ELIZADE UNIVERSITY, ILARA-MOKIN

FACULTY OF BASIC AND APPLIED SCIENCES
DEPARTMENT: PHYSICAL AND CHEMICAL SCIENCES

PROGRAMME: APPLIED GEOPHYSICS EXAM TITLE: DEGREE EXAMINATION
COURSE CODE & TITLE: AGP 206 – INTRODUCTORY GEOMATHEMATICS

TIME ALLOWED: 2 Hrs 30 mins. **SEMESTER/SESSION: 2nd SEMESTER / 2020/2021**

INSTRUCTIONS:

1. Write your matriculation number in the space provided above and also on the cover page of the exam booklet.
2. This question paper consists of 2 pages including this page.
3. Answer any four questions.

HOD's SIGNATURE

1. (a) For a Legendre polynomial, $P_n(x)$; evaluate the values for $P_1(x)$ and $P_3(x)$

   (b) Sketch the graph of the equation $y = x^2 - 4x + 7$ i.e. for $-3 < x \leq 3$ and determine its
   (i) vertex (ii) intercept at both x and y axes.

20 Marks

2. (a) Determine the Fourier series for a periodic function

$$f(x) = \begin{cases} -2 & -\pi < x < 0 \\ +2 & 0 < x < \pi \end{cases}$$

   (b) Sketch the following mathematical functions

$$\text{(i) } f(x) = \begin{cases} 1 & -2 \leq x \leq 1 \\ 2 & -1 \leq x \leq 0 \\ 3 & 0 < x < 2 \end{cases} \quad ; \quad \text{(ii) } f(x) = \begin{cases} 0 & x < -2 \\ -3 & -1/2 \leq x \leq 1/2 \\ 1 & x > 1 \end{cases}$$

20 Marks

3. The relationship between the voltages applied to an electrical circuit and the current flowing is as shown

X (volt)	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5
Y(mA)	3.9	4.4	5.8	6.6	7.0	7.1	7.3	7.7

(a) Plot a scatter diagram of current, y, against amount of voltage, x.
   (i) Calculate the equation of the least squares regression line of y on x
   (ii) Estimate the current flow assuming a voltage of 2.0 volts is applied

(b) Determine the product moment correlation coefficient.

20 Marks

4. (a) Assuming $p = 3i + j - k$ and $q = i - 4j + 2k$ determine:
(i) $p \cdot q$ (ii) $p+q$ (iii) $|p+q|$ (iv) $|p|+|q|$

(b) Plot the mathematical function $f(x) = -3x^2 + 12x - 15$

20 Marks

5. (a) Use the method of inverse to solve the following set of simultaneous linear equations:

$$x + 2y + z = 4$$
$$3x - 4y - 2z = 2$$
$$5x + 3y + 5z = -1$$

(b) Find the solution using Laplace equation of cylindrical coordinate for a scalar potential field, U with single variable, r and independent of θ.

20 Marks

6. (a) Derive the Legendre's equation $(1 - x^2)\, y'' - 2xy' + (n + 1) = 0$ for a function G representing an ore body in the shape of a sphere, independent of azimuth angle Φ.

(b) Explain the importance of Laplacian coordinates in geophysical interpretation.

20 Marks