INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal - 500 043, Hyderabad, Telangana

COURSE CONTENT

GEOMATICS ENGINEERING LABORATORY								
III Semester: CE								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
ACEE07	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		0	0	2	1	40	60	100
Contact Classes: Nil	**Tutorial Classes: Nil**	**Practical Classes: 45**				**Total Classes: 45**		
Prerequisite: Nil								

I. COURSE OVERVIEW:

The Geomatics Engineering Laboratory provides practical training in the measurement, representation, and analysis of the Earth's surface using traditional and modern surveying techniques. Students will gain hands-on experience in operating surveying instruments, collecting field data, and processing it into usable maps, plans, and digital models. The lab bridges theoretical knowledge from geomatics with applied skills in land measurement, mapping, and emerging geospatial technologies. Students learn techniques for gathering field data with both traditional and modern instruments. A set of traditional and modern instruments are used, including auto level, theodolite, total station, level rods, tripods, tape measures, chaining pins, and other common surveying tools and ancillary equipment.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The practical knowledge on computation of an area, volume of an irregular and regular land surface using chains and tapes.

II. Different types of instruments in surveying, perform field surveys for horizontal and vertical measurements.

III. Understand error sources in surveying and apply correction techniques.

IV. Integrate surveying data with modern geomatics tools for engineering applications.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1 Utilize the concept of bearing system to measure azimuth and survey lines in field.

CO 2 Make use of digital theodolite apparatus to measure vertical and horizontal distances, gradients and elevations.

CO 3 Demonstrate the two point and three-point problem in plane table surveying for tracing out the centering point or station point.

CO 4 Identify the reduced levels using leveling apparatus for illustrating longitudinal section and cross section and plotting.m

CO 5 Make use of Rankine's curve setting procedure for investigating the suitable path along the alignment and conflict points.

CO 6 Distinguish between tacheometry and trigonometry surveying for various operating conditions data record keeping.

IV. COURSE CONTENT:

Safety

Safety is a vital issue in all workplaces. Before using any equipment and machines or attempting practical work in a laboratory everyone must understand basic safety rules. These rules will help keep all safe in the laboratory.

Safety Rules

1. New students must receive an orientation on laboratory operating procedures before working in a laboratory.
2. Students shall publish a safety checklist for equipment for which they are responsible.
3. Students must read the safety checklist for each piece of equipment before operating it.
4. Ensure you know the location of the emergency stop button before starting equipment.

Getting started Exercises

1. Introduction

The purpose is to Identify survey equipment like chain, tape, compass, levelling, plane table, theodolite, and total stations as shown in Fig.1.1. Remembering the suitability and application of equipment. Surveying lab equipment is essential for precise measurements and data collection in various engineering and construction projects. Key instruments include theodolites for measuring horizontal and vertical angles, levels for establishing elevations, and total stations which combine electronic distance measurement and angle measurement capabilities. Additionally, GPS devices are used for high-accuracy location data, while measuring tapes and ranging rods assist in basic distance measurements. Together, these tools enable surveyors to create accurate maps and plans crucial for project planning and execution.

Fig.1.1 Various equipment used in surveying

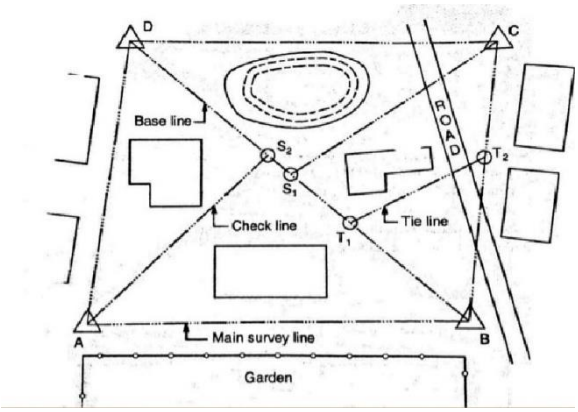
Try

1. Identify the different instruments used in surveying?
2. Remember the uses of different equipment?
3. What is the suitability of equipment for a specific work?

