**ENGINEERING SURVEYING – CVE 310**

**QUESTION 1**

1. The two methods of levelling include;
2. The Rise & Fall Method,
3. The Height of Collimation Method.

**Rise and Fall Method;**

* Advantage - Effective checks can be performed and confirmed using the

 reduced levels and with the rise and fall of the instrument.

* Disadvantage – The rise and fall method tends to become tedious on longer

 roads and wider areas of a site.

**Height of Collimation Method;**

* Advantage – It is faster to perform the height of collimation method

 compared to the rise and fall method.

* Disadvantage – It is more susceptible to errors and effective checks are only

 confirmed using the reduced levels.

1. Using Height of Collimation Method

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| B.S  | I.S | F.S | H OF C | R.L | DISTANCE | REMARK |
| 0.771 |  |  | 162.771 | 162.000 | 10 | OBM |
| 0.802 |  | 1.520 | 162.053 | 161.251 | 20 | C.P |
|  | 2.311 |  |  | 159.742 | 30 |  |
| 3.580 |  | 1.990 | 163.643 | 160.063 | 40 | C.P |
|  | 1.220 |  |  | 162.423 | 50 |  |
|  | 3.675 |  |  | 159.968 | 60 |  |
| 2.408 |  | 4.020 | 162.031 | 159.623 | 70 | C.P |
|  | 0.339 |  |  | 161.692 | 80 |  |
| 0.780 |  | 0.157 | 162.654 | 161.874 | 90 | C.P |
|  | 1.535 |  |  | 161.119 | 100 |  |
|  | 1.955 |  |  | 160.699 | 110 |  |
|  | 2.430 |  |  | 160.224 | 120 |  |
|  | 2.985 |  |  | 159.669 | 130 |  |
| 1.155 |  | 3.480 | 160.329 | 159.174 | 140 | C.P |
|  | 1.960 |  |  | 158.369 | 150 |  |
|  | 2.365 |  |  | 157.964 | 160 |  |
| 0.935 |  | 3.640 | 157.624 | 156.689 | 170 | C.P |
|  | 1.045 |  |  | 156.579 | 180 |  |
|  | 1.630 |  |  | 155.994 | 190 |  |
|  |  | 2.545 |  | 155.079 | 200 |  |
| 10.431 |  | 17.352 |  |  |  |  |

CHECKS

$\sum\_{}^{}F.S$ - $\sum\_{}^{}B.S$ = $R.L\_{first}$ - $R.L\_{last}$

= 17.352 – 10.431 = 162.000 – 155.079

= 6.921 = 6.921

**QUESTION 2**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Chainage (m)** | 0 | 30 | 60 | 90 | 120 | 150 | 180 | 210 | 240 | 270 |
| **Offset length (m)** | 0 | 2.65 | 3.80 | 3.75 | 4.65 | 3.60 | 5.00 | 5.80 | 6.10 | 5.85 |

**USING MID-ORDINATE RULE;**

A=$Σ$hd

h1= $\frac{0+2.65}{2}$=1.325m

h2= $\frac{2.65+3.80}{2}$=3.225m

h3= $\frac{3.80+3.75}{2}$=3.775m

h4= $\frac{3.75+4.65}{2}$=4.2m

h5= $\frac{4.65+3.60}{2}$=4.125m

h6= $\frac{3.60+5.00}{2}$=4.3m

h7= $\frac{5.00+5.80}{2}$=5.4m

h8= $\frac{5.80+6.00}{2}$=5.9m

h9= $\frac{6.00+5.85}{2}$=5.925m

$$Σh=1.325+3.225+3.775+4.2+4.125+4.3+5.4+5.9+5.925$$

$ Σh=$38.175m

d=30m

A=$Σhd$

= $38.175×30$

A= $1145.25m^{2}$

∴A=0.11453 hectares

**USING AVERAGE ORDINATE RULE;**

A=$\frac{O\_{1}+O\_{2 }+O\_{3}+…+O\_{n}}{n+1}$ ×nd

n=9

d=30

$$ΣO=0+2.65+3.80+3.75+4.65+3.60+5.00+5.80+6.10+5.85$$

$ ΣO=$41.2m

A=$\frac{41.2}{9+1}$×9×30

A=$1112.4m^{2}$

∴A= 0.11124 hectares

**USING TRAPEZOIDAL RULE;**

A=$d(\frac{O\_{1}+O\_{n }}{2}+O\_{2}+O\_{3}+O\_{4}+.....+O\_{n-1})$

$$d=30$$

A=$30(\frac{0+5.85}{2}+2.65+3.80+3.75+4.65+3.60+5.00+5.80+6.10)$

A=$30(38.275)$

A=$1148.25m^{2}$

∴A= 0.11483 hectares

**USING SIMPSON'S RULE**

$$A=\frac{d }{3 }\left[\left(O\_{1}+O\_{n}\right)+4\left(O\_{2}+O\_{4}+…+O\_{n-1}\right)+2\left(O\_{3}+O\_{5}+…+O\_{n-1}\right)\right]$$

$$d=30$$

**NOTE:** The last offset was removed because number of offsets were even

$$A=\frac{30}{3 }\left[\left(0+6.10\right)+4\left(2.65+3.75+3.60+5,80\right)+2\left(3.80+4.65+5.00\right)\right]$$

$$A=962m^{2}$$

Calculating for last offset using **trapezoidal rule;**

A=$d(\frac{O\_{1}+O\_{n }}{2}+O\_{2}+O\_{3}+O\_{4}+…+O\_{n-1})$

$$A=30\left[\frac{6.40+5.85}{2}\right]$$

$$A=183.75m^{2}$$

Therefore $ΣA=962+183.75$

$$A=1145.75m^{2}$$

∴A = 0.11458 hectares

1. **CHARACTERISTICS OF CONTOURS**
2. On a contour map, A Uniform slope is indicated where the contour lines are uniformly spaced and a plain surface is indicated when the contour lines are straight parallel and equally spaced



1. Contour lines crosses a ridge or a valley at approximate right angles. If the higher values are inwards to the bend or loop in the contour map it represents a ridge and if the higher values are outwards to the bend it represents a valley.



1. Contour lines can not merge or cross one-another on a contour map except in the case of an overhanging cliff where the full perimeter of the base is only partially visible from the top.



1. A series of closed contours on a map indicates a depression if the higher values are outwards as shown.
2. A series of closed contours on a map indicates a hill if the higher values are inwards as shown.

