	b)	Differentiate between LiDAR survey and Photogrammetry.	L2	CO4	5 M
		UNIT-V			
10	a)	Define photogrammetry. Explain its advantages and applications.	L1	CO5	5 M
	b)	Differentiate between focal length and flying height.	L2	CO5	5 M
		OR			
11	a)	Explain advantages and limitations of terrestrial photogrammetry.	L4	CO5	5 M
	b)	Define mosaic and Explain its types in detail.	L1	CO5	5 M

PVP 23

Code: 23CE3301

II B.Tech - I Semester – Regular / Supplementary Examinations
NOVEMBER 2025

SURVEYING
(CIVIL ENGINEERING)

Duration: 3 hours Max. Marks: 70

Note: 1. This question paper contains two Parts A and B.
2. Part-A contains 10 short answer questions. Each Question carries 2 Marks.
3. Part-B contains 5 essay questions with an internal choice from each unit. Each Question carries 10 marks.
4. All parts of Question paper must be answered in one place.

BL – Blooms Level CO – Course Outcome

PART – A

		BL	CO
1.a)	State the principle of "working from whole to part"	L1	CO1
1.b)	Name two direct methods of measuring distances.	L1	CO1
1.c)	State the principle of leveling.	L1	CO2
1.d)	List any four characteristics of contour lines.	L1	CO2
1.e)	Define a theodolite.	L1	CO3
1.f)	List the steps for measuring a vertical angle.	L1	CO3
1.g)	Define tacheometry.	L1	CO4
1.h)	List any two types of EDM instruments.	L1	CO4
1.i)	Define photogrammetry.	L1	CO5
1.j)	Distinguish between vertical and tilted photographs.	L1	CO5

PART – B

			BL	CO	Max. Marks
		UNIT-I			
2	a)	Differentiate between plane surveying and geodetic surveying.	L2	CO1	5 M
	b)	Explain different methods of plane table surveying.	L2	CO1	5 M
		OR			
3	a)	Explain the different types of tape corrections with formulae.	L2	CO1	5 M
	b)	The following are bearings taken on a closed compass traverse: **Line** / **F.B.** / **B.B.** AB / 80° 10' / 259° 0' BC / 120° 20' / 301° 50' CD / 170° 50' / 350° 50' DE / 230° 10' / 49° 30' EA / 310° 20' / 130° 15' Compute the interior angles and correct them for observational errors. Assuming the observed of the line CD to be correct adjust the bearing of the remaining sides.	L3	CO1	5 M
		UNIT-II			
4	a)	Explain the methods of levelling – rise & fall method and height of collimation method.	L2	CO2	5 M

	b)	Develop the formula for volume of earthwork in a level section.	L3	CO2	5 M
		OR			
5	a)	Explain direct and indirect methods of contouring.	L2	CO2	5 M
	b)	Write short notes on: (i) Borrow pit method, (ii) Spot level method.	L2	CO2	5 M
		UNIT-III			
6	a)	Explain the procedure of measuring a horizontal angle by repetition method.	L2	CO3	5 M
	b)	Differentiate between open traverse and closed traverse	L2	CO3	5 M
		OR			
7	a)	Explain the case when one bearing is omitted in a traverse.	L2	CO3	5 M
	b)	Distinguish between transit and non-transit theodolites.	L5	CO3	5 M
		UNIT-IV			
8	a)	Explain different types of vertical curves with applications.	L2	CO4	5 M
	b)	Explain the advantages and applications of tacheometry.	L4	CO4	5 M
		OR			
9	a)	Write the advantages and limitations of GPS.	L6	CO4	5 M

Code: 23CE3301 PVP23

II B.Tech - I Semester – Regular/Supplementary Examinations NOV - 2025
SURVEYING
(CIVIL ENGINEERING)
Scheme of Valuation

PART – A

(10 × 2 = 20 Marks)

Each answer must be brief but correct.