2. Survey of an area by chain survey closed traverse and plotting

Determine the area of a given land using chain surveying. Fig.2.1 shows the chain and Fig.1.2 shows the chain surveying. In the reconnaissance survey given area is surveyed by closed traverse and plotted using chain.

Fig.2.1 Chain



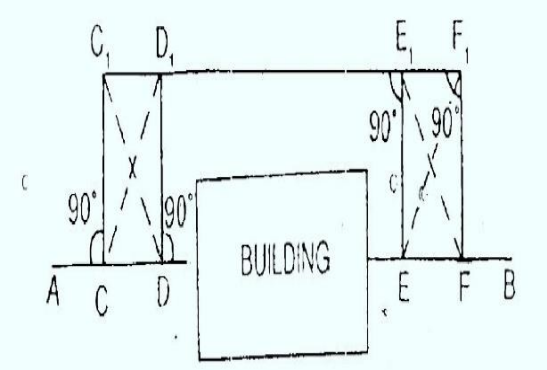
Try:

1. Measure an Area of given land and plot on drawing sheet?
2. Plot ground with undulating surface?
3. Finding out an Area of given land by using plane table

3. Chaining across obstacle

Determine the length of a line which is passing across the river, building, uphill, valley, we will use different techniques to measure length of line. Fig.3.1 shows the Chaining across building obstacle.

Fig.3.1 Chaining across building obstacle



Try:

1. Measure a line if building comes across the line using a chain or tape?
2. Quantify a line if river comes across the line using a chain or tape?

4. Determine of distance between two inaccessible points with compass

Measure the distance between the points which are not accessible like distance between moon and sun we will utilise this method by using compass as shown in Fig. 4.1

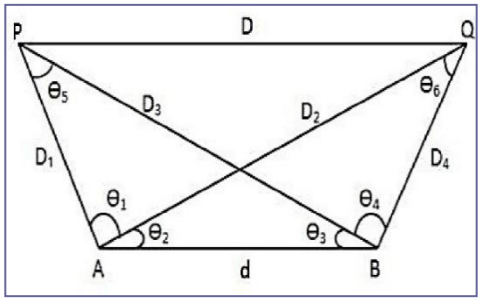


Fig.4.1 Length of inaccessible line using compass

Try:

1. Measure a distance between two inaccessible points using compass?
2. Find out the distance between top points of two different hills?

5. Surveying of a given area by prismatic compass closed traverse and plotting after adjustment

Plot the given area of land by using prismatic compass closed traverse survey after adjustment is done as shown in Fig.5.1

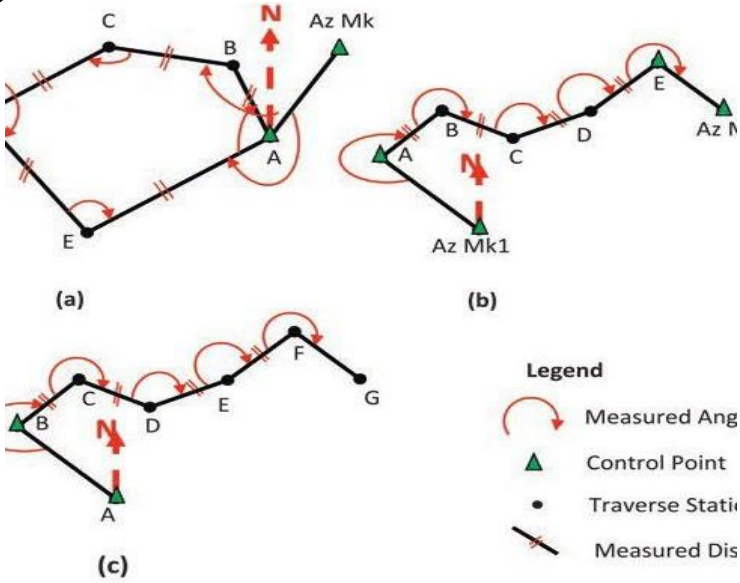


Fig. 5.1 Prismatic compass closed traverse

Try:

1. Measure area of a land using compass.
2. Plot the college playground land by traverse using compass?

6. Correction for local attraction by prismatic compass

Determine the error due to local attraction by using prismatic compass near electric iron poles or ground having iron ore inside as magnet needle affects with iron material using Fig.6.1.

