MACHAKOS UNIVERSITY

University Examinations 2020/2021 Academic Year

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS AND STATISTICS

SECOND YEAR SECOND TERM EXAMINATION FOR

DIPLOMA IN ELECTRICAL ENGINEERING

MATHEMATICS II

DATE:4/6/2021 **TIME: 8.30-11.30 AM**

INSTRUCTIONS:
Answer ALL the questions.
ALL questions carry equal marks.
Show all your working

1. a) Given the vectors $\tilde{A} = 2\tilde{\imath} - 3\bar{\jmath} + 4\bar{k}$ and $\bar{B} = -3\bar{\imath} + 2\bar{\jmath} - 6\bar{k}$, determine:

   i. $\bar{A} \,.\, \bar{B}$

   ii. the angle between $\bar{A}$ *and* $\bar{B}$ (10 marks)

   b) An electric potential $V_{(xyz)} = 2x^2y + zy^2$ exists in a region of space. Determine, at the point(1,1,-2)

   i grad V

   ii div(gradV)

   iii curl(gradV) (10 marks)

2. a) Given the matrices

$$A = \begin{bmatrix} 1 & -2 & 3 \\ -2 & 1 & 4 \\ 3 & 3 & -2 \end{bmatrix} \quad \text{and} \quad B = \begin{bmatrix} 1 & 2 & 2 \\ 1 & 3 & 1 \\ 3 & 1 & 1 \end{bmatrix}$$

   Determine:

   i. AB

   ii. $(AB)^{-1}$. (10 marks)

b) Three currents I_1, I_2 and I_3 in an electric circuit satisfy the simultaneous equations:

$I_1 + I_2 + I_3 = 12$

$2I_1 - 3I_2 + 2I_3 = 4$

$-4I_1 + 2I_2 + I_3 = 1$

Use Cramer's rule to determine the values of the currents. (10 marks)

3. Solve the following differential equations;

a) $(x+2)\frac{dy}{dx} = (1 - y)$ (8 marks)

b) $9\frac{d^2y}{dx^2} - 12\frac{dy}{dx} + 4y = 0, given\ that\ y = 3\ when\ x = 0$

$\frac{dy}{dx} = 4\ when\ x = 0$ (12 marks)

4. a) show that the general solution of the differential equation

$x^2\frac{dy}{dx} = 2xy + y^2$

may be expressed in the form x(x+y) = cy, where c is an arbitrary constant.

(9 marks)

b) Using the method of undetermined coefficient, solve the differential equation

$\frac{d^2y}{dt^2} + 4\frac{dy}{dt} + 3y = t^3 + t^2 + 2$ (11 marks)