

Surveying

Course Title:	Surveying	Course Code :	CE-106
Semester:	I year	Course Group :	Core
Teaching Scheme in Periods(L:T:P):	120:30:0	Credits :	3
Type of Course :	Lecture+ Tutorials	Total Contact Periods :	150 Periods
CIE :	60 Marks	SEE :	40 Marks

Pre requisites

This course requires the basic knowledge of unit conversations, Trigonometry, geometry and basics of map study

Course Outcomes

Upon completion of the course, the student shall be able to

CO1	Explain basic concepts, principles, and classifications of surveying and apply linear measurement techniques for simple field surveys.
CO2	Perform compass surveying and levelling operations and compute reduced levels, bearings, and traverse plots.
CO3	Interpret contour maps and compute areas and volumes required for earthwork and site development projects
CO4	Explain the construction, working, and applications of theodolite and apply principles of curve setting for roads and railways.
CO5	Describe the principles and applications of Electronic Distance Measurement (EDM), Total Station, and GPS in modern surveying practice.
CO6	Understand the principles, planning, data acquisition, and applications of drone surveying and relate theory to advanced surveying laboratory practices.

Course Content and Blue Print of Marks for SEE

UNIT NO	UNIT NAME	PERIODS	questions to be set for SEE				
			R		U	A	
1	Introduction to surveying and linear measurements	22	q4	q1		q9(a)	q13(a)
2	Compass surveying and Levelling	28					
3	Contouring, area and volume computations	22		q2		q10(a)	q14(a)
4	Theodolite surveying and curves	28					
5	Electronic distance measurement and Total station	28		q3	q5,q6	q9(b), q11(a), q11(b)	q13(b), q15(a), q15(b)
6	Modern surveying techniques and Drone surveying	22			q7,q8	q10(b), q12(a), q12(b)	q14(b), q16(a), q16(b)
Total		150	8		8	8	

Course Contents

UNIT-I: INTRODUCTION TO SURVEYING AND LINEAR MEASUREMENTS

1.1 Introduction to Surveying

- Definition of surveying and its objectives
- Importance of surveying in planning, design, construction, and maintenance of civil engineering projects
- Role of surveying in buildings, roads, railways, canals, dams, and urban development

1.2 Classification of Surveying

- Classification based on extent and curvature of earth: plane surveying and geodetic surveying
- Classification based on purpose: land surveying, engineering surveying, route surveying, construction surveying

1.3 Principles of Surveying

- Fundamental principles of surveying
- Working from whole to part
- Fixing the position of a point using two independent measurements

1.4 Linear Measurement

- Units of linear measurement used in surveying
- Conventional methods of distance measurement
- Chains and tapes: types, construction, and uses
- Errors in chaining and taping and basic corrections

1.5 Chain Surveying

- Principle and suitability of chain surveying
- Limitations of chain surveying
- Instruments used in chain surveying and their functions
- Ranging: direct and indirect ranging
- Offsets and types of offsets
- Chaining on level and sloping ground
- Field book and booking of field notes
- Plotting of chain survey
- Errors and precautions in chain surveying

UNIT–II: COMPASS SURVEYING AND LEVELLING

2.1 Compass Surveying

- Introduction and applications of compass surveying
- Meridians: true, magnetic, and arbitrary meridians
- Bearings: whole circle bearing and quadrantal bearing
- Conversion of bearings from one system to another

2.2 Compass Instruments

- Prismatic compass: construction, working, and uses
- Surveyor's compass: construction, working, and uses
- Comparison between prismatic compass and surveyor's compass

2.3 Compass Traversing

- Fore bearing and back bearing
- Local attraction: causes, detection, and correction

- Closed and open traverses
- Plotting of compass traverse

2.4 Introduction to Levelling

- Definition and objectives of levelling
- Terms used in levelling: benchmark, reduced level, back sight, intermediate sight, fore sight, line of collimation, height of instrument

2.5 Levelling Instruments

- Dumpy level, tilting level, and auto level
- Temporary adjustments of levelling instruments

2.6 Methods of Levelling

- Height of Instrument method
- Rise and Fall method
- Numerical problems on levelling

UNIT–III: CONTOURING, AREA AND VOLUME COMPUTATIONS

3.1 Contouring

- Definition of contours and contour lines
- Characteristics of contour lines
- Contour interval and horizontal equivalent

3.2 Methods of Contouring

- Direct method of contouring
- Indirect methods: grid method and radial line method