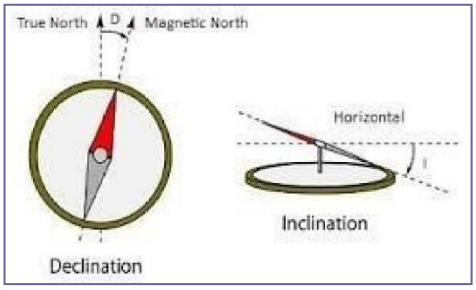


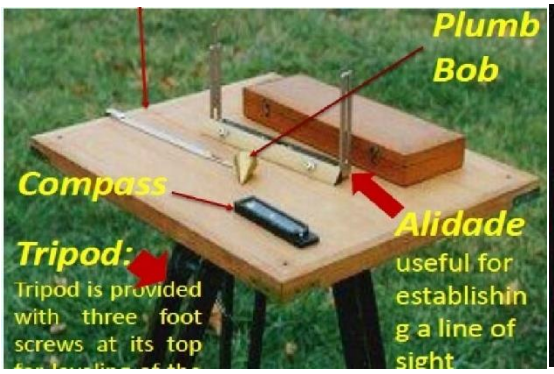
Fig.6.1 Local attraction

Try:

1. Traverse a given land using compass when come across an iron ore below the earth?
2. Apply corrections to the errors caused by iron objects while doing surveying and find out the corrected values?

7. RADIATION METHOD, INTERSECTION METHODS BY PLANE TABLE SURVEY

7.1 Plot a given area of land with the use of plane table by radiation method. Fig.7.1 shows the Plane table, with accessories and plotting of an area by radiation method is as shown in Fig.6.2.



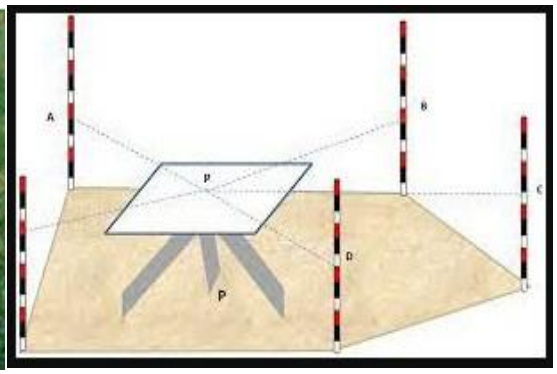


Fig.7.1 Plane table Radiation Method Fig.7.2 Area plotting by radiation method

7.2 Plot a given area of land with the use of plane table by intersection method. Plotting of an area by intersection method is as shown in Fig.7.3.

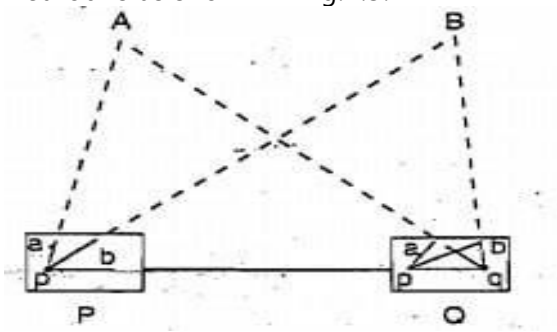


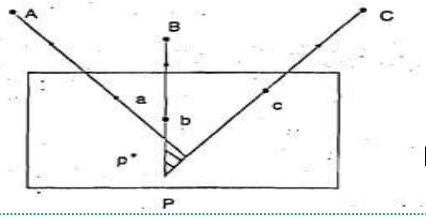
Fig.7.3 Plane table intersection Method

Try:

1. Extending the survey which is closed in the previous days.
2. Orienting and aligning the old previous points in the field.

8. Three-point problems in plane table survey

Orient the plane table at point P, if three points are already in the existing drawing sheet and in the site by three-point as shown in Fig.8.1.



lane table

Try:

1. Extending the survey which is closed in the previous days.
2. Orienting and aligning the old previous points in the field.