1(a) Principle of "Working from Whole to Part" – 2 M

Definition (1 M):
A surveying principle in which the main control points are established first (entire area) and then minor details are filled in (small parts).

Explanation (1 M):
This prevents accumulation of errors and ensures accuracy of the entire survey.

1(b) Two direct methods of measuring distance – 2 M

Any two of the following (1 M each):

- Chain/Tape measurement
- Pacing
- EDM (Electronic Distance Measurement)
- Optical methods (tacheometry)

1(c) Principle of Leveling – 2 M

- **Definition (1 M):** Leveling determines the relative heights of points.
- **Principle (1 M):** A horizontal line of sight is established using a level instrument.

1(d) Four Characteristics of Contour Lines – 2 M

Any four points (0.5 M each):

- Contours never intersect (except in overhanging cliffs).

- Close spacing = steep slope.
- Wide spacing = gentle slope.
- Contours form closed loops (hill or depression).
- Contours cross water bodies at right angles.

1(e) Theodolite – Definition – 2 M

A theodolite is a precision surveying instrument used to measure horizontal and vertical angles with high accuracy.

1(f) Steps for Measuring a Vertical Angle – 2 M

Any four steps (0.5 M each):

- Set instrument over the station.
- Level the instrument.
- Sight the target.
- Read the vertical circle.
- Apply corrections if needed.

1(g) Define Tacheometry – 2 M

Tacheometry is a rapid method of surveying in which **distances and elevations are measured indirectly** using a theodolite fitted with a stadia diaphragm.

1(h) Any Two EDM Instruments – 2 M

Any two (1 M each):

- Total Station
- Distomat
- Geodimeter
- Tellurometer

1(i) Photogrammetry – 2 M

Photogrammetry is the **science of obtaining reliable measurements** from photographs (usually aerial).

1(j) Vertical vs Tilted Photographs – 2 M

Two differences (1 M each):

- Vertical: optical axis vertical; Tilted: optical axis inclined.
- Vertical used for mapping; tilted used for reconnaissance.

PART – B

(5 × 10 = 50 Marks)

UNIT – I

2(a) Difference Between Plane & Geodetic Surveying – 5 M

Any five differences (1 M each):

S.No	Plane Surveying	Geodetic Surveying
1	The earth's surface is assumed to be **flat (plane)**.	The earth's surface is considered **curved (spheroidal/ellipsoidal)**.
2	Curvature of the earth is **neglected**.	Curvature of the earth is **fully considered**.
3	Used for **small areas** (less than 260 sq. km).	Used for **large areas**, such as states or countries.
4	**Simple geometry** (plane trigonometry) is used.	**Spherical trigonometry** is required.
5	Lower accuracy compared to geodetic surveys.	Very high accuracy because adjustments are made for curvature.
6	Instruments used: chain, tape, compass, dumpy level.	Instruments used: theodolite, total station, GPS, satellite equipment.
7	Stations are close to each other.	Stations are widely spaced and connected by long triangles.

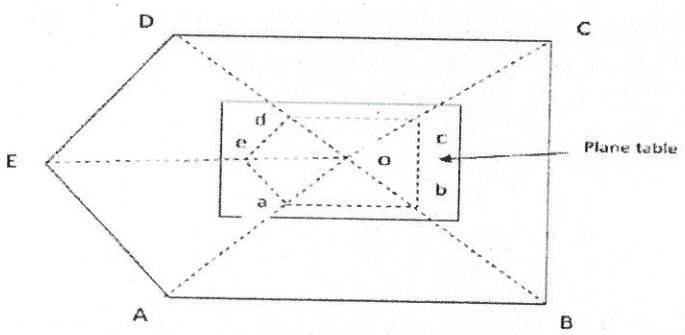
8	Suitable for engineering works like roads, canals, buildings.	Suitable for mapping continents, national boundaries, and control networks.
9	Calculations are simple and faster.	Calculations are complex due to spherical corrections.
10	No need for geodetic control points.	Requires **geodetic control** and high-order triangulation.