3.3 Interpretation and Applications of Contours

- Interpretation of contour maps
- Use of contours in route alignment, reservoir planning, and site grading

3.4 Area Computations

- Importance of area computation in surveying
- Methods of area calculation:
 - Mid-ordinate rule
 - Average ordinate rule
 - Trapezoidal rule
 - Simpson's rule

3.5 Volume Computations

- Earthwork calculation and its importance
- Volume computation using trapezoidal and prismoidal rules
- Computation of volumes for roads, railways, excavations, and embankments

UNIT–IV: THEODOLITE SURVEYING AND CURVES

4.1 Introduction to Theodolite

- Definition and uses of theodolite
- Classification of theodolites
- Transit theodolite

4.2 Parts and Adjustments of Theodolite

- Main parts of theodolite and their functions
- Temporary adjustments (conceptual understanding)
- Permanent adjustments (conceptual understanding)

4.3 Measurement Using Theodolite

- Measurement of horizontal angles
- Measurement of vertical angles
- Prolonging a straight line
- Theodolite traversing

4.4 Tacheometric Surveying

- Definition and principle of tachometry
- Need for Tacheometric surveying in engineering projects
- Instruments used in tachometry
- Stadia constants: multiplying constant and additive constant
- Methods of Tacheometric surveying:
 - Stadia method (horizontal and inclined sights)
 - Tangential method
- Computation of horizontal distance and difference in elevation using tacheometric observations (numerical problems)
- Advantages, limitations, and applications of Tacheometric surveying in rough and hilly terrain

4.5 Curves

- Necessity of curves in highways and railways
- Simple circular curves
- Elements of simple circular curve

4.6 Setting Out of Simple Circular Curves

- Offset method
- Deflection angle method (basic concept)

UNIT–V: ELECTRONIC DISTANCE MEASUREMENT AND TOTAL STATION

5.1 Electronic Distance Measurement (EDM)

- Definition and principle of EDM
- Types of EDM instruments
- Advantages of EDM over conventional methods
- Sources of errors in EDM

5.2 Total Station

- Introduction to Total Station
- Components of Total Station
- Working principle of Total Station

5.3 Field Procedures Using Total Station

- Setting up and levelling of Total Station
- Orientation and station setup
- Measurement of distances and angles
- Determination of coordinates

5.4 Applications of Total Station

- Building layout and setting out works
- Road and highway projects
- Contouring and topographic surveys
- Earthwork measurements
- Introduction to data transfer and CAD integration

UNIT–VI: MODERN SURVEYING TECHNIQUES AND DRONE SURVEYING

6.1 Global Positioning System (GPS)

- Introduction to GPS
- Components of GPS
- Basic working principle
- Applications of GPS in surveying and construction

6.2 GIS and Remote Sensing

- Introduction to Geographic Information System (GIS)
- Components and functions of GIS
- Applications of GIS in civil engineering
- Basic concept of remote sensing

6.3 Introduction to Drone Surveying

- Definition and importance of drone surveying
- Comparison with conventional surveying methods
- Advantages and limitations of drone surveying

6.4 UAV Types and Components

- Classification of survey drones: fixed-wing and multirotor
- Components of a survey drone system
- Cameras and sensors used in drone surveying

6.5 Principles and Planning of Drone Survey

- Principles of photogrammetry
- Image overlap and flight parameters
- Survey planning considerations

6.6 Ground Control Points and Data Acquisition

- Importance and types of ground control points
- Data capture process
- Errors and accuracy considerations

6.7 Drone Survey Outputs and Applications

- Orthomosaic maps
- DEM, DTM, and contour maps
- Applications in roads, construction, mining, and urban planning

6.8 Safety and Regulatory Awareness

- Safety considerations in drone operations
- Overview of drone regulations in India (DGCA – concept only)
- Ethical and privacy considerations

Recommended Books

1. Surveying - N.N.Basak - Tata McGraw Hill
2. Surveying Vol-I - S.K.Duggal -McGraw Hill Edn (India) Pvt Ltd
3. Surveying and Levelling Vol -1 -Kulkarni and Kanetkar
4. Surveying and Levelling Vol. - 1 - B.C. Punmia
5. Surveying and Levelling -Vol -1 -R.Agor- Khanna Publishers

Suggested E-Learning references

1. www.elearning.com/survey
2. <http://nptel.ac.in>

Suggested Learning Outcomes

Upon completion of the course, the student shall be able to

UNIT-I: INTRODUCTION TO SURVEYING AND LINEAR MEASUREMENTS

1.1 Introduction to Surveying: Students will be able to explain the definition, objectives, and importance of surveying in civil engineering projects.