9. TRAVERSINGG BY PLANE TABLE SURVEY

Plotting of an area by Traversing using plane table as shown in Fig. 9.1

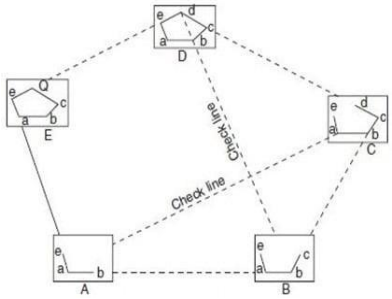


Fig. 9.1 Plotting of an area by traversing using plane table

Try:

1. Traverse and calculate the area of agricultural land by using Plane table equipment?
2. Cross check the accuracy of work of traversing?

10. FLY LEVELLING DIFFERENTIAL LEVELLING

Determine the difference of elevation between two far points by fly leveling. Fig.10.1 shows the Level equipment and Fig.10.2 shows the fly levelling.

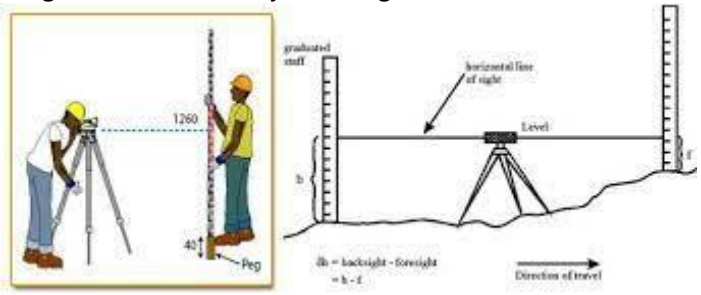


Fig.10.1 Level equipment

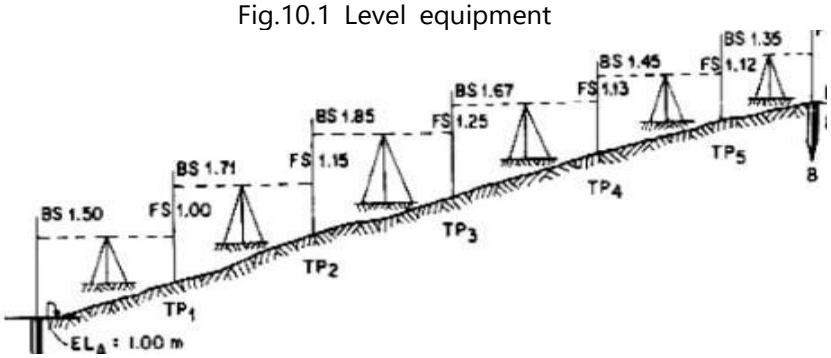


Fig.10.2 Fly levelling

Try:

1. Measure the difference of elevation between two far points using dumpy level.
2. Measure the difference of elevation between two far elevated points using auto level.

11. EXERCISE OF LONGITUDINAL SECTION AND CROSS SECTION AND PLOTTING

Calculate the Road quantity by longitudinal and cross sectioning before and after road construction. Road surveying before and after laying road as shown in Fig. 11.1

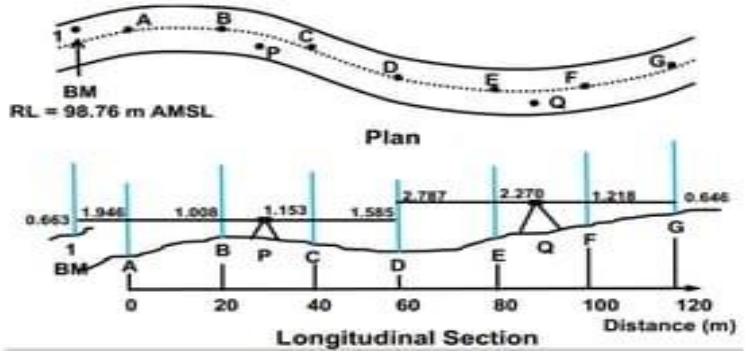


Fig. 11.1 Road surveying before and after laying.

Try:

1. Arriving the quantity of earth work excavation by Longitudinal and cross sectioning for a canal using auto level.
2. Finding out the quantity of soil required for a road work by Longitudinal and cross sectioning by using tacheometer.