2(b) Methods of Plane Table Surveying – 5 M

Method (explain any 3):

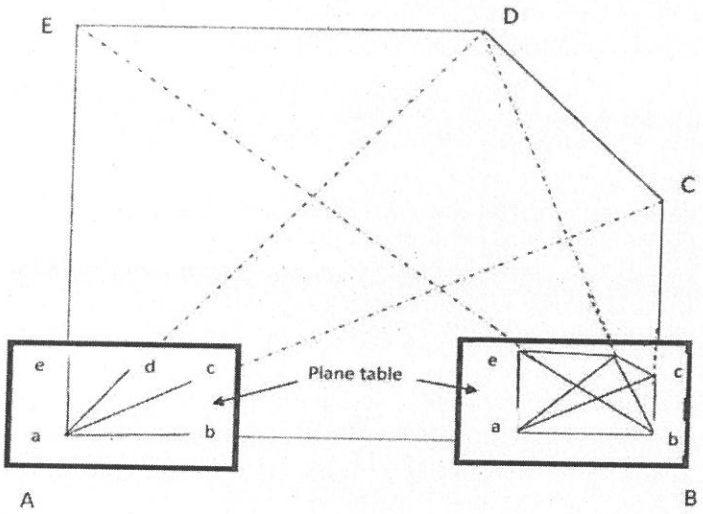
1. **Radiation method** (sketch): rays drawn from station to objects

   Radiation Method Here, the plane table is set up at one station which allows the other station to be accessed. The points to be plotted are then located by radiating rays from the plane table station to the points. After reducing the individual ground distances on the appropriate scale, the survey is then plotted. This method is suitable for small area surveys. It is rarely used to survey a complete project but is used in combination with other methods for filing in details within a chain length

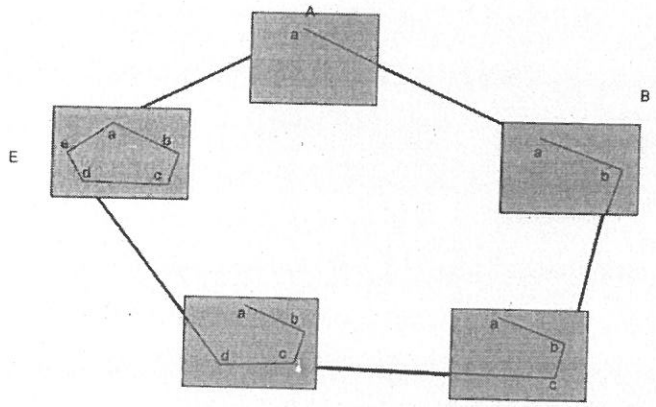


2. **Intersection method**: location found by intersection of rays

   In this method, two instrument stations are used with the distance between them called based line serving as the base to measure and plot the other locations: 1. 2 points A and B are selected from which the rest of the stations can be seen. 2. Set up and level the plane table at A and mark it as a in the paper to coincide with A on the ground. 3. Sight B, C, D and E with the Alidade from a and draw rays which forwards them. 4. Measure AB, AC, AD and AE and using appropriate scale draw the corresponding paper distance. 5. Remove the equipment from A to B and repeat the procedure using B as the measuring station.



