FACULTY OF ENGINEERING

DEPARTMENT OF CIVIL ENGINEERING
FIRST SEMESTER EXAMINATION (MARCH 2018)
2017/2018 ACADEMIC SESSION

HOD'S SIGNATURE

Instructions:

1) **Attempt any four Questions**
2) **Time Allowed: 3 hours**
3) **SEVERE PENALTIES APPLY FOR MISCONDUCT, CHEATING, POSSESSION OF UNAUTHORIZED MATERIALS DURING EXAMINATION**

Course Title: ENGINEERING MATHEMATICS I

Course Code: CVE GNE 211

ELIZADE UNIVERSITY, ILARA – MOKIN

FACULTY OF ENGINEERING
DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
First Semester 2017/2018 Session

Course Title: Engineering Mathematics I **Course Code: GNE 211** **Units: 3**

Instruction: Attempt any Four Questions **Time Allowed: 2 hours**

Question 1 (20 marks)

a) Determine the first derivative of the following functions:

i. $Y = (X^2 - 3X + 3)(X^3 - 1)$

ii. $Y = 10^{3X+1}$

iii. $Y = 5^{\text{Sin}\,X}$

iv. $Y = \dfrac{X^3 + 2^X}{X}$

v. $Y = X^2 \text{Log}_3 X$ (10 marks)

b) Answer two of the following questions as the case may be

i. Newtons law of cooling is given by $\theta = \theta_0 e^{-kt}$, where the excess of temperature at zero time is θ_0 °C and at time t seconds is θ °C. Determine the rate of change of temperature after 40 s, given that $\theta_0 = 16$ °C and k = – 0.03. (5 marks)

ii. The length (L) in metres of a certain metal rod at temperature (θ °C) is given by: $L = L + 0.00005\theta + 0.0000004\theta^2$. Determine the rate of change of length, in mm /°C, when the temperature is (a) 100 °C and (b) 400 °C. (5 marks)

iii. The luminous intensity (I) candelas of a lamp at varying voltage (V) is given by: $I = 4\,x\,10^{-4} V^2$. Determine the voltage at which the light is increasing at a rate of 0.6 candelas per volt. (5 marks)

Question 2 (20 marks)

a) If matrix A = $\begin{bmatrix} 1 & 2 & 1 & 0 \\ 0 & 3 & 1 & 1 \\ -1 & 0 & 3 & 1 \\ 3 & 1 & 2 & 0 \end{bmatrix}$

Calculate the determinant of matrix A. (10 marks)

b) Using matrix solving this simultaneous equation

$$2X + Y = 3$$
$$5X + 3Y = 7$$

(10 marks)

Question 3 (20 marks)

a) If matrices $A = \begin{bmatrix} 1 & 0 \\ 3 & 1 \end{bmatrix}$, $B = \begin{bmatrix} -1 & 4 \\ 1 & -2 \end{bmatrix}$ and $C = \begin{bmatrix} 2 \\ 3 \end{bmatrix}$

Calculate the following matrices as follows:

i. AB ii BA iii AB + BC v A + B . (10 marks)

b) Using matrix solving this simultaneous equation

$$X + 2Y + 2Z = -1$$
$$3Y - 2Z = 2$$
$$2X - Y + 8Z = 7$$

(10 marks)

Question 4 (20 marks)

If matrices $A = \begin{bmatrix} 1 & 0 \\ 3 & 1 \end{bmatrix}$, $B = \begin{bmatrix} -1 & 4 \\ 1 & -2 \end{bmatrix}$ and $C = \begin{bmatrix} 2 \\ 3 \end{bmatrix}$

Test for the following algebra and linear operation rules as follows:

i. Distributive AB + AC = A(B +C) (5marks)

ii. Distributive (A + B)C = AC + BC (5marks)

iii. Associative (AB)C = A(BC) (5marks)

iv. Moving Constant 3(AB) = A(3B) . (5 marks)

Question 5 (20 marks)

a) Given $Z_1 = 2 + j4$ and $Z_2 = 3 - j$ determine

i. $Z_1 + Z_2$, (4marks)

ii. $Z_1 - Z_2$, (4marks)

iii. $Z_2 - Z_1$ (4marks)

iv. show the results on an Argand diagram. (4 marks)

b) Evaluate in polar form

$$\frac{16 < 75^{\circ}}{2 < 15^{0}}$$ (4marks)

Question 6 (20 marks)

a) The Pythagorean Theorem states that in a right-angle triangle, the square of the hypotenuse is equal to the sum of the squares of the other two sides. **Given:** A ∇ABC, right angled at B (Figure Q1) **To prove:** $AC^2 = AB^2 + BC^2$

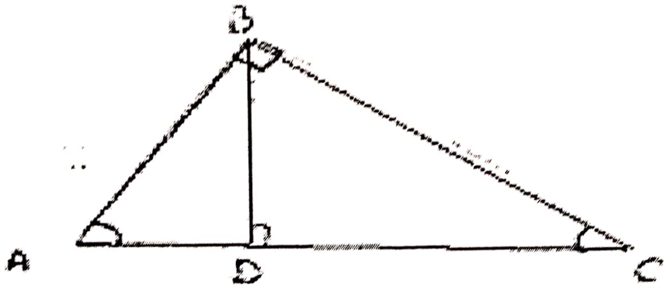

Figure Q1: A right angle triangle (6 marks)

b) Provide the proving for the trigonometric functions using the trigonometric values (Sine, Cosine, Tangent, Cosecant, Secant, Cotangent) at 30°, 60° and 90°. (6 marks)

c) Engr. Jide wants to know the height of a building. From a given point on the ground, he finds the angle of elevation to the top of the building to be 67.2°. He then moves back 15m. From the second point, the angle of elevation to the top of the building is 41.5°. With the aid of a diagram, find the height of the building. (8 marks)