12. EXERCISE ON CONTOURING HILLY AREA

Draw the contours for a given hilly area to lay ghat roads or measure the capacity of reservoir. Hilly area contouring as shown in Fig. 12.1

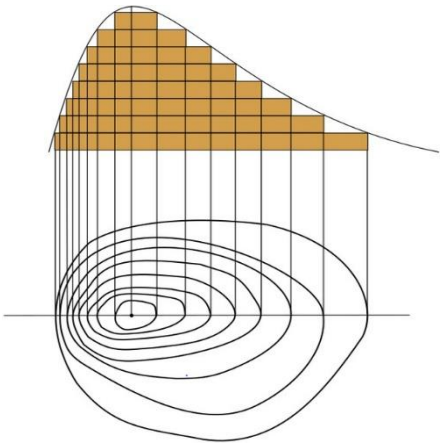


Fig.12.1 Contouring in hilly area

Try:

1. Calculate the quantity of earth work excavation by contouring in irregular ground areas.
2. Finding out the quantity of water can be stored in a reservoir before construction of dam.
3. Estimate the quantity of water in reservoir before construction of dam using tacheometer

13. EXERCISE ON CONTOURING FLAT GROUND

Draw the contours for a given flat area to calculate the quantity earth work excavation. Flat ground area contouring as shown in Fig. 13.1.

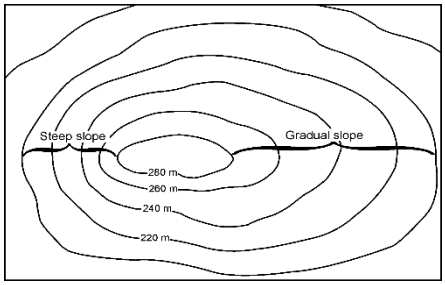


Fig. 13.1 Contouring in Flat land area

Try:

1. Finding out the quantity of water can be stored in a reservoir before construction of dam.
2. Estimate the quantity of water in reservoir before construction of dam using tacheometer.
3. Calculate the quantity of earth work excavation by contouring in irregular ground areas.

14. STUDY OF TOTAL STATION, MEASURING HORIZONTAL AND VERTICAL ANGLES

Study the operation of a Total Station instrument and measure horizontal and vertical angles for determining the position and elevation of points accurately in surveying works. The experiment helps in understanding electronic distance measurement, angle observation, and coordinate calculation used in modern surveying applications. Flat ground area contouring as shown in Fig. 14.1.

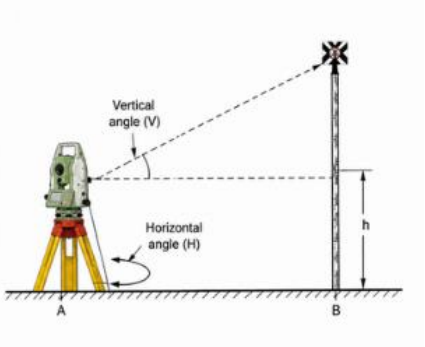


Fig. 14.1 Total station used for angle measurement

Try:

1. Measure horizontal angles between different survey points using a Total Station.
2. Determine vertical angles and calculate differences in elevation between points.
3. Perform traversing and coordinate measurement using Total Station observations.

V. TEXTBOOKS:

1. H. S. Moondra, Rajiv Gupta, "*Laboratory Manual for Civil Engineering*", CBS Publishers Pvt.Ltd., New Delhi, 2nd Edition, 2013.
2. S. S. Bhavikatti, "*Surveying Theory and Practice*", IK Books, New Delhi, 2010.

VI. REFERENCE BOOKS:

1. James M. Anderson, Edward M. Mikhail, "*Surveying: Theory and Practice*", Tata Mc Graw Hill Education, 2012.

VII. ELECTRONICS RESOURCES:

1. https://www.iare.ac.in/sites/default/files/lab1/Surveying
2. https://aust.edu/lab-manuals/CE/ce-104.pdf

VIII. MATERIAL ONLINE:

1. Course outline description
2. Laboratory manual