3. **Traversing**: similar to chain traverse



4. **Resection**: station location determined by back rays

Marking:

- Explanation of any 3 × 1.5 M = 4.5 M
- Sketch/diagram = 0.5 M

OR

3(a) Tape Corrections with Formulae – 5 M

Any five (1 M each):

1. **Correction for standard length**
2. **Temperature correction**
3. **Sag correction**
4. **Slope correction**
5. **Pull correction**
6. **Alignment correction**
   Each answer must include:

- Formula
- Meaning of terms

3(b) Compass Traverse Calculations – 5 M

Expected steps:

- Conversion of FB → BB check – 1 M
- Interior angle computation – 2 M
- Check sum of interior angles – 0.5 M
- Applying correction proportionately – 1 M
- Final corrected bearings – 0.5 M

UNIT – II

4(a) Methods of Levelling – Rise & Fall and Height of Collimation – 10 M

Rise & Fall Method – 5 M

1. Introduction

Levelling is the process of determining the relative heights of points on the earth's surface. The **Rise & Fall Method** is one of the two standard methods of reducing levels (the other being the Height of Collimation / HI method).

This method finds the **rise** or **fall** between consecutive staff readings and then computes the **Reduced Level (RL)** of each point.

The difference in elevation between two consecutive points is obtained by:

- **Rise** = Previous reading − Next reading (if staff reading decreases)
- **Fall** = Next reading − Previous reading (if staff reading increases)

Then:

- **RL of next point = RL of previous point + Rise – Fall**

At each setup of the level:

- **B.S. (Back Sight):** First reading taken after instrument setup
- **I.S. (Intermediate Sight):** Any reading between BS and FS
- **F.S. (Fore Sight):** Last reading before instrument shift

These readings are used to calculate rise or fall.

A standard Rise & Fall table contains:

Station	B.S.	I.S.	F.S.	Rise	Fall	R.L.	Remarks

Fill BS, IS, FS in order of survey.

For every pair of consecutive readings:

- If next reading < previous reading → **Rise**
- If next reading > previous reading → **Fall**

From a known **Benchmark (BM)**:

- **RL = RL(previous) + Rise – Fall**

Two mandatory checks ensure accuracy:

- Principle – 1 M

- Table format – 2 M
- Calculations – 1 M
- Check: ΣRise – ΣFall = Last RL – First RL – 1 M

Height of Collimation Method – 5 M

- Formula (HI = RL of BM + BS) – 1 M
- Table – 2 M
- RL calculation – 1 M
- Check – 1 M

4(b) formula for earthwork in a level section

UNIT – III

5(a) Direct and Indirect Methods of Contouring – 5 M

Direct methods (any two):

- Levelling
- Tacheometry
  (1 M each)

Indirect methods (any two):

- Square/Grid method
- Cross-sectioning
- Radial line method
  (1 M each)

Sketch/remarks – 1 M

5(b) Borrow Pit & Spot Level Method – 5 M

Borrow Pit Method – 2.5 M
Used in small areas by measuring ground levels at pits.

Spot Level Method – 2.5 M
Spot heights taken at selected points to draw contours.

OR

6(a) Repetition Method – 5 M

Steps (1 M each):

1. Set instrument
2. Take initial reading
3. Transiting telescope
4. Repetition of observation
5. Mean angle computed

6(b) Open vs Closed Traverse – 5 M

Any five differences (1 M each):

- Open has no closure / closed returns to starting point
- Error check possible only in closed
- Used for road surveys / boundaries

UNIT – IV

8(a) Vertical Curves: Types & Applications – 5 M

Types:

1. Summit curves – 2 M
2. Valley curves – 2 M
   Applications – 1 M

8(b) Advantages & Applications of Tacheometry – 5 M

Any five points (1 M each):

- Rapid
- Useful in rough terrain
- Useful for contouring
- Distance & elevation measured simultaneously

OR

9(a) Advantages & Limitations of GPS – 5 M

Any five points:

- Advantages (3 points)
- Limitations (2 points)

UNIT – V

10(a) Photogrammetry Definition, Advantages, Applications – 5 M

- Definition – 1 M
- Advantages (any 3) – 1.5 M
- Applications (any 3) – 1.5 M
- Simple sketch/general notes – 1 M

10(b) Focal Length vs Flying Height – 5 M

Any five differences (1 M each):

- Focal length: camera constant
- Flying height: aircraft height
- Image scale relation, etc.

