SNS COLLEGE OF TECHNOLOGY

Coimbatore – 641 035

An Autonomous Institution

DEPARTMENT OF CIVIL ENGINEERING

23GET102-BASIC CIVIL AND MECHANICAL ENGINEERING

I YEAR / I SEMESTER

UNIT 1 : CIVIL ENGINEERING MATERIALS AND SURVEYING

Topic : Determination of Areas

UNIT 1 :CIVIL ENGINEERING MATERIALS AND SURVEYING

1. *Introduction to Civil engineering*
2. *Scope of civil engineering*
3. *Building materials*
4. *Brick, stone, cement, concrete, properties-uses*
5. *Introduction to Surveying*
6. *Objectives – types – classification – principles of Surveying*
7. *Measurements of distances, angles*
8. *Concepts of Levelling*
9. *determination of areas*
10. *Illustrative examples.*

Determination of Areas

- *The primary object of land surveying is to determine the area.*
- *The units of area in metric system commonly used are square metres or hectares.*

Area can be determined by Computation of areas by direct field Measurements

1. *By Dividing the Area into Number of Triangles*
2. *Areas between the survey lines and boundaries*

By Dividing the Area into Number of Triangles

- *The area is divided into a number of triangles and the area of each triangle is calculated by measuring their sides and included angles.*
- *Then, the total area of the land will be equal to the sum of areas of individual triangles.*

If two sides and one included angle of a triangle is known then area

$$= \frac{1}{2} ab \sin \theta$$

When the lengths of the three sides of a triangle are measured, then,

$$\text{Area} = \sqrt{S(S-a)(S-b)(S-c)}$$

where $S = \frac{1}{2}(a+b+c)$ and a, b, c are sides of the triangle.

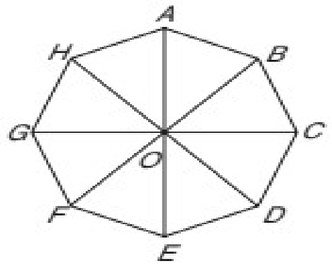
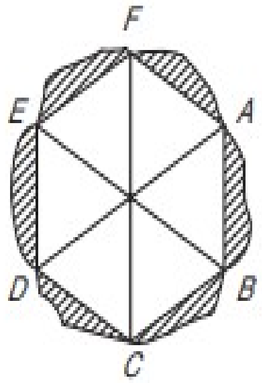


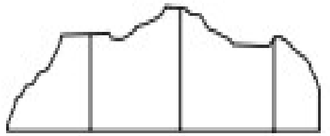
Fig. 2.24

Areas between the survey lines and boundaries

- *A number of offsets are measured from the survey line to the boundary one at regular intervals. Then, the area between survey line and boundary line can be measured by the following rules.*

1. *Trapezoidal rule*
2. *Simpson's rule*
3. *Mid-ordinate rule*
4. *Average Ordinate Rule*





Trapezoidal rule

- *It is based on the assumption that the figures are trapezoids. The base line AB is divided into equal parts*

h1, h2,…, h – length of ordinates at equal intervals

n – number of divisions

L – length of the base line

d – distance between adjacent ordinates

Total area, $A = \frac{d}{2}(h_1 + 2h_2 + 2h_3 + \ldots + 2h_{n-1} + h_n)$

$= \frac{d}{2}$ [first ordinate + 2 (sum of intermediate ordinates) + last ordinate]

Note: If h1 or h2…. is equal to zero, that is also included in the formula

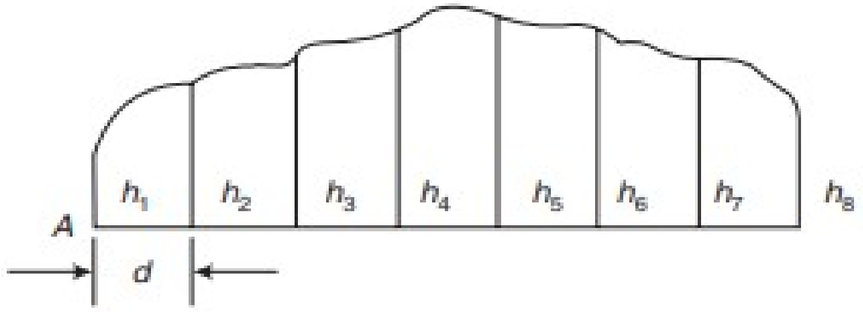
Simpson's rule

- *In this rule, the terms and procedures are same as that of the above rule. But total area is given by*

$$A = \frac{d}{3}[h_1 + h_n + 2(h_3 + h_5 + h_7 + \ldots + h_{n-2}) + 4(h_2 + h_4 + \ldots + h_{n-1})]$$

