVET)

ENGINEERING MATHEMATICS II

DATE: 24/3/2020

TIME: 8.30-11.30 AM

INSTRUCTIONS:

This paper consists of five questions, attempt ALL.

QUESTION ONE

- a) Given the vectors $A = 2\hat{i} + 3\hat{j} + 5\hat{k}$ and $B = 6\hat{i} + 3\hat{j} + 7\hat{k}$ determine:
- a vector $\vec{C}$ perpendicular to $\vec{A}$ and $\vec{B}$
 - area of the parallelogram spanned by $\vec{B}$ and $\vec{C}$ (9 marks)
- b) Given the scalar function $\phi = 4x^2y^3z^4$ and the vector $F = 2xy^2zi + 5xy^2z^2j + 6xy^2zk$ determine at the point $(1, -1, -1)$.
- $\nabla\phi$
 - $\nabla \bullet F$
 - $\nabla \times F$ (11 marks)

QUESTION TWO

- a) Given the matrices $A = \begin{bmatrix} 2 & 2 & 3 \\ 5 & 3 & 7 \\ 8 & 4 & 4 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & -8 & 5 \\ 6 & 2 & 3 \\ 5 & 9 & 4 \end{bmatrix}$ determine:
- $A + B$
 - AB
 - $2A - 3B$ (11 marks)
- b) Given the system of equations (9 marks)

Use inverse method to determine the value of

X_1, X_2 and X_3

$$2x_1 + 3x_2 + x_3 = 9$$

$$x_1 + 2x_2 + 3x_3 = 6$$

$$3x_1 + x_2 + 2x_3 = 8$$

Give your answer correct to two decimal places.

QUESTION THREE

- a) Use Taylor's theorem to expand $\sin\left(\frac{\pi}{6} + h\right)$ in ascending powers of h as far as the term in

h^4 . (13 marks)

- b) Use Maclaurin's theorem to expand $\ln(1+x)$ in ascending powers of x as far as the term in x^5 (7 marks)

QUESTION FOUR

- a) Determine the angle between the vectors $A = 2i + 3j + 6k$ and $B = 6i - 4j + 6k$ and the cross product of A and B (7 marks)

- b) Given that $\phi = x^2 y^3 z^4$ and $A = 3x^2 yi + 6xy^2 z^2 j - 4xy^2 z^2 k$. Determine at (1, -2, 4).

(13 marks)

i) $\nabla\phi$

ii) $\nabla \cdot F$

iii) $\nabla \times F$

QUESTION FIVE

- a) Use the Cramer's rule to find V_1, V_2 , and V_3 if (10 marks)

$$2V_2 + 3V_1 - 4 - V_3 = 0$$

$$2V_1 - 5 - V_2 + 3V_3 = 0$$

$$-2V_3 - 3V_2 - 4V_1 = 0$$

- b) Compute adjoint A given that (5 marks)

$$A = \begin{pmatrix} 1 & 2 & 3 \\ 1 & 3 & 4 \\ 1 & 4 & 3 \end{pmatrix}$$

- c) Determine the values of k given that matrix A is a singular. (5 marks)

$$A = \begin{pmatrix} 1 & 2 & 3 \\ 2 & k & 4 \\ 3 & 5 & k \end{pmatrix}$$