OR

11(a) Adv & Limitations of Terrestrial Photogrammetry – 5 M

Any five points (1 M each)

11(b) Mosaic: Definition and Types – 5 M

- **Definition – 1 M**
- **Types:
  - Uncontrolled – 1 M
  - Semi-controlled – 1.5 M
  - Controlled – 1.5 M**

that the corrected volume is equal to that as if it has been calculated by applying the prisomoidal formula directly. The indirect method being simpler is more commonly used.

When the centre line of the project is curved in plan, the effect of curvature is also taken into account specially in final estimates of earthwork where much accuracy is needed. It is the common practice to calculate the volumes as straight as mentioned above and then to apply the correction for curvature to them. An other method of finding curved volumes is to apply the correction for curvature to the areas of cross-sections, and then to compute the required volumes from the corrected areas from prismoidal formula.

12.2. Formulae for Areas of Cross-sections :

The following are the various cross-sections usually met with whose areas are to be computed :–

1. Level section.
2. Two-level section.
3. Side-hill two-level section.
4. Three-level section.
5. Multi-level section.

Notations., Refer fig. 12.1.

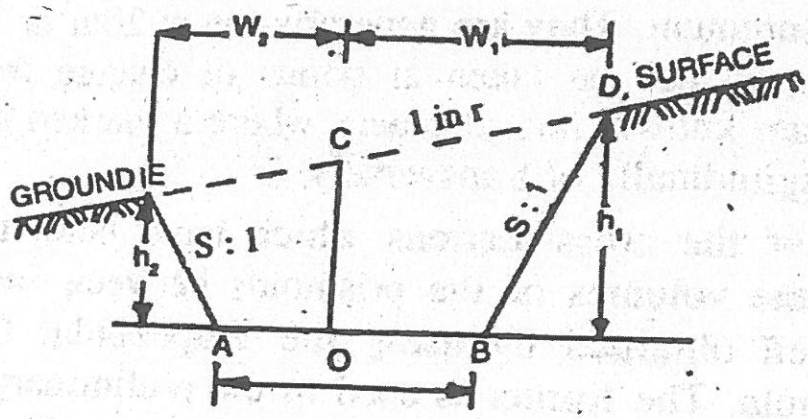


Fig. 12.1.

Let b = the breadth of formation or sub-grade which is usually constant.

S : 1 = the side slope (S horizontal to 1 vertical).

1 in r = the transverse slope of the original ground (1 vertical in r horizontal).

h = the height of earthwork (cutting or filling) on the centre line.

h_1 and h_2 = the side heights, *i.e.* the vertical distances from formation level to the intersections of the side slopes with the original surface.

w_1 and w_2 = the side-widths or half breadths *i.e.* the horizontal distances from the centre line to the intersections of the side slopes with the original surface.

A = the area of cross-section.

Formulae for the dimensions of the cross-sections of cutting and fillting for the above cases are given below and should be verified by the readers as exercises.

1. **Level-Section.** (Fig. 12.2). In this case the ground is level transversely.

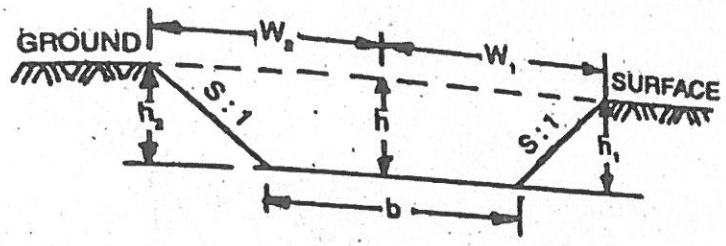


Fig. 12.2

$$h_1 = h_2 = h$$

$$w_1 = w_2 = \frac{b}{2} + sh$$

$$A = \frac{1}{2}[b + (b + 2sh)]h$$

$$= (b + sh)\,h \quad \ldots \quad \ldots \quad \ldots \text{ (Eqn. 12.1)}$$

2. Two-level Section. (Fig. 12.1). In this case, the ground is sloping transversely, but the slope of the ground does not intersect the formation level.