1.2 Classification of Surveying: Students will be able to classify surveying into plane and geodetic; and into land, engineering, route, and construction surveying.

1.3 Principles of Surveying: Students will understand the fundamental principles and apply them to simple survey measurements.

1.4 Linear Measurement: Students will perform linear measurements using chains and tapes and correct basic errors.

1.5 Chain Surveying: Students will conduct basic chain surveys, record accurate field notes, and plot simple survey plans.

UNIT–II: COMPASS SURVEYING AND LEVELLING

2.1 Compass Surveying: Students will identify meridians, bearings, and types of compass used.

2.2 Compass Instruments: Students will demonstrate knowledge of prismatic and surveyor's compass operation.

2.3 Compass Traversing: Students will compute fore and back bearings, correct for local attraction, and plot traverses.

2.4 Introduction to Levelling: Students will understand levelling terms and concepts.

2.5 Levelling Instruments: Students will identify and adjust dumpy, tilting, and auto levels.

2.6 Methods of Levelling: Students will calculate reduced levels using Height of Instrument and Rise & Fall methods.

UNIT–III: CONTOURING, AREA AND VOLUME COMPUTATIONS

3.1 Contouring: Students will explain contour lines, intervals, and horizontal equivalents.

3.2 Methods of Contouring: Students will apply direct and indirect contouring methods to produce contour plans.

3.3 Interpretation and Applications of Contours: Students will analyze contour maps for planning routes, reservoirs, and site grading.

3.4 Area Computations: Students will calculate areas using mid-ordinate, average ordinate, trapezoidal, and Simpson's rules.

3.5 Volume Computations: Students will compute earthwork volumes for roads, embankments, and excavations.

UNIT–IV: THEODOLITE SURVEYING, TACHEOMETRY AND CURVES

4.1 Introduction to Theodolite: Students will describe theodolite types and applications.

4.2 Parts and Adjustments of Theodolite: Students will identify parts and understand adjustments.

4.3 Measurement Using Theodolite: Students will measure horizontal and vertical angles and perform traversing.

4.4 Tacheometric Surveying: Students will explain tacheometry principles, methods, and compute distances and elevation differences.

4.5 Curves: Students will understand the need and elements of simple circular curves.

4.6 Setting Out of Simple Circular Curves: Students will apply methods to set out curves using offsets and deflection angles.

UNIT–V: ELECTRONIC DISTANCE MEASUREMENT AND TOTAL STATION

5.1 Electronic Distance Measurement (EDM): Students will describe principles, types, advantages, and errors in EDM.

5.2 Total Station: Students will identify components and understand the working principle.

5.3 Field Procedures Using Total Station: Students will set up, orient, measure distances and angles, and determine coordinates.

5.4 Applications of Total Station: Students will apply Total Station data for building layout, roads, contouring, and earthwork calculations.

UNIT–VI: MODERN SURVEYING TECHNIQUES AND DRONE SURVEYING

6.1 Global Positioning System (GPS): Students will explain GPS components, working, and applications in surveys.

6.2 GIS and Remote Sensing: Students will describe GIS functions, remote sensing concepts, and civil engineering applications.

6.3 Introduction to Drone Surveying: Students will explain drone survey principles, advantages, limitations, and comparison with conventional methods.

6.4 UAV Types and Components: Students will identify drone types, components, and sensors.

6.5 Principles and Planning of Drone Survey: Students will understand photogrammetry, image overlap, and plan survey missions.

6.6 Ground Control Points and Data Acquisition: Students will apply knowledge of GCPs and understand accuracy considerations.

6.7 Drone Survey Outputs and Applications: Students will interpret orthomosaics, DEM/DTM, contour maps, and relate outputs to civil projects.