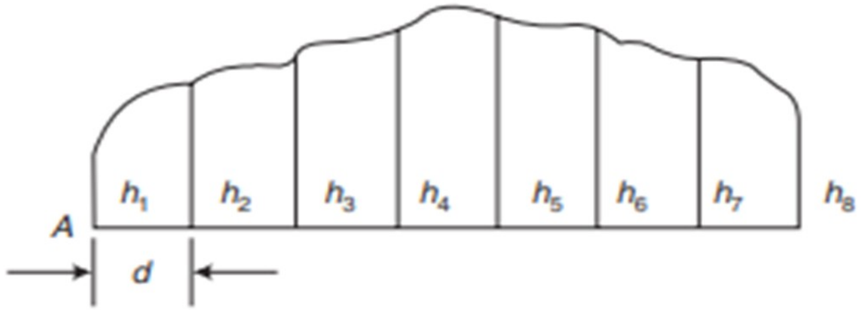
$$A = \frac{d}{3}[\text{First ordinate} + \text{Last ordinate} + 2(\text{sum of odd ordinates}) + 4(\text{sum of remaining even ordinates})]$$

[M



- *This rule is applicable only if the number of ordinates is odd. If the number of ordinates is even, the area of the last trapezoid is calculated separately and added to the result*.

Simpson's Rule Example



Number of ordinates = 8.

The area for first seven ordinates can be obtained by applying Simpson's rule,

$$A_1 = \frac{d}{3}[h_1 + 2(h_3 + h_5) + 4(h_2 + h_4 + h_6) + h_7]$$

$$A_2 = \frac{1}{2}(h_7 + h_8) \times d$$

Then, total area $A = A_1 + A_2$.

Comparison b/w Trapezoidal and Simpson's rule

1. *The results obtained by the use of Simpson's rule are more accurate in all cases*
2. *In dealing with irregularly shaped figures, the degree of precision of either method can be increased by increasing the number of ordinates.*

Mid-ordinate rule

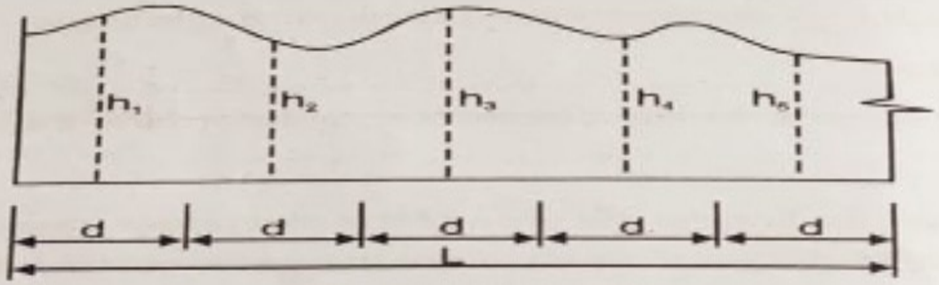


Fig.1.23 Mid ordinate rule

Let,

n = no.of equal parts

d = length of each part

l = length of base line = nd

h_1, h_2 = ordinates at midpoint of each division.

Area = $dh_1 + dh_2 + dh_3 + \ldots\ldots\ldots + dh_n$

= $d(h_1 + h_2 + h_3 + \ldots\ldots\ldots + h_n)$

= $(h_1 + h_2 + h_3 + \ldots\ldots\ldots + h_n)$

Where, $l = nd$,

$d = \frac{l}{n}$

Average Ordinate Rule

2. Average ordinate rule:

In this method, the length of the average ordinate is obtained by dividing the sum of all ordinates with the number of ordinates measured.

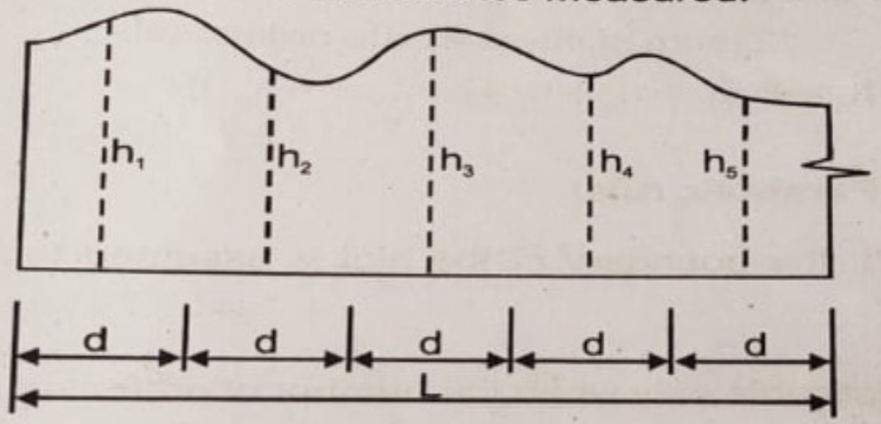


Fig.1.24 Average ordinate rule

$h_1, h_2 \ldots \Rightarrow$ ordinates at each of the ponts.

Then number ordinates = n+1

$$\text{Area} = \frac{[h_1 + h_2 + \ldots\ldots\ldots\ldots + h_n]l}{n+1}$$

Illustrative Examples

- *All Basic Problems in Levelling*


Thank You!