$$w_1 = \frac{b}{2} + \frac{rs}{r-s}\left(h + \frac{b}{2r}\right)$$

$$w_2 = \frac{b}{2} + \frac{rs}{(r+s)}\left(h - \frac{b}{2r}\right)$$

$$h_1 = h + \frac{w_1}{r}$$

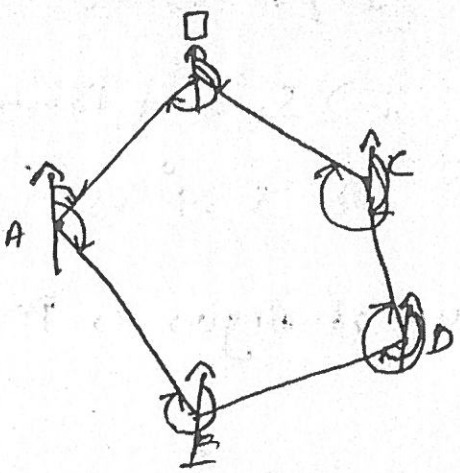
$$h_2 = h - \frac{w_2}{r}$$

$$A = \frac{1}{2}\left[(w_1 + w_2)\left(h + \frac{b}{2s}\right) - \frac{b^2}{2s}\right]$$

$$= \left[\frac{s(\frac{b}{2})^2 + r^2bh + r^2sh^2}{(r^2 - s^2)}\right] \quad \ldots \quad \ldots \quad \text{(Eqn. 12.2)}$$

3 (b)

Line	FB	BB
AB	80°10'	259°0'
BC	170°20'	301°50'
CD	170°50'	350°50' = 180°
DE	230°10'	49°30'
EA	310°20'	130°15'



Solut

Bearing of EA ⇒

$\angle A \Rightarrow$ B.B of E.A − f.B. of AB

$\Rightarrow 130^\circ 15' - 80^\circ 10'$

$= 50^\circ 05'$

$\angle B \Rightarrow$ B.B of AB − f.B of B.C

$\Rightarrow 259^\circ 0' - 170^\circ 20'$

$\Rightarrow 138^\circ 40'$

$\angle C \Rightarrow$ B.B of B.C − f.B of CD

$\Rightarrow 301^\circ 50' - 170^\circ 50'$

$\Rightarrow 131^\circ 00'$

$\angle D \Rightarrow$ B.B of CD − f.B of D.E

$\Rightarrow 170^\circ 40'$

$\angle E \Rightarrow$ B.B of DE − f.B of EA

$\Rightarrow 49^\circ 30' - (310^\circ 20' - 360^\circ)$

$= 99^\circ 10'$

Sum of All the Angles

$\Rightarrow \angle A + \angle B + \angle C + \angle D + \angle E$

$\Rightarrow 50^\circ 05' + 138^\circ 40' + 131^\circ 00' + 170^\circ 40' + 99^\circ 10'$

$\Rightarrow 539^\circ 35''$

Sum of Angles in Pentagon $\Rightarrow (2n-4) \times 90^\circ$

$\Rightarrow (2(5)-4) \times 90^\circ$

$\Rightarrow 540^\circ$

The difference $\Rightarrow 540^\circ - 539^\circ 35'$

Angle Misclosure $\Rightarrow 25'$ shortage

$\Rightarrow \frac{25'}{4} = 6' 15''$

Corrected Interior Angles

$\angle A = 50^\circ 11'$

$\angle B = 138^\circ 46'$

$\angle C = 131^\circ 00'$

$\angle D = 170^\circ 46'$

$\angle E = 99^\circ 16'$

Sum of All the Angles $= 540^\circ$