

SECTION A: PHYSICAL SCIENCE

Answer at least **TWO** questions from this section.

1. (a) Given that $Z_1 = 4 - i$ and $Z_2 = 2 + 5i$, find: $\frac{Z_1}{Z_2}$ giving your answer in the form $re^{j\theta}$. (8 marks)

- (b) (i) Use the Taylor's theorem to expand $\sin\left(\frac{\pi}{4} + h\right)$ in ascending powers of h as far as the term h^4 .

- (ii) Use your results in b (i) to find the value of $\sin 46^\circ$ to four decimal places. (12 marks)

2. (a) Find $\frac{dx}{dy}$ given that:

(i) $y = \log_e \{\sin x^2\}$.

(ii) $y = \frac{e^{2x+1}}{x^2 - 1}$



(4 marks)

(5 marks)

- (b) Find the general solution of the differential equation:

$$\frac{d^2y}{dx^2} - 2\frac{dy}{dx} - 3y = 7x$$

(11 marks)

3. (a) Given the function $f(x,y) = \tan^{-1}\left(\frac{y}{x}\right)$

Show that:

$$\frac{\partial^2 y}{\partial x^2} + \frac{\partial^2 f}{\partial y^2} = 0$$

(7 marks)

- (b) Solve the hyperbolic equation:

$$2\cosh x + \sinh x = 2$$

(8 marks)

- (c) Find the integral

$$\int \frac{dx}{2x^2 + 3x - 5}$$

(5 marks)

4. (a) A body performs simple harmonic motion represented by the equation:

$$\frac{d^2x}{dt^2} = -n^2x$$

Where n is a constant and the periodic time $T = \frac{2\pi}{n}$. Determine the displacement x at any time t . (12 marks)

- (b) Show that $\text{Sinh}^{-1}x = \ln\{x + \sqrt{x^2 + 1}\}$. (8 marks)



SECTION B: SURVEYING II

Answer at least **TWO** questions from this section.

5. (a) Outline the functions of the following components of a theodolite:
- tribrach;
 - foot screws;
 - optical plummet.
- (3 marks)
- (b) Outline the procedure of setting up a theodolite. (6 marks)
- (c) Describe the procedure of locating tangent points when the intersection point is inaccessible. (11 marks)
6. **Table 1** shows observed bearing of the lines of a traverse ABCDEA with a compass in a place where local attraction was suspected. Compute the corrected bearings of the lines. (20 marks)

Table 1

Line	Fore bearing		Back bearing	
AB	191°	45'	13°	00'
BC	39°	30'	222°	30'
CD	22°	15'	200°	30'
DE	242°	45'	62°	45'
EA	330°	15'	147°	45'

7. (a) Using illustrations distinguish between the following terms:

- (i) interior and exterior angles;
- (ii) forward and back bearings;
- (iii) whole circle bearing and quadrantal bearing.

(9 marks)

(b) Convert the following forward bearings to back bearings:

- (i) $45^{\circ} \quad 00' \quad 30''$
- (ii) $295^{\circ} \quad 35' \quad 45''$
- (iii) N $45^{\circ} \quad 00' \quad 30''$ E
- (iv) S $50^{\circ} \quad 40' \quad 15''$ E



(4 marks)

(c) Convert the following whole circle bearings to quadrantal bearings:

- (i) $35^{\circ} \quad 40' \quad 15''$
- (ii) $305^{\circ} \quad 15' \quad 45''$
- (iii) $165^{\circ} \quad 20' \quad 25''$

(3 marks)

(d) **Figure 1** is a closed polygon. If the bearing of the line AB is $125^{\circ} \quad 30' \quad 45''$, compute the bearings of the lines BC, CD, DE and EA given that the interior angles had been adjusted. (4 marks)

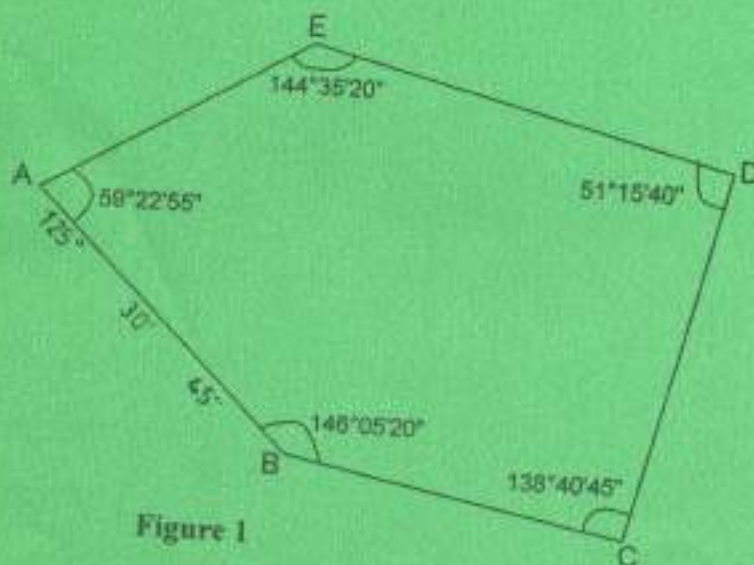


Figure 1

8. (a) Using illustrations distinguish between a loop and a closed oriented traverse. (4 marks)
- (b) Table 2 shows bearings and distances for a loop traverse. Given the coordinates of point T_1 are (1000.00N, 1000.00E) compute the final coordinates of A, B, and C. Adjust the coordinates using Bowditch method. (16 marks)

Table 2

Line	Bearing			Distance (m)
TA	25°	33'	51"	1035.92
AB	72°	55'	15"	1415.50
BC	145°	43'	30"	1645.55
CT ₁	270°	15'	36"	2732.11