6.8 Safety and Regulatory Awareness: Students will follow safety protocols and understand drone regulations and ethics.

Suggested Student Activities

1. Tech fest/Srujana
2. Paper/Poster presentation

3. Quiz
4. Group discussion
5. Surprise test

CO-PO Mapping Matrix

	Basic and Discipline Specific Knowledge	Problem Analysis	Design/Development of Solutions	Engineering Tools, Experimentation and Testing	Engineering Practices for Society, Sustainability and Environment	Project Management	Lifelong Learning	Linked PO
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	
CO1	3	3	2	-	-	-	-	1,2,3
CO2	3	3	2	-	2	-	-	1,2,3,5,
CO3	3	2	-	2	2	-	-	1,2,4,5
CO4	3	3	2	-	2	2	-	1,2,3,5,6,
CO5	3	3	2	2	-	2	2	1,2,3,4,6,7
CO6	3	2	-	2	2	3	2	1,2,4,5,6,7

QUESTION PAPER PATTERN FOR MID SEMESTER EXAMS

Sl.No	Description	Level	No of Questions	Marks for each question	Choice	Total Marks
01	Part-A	Remembering(R)	4	1	Nil	4 Marks
02	Part-B	Understanding(U)	4	3	2	6 Marks
03	Part-C	Application(A)	4	5	2	10 Marks
Total Marks						20 Marks

MID SEM-I EXAM

S.No	Unit No	R	U	A	Remarks
1	Unit-I	1,2	5(a)	7(a)	
			5(b)	7(b)	
2	Unit-II	3,4	6(a)	8(a)	
			6(b)	8(b)	
Total Questions		4	4	4	

MID SEM-II EXAM

S.No	Unit No	R	U	A	Remarks
1	Unit-III	1,2	5(a)	7(a)	
			5(b)	7(b)	
2	Unit-IV	3,4	6(a)	8(a)	
			6(b)	8(b)	
Total Questions		4	4	4	

The length of answer for each question framed in respect of Part-A, B&C shall not exceed $\frac{1}{4}$ of a page, 1 page and 2 pages respectively

QUESTION PAPER PATTERN FOR SEMESTER END EXAM

Sl.No	Description	Level	No of Questions	Marks for each question	Choice	Total Marks
01	Part-A	Remembering(R)	8	1	Nil	8 Marks
02	Part-B	Understanding(U)	8	3	4	12 Marks
03	Part-C	Application(A)	8	5	4	20 Marks
Total Marks						40 Marks

Unit No	Questions to be set for SEE				
	R		U		A
I	Q4	Q1		Q9(a)	Q13(a)
II					
III		Q2		Q10(a)	Q14(a)
IV					
V		Q3	Q5,Q6	Q9(b), Q11(a), Q11(b)	Q13(b), Q15(a), Q15(b)
VI			Q7,Q8	Q10(b), Q12(a), Q12(b)	Q14(b), Q16(a), Q16(b)
Total Questions	8		8	8	

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Model Question paper

DCE I semester Mid Semester-I Examination

Course Code: CE-106

Duration: 1 hour

Course Name: Basic Surveying

Max. Marks: 20 Marks

PART-A

Answer **all** questions, Each Question carries **one** mark

4x1 = 04 Marks

1. Define surveying.
2. State any one objective of surveying.
3. What is a bearing?
4. Define benchmark.

PART-B

Answer **two** questions, Each Question carries **Three** marks

2x3 = 06 Marks

5. (a) Differentiate between whole circle bearing and quadrantal bearing.
(OR)
(b) Define back sight, intermediate sight, and fore sight.
6. (a) Explain true meridian and magnetic meridian.
(OR)
(b) List the temporary adjustments of a levelling instrument.

PART-C

Answer **two** questions, Each Question carries **five** marks

2x5 = 10 Marks

- 7 (a) What are the obstacles in chain survey and methods to overcome the obstacles
(OR)
- 7 (b) Write suitability of chain surveying and selection of survey station.

8 (a) Explain ranging and offsets used in chain surveying. Describe the types of ranging and types of offsets with neat sketches.

(OR)

8 (b) Explain local attraction in compass surveying. Discuss its causes, detection, and methods of correction with suitable examples.

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Model Question paper
DCE I semester Mid Semester-II Examination

Course Code: CE-106
Course Name: Surveying

Duration: 1 hour
Max. Marks: 20 Marks

PART-A

Answer **all** questions, Each Question carries **one** mark **4x1 = 04 Marks**

- 1) What is contour interval?
- 2) State any one method of area computation in surveying.
- 3) Define tacheometry.
- 4) Define deflection angle.

PART-B

Answer **two** questions, Each Question carries **Three** marks **2x3 = 06 Marks**

- 5 (a) Define contour lines and state any four characteristics of contour lines.
(or)
- 5 (b) State the importance of earthwork computation and mention its applications in civil engineering.
- 6 (a) Explain the temporary adjustments of a theodolite.
(or)
- 6 (b) Define tacheometry and state its advantages and applications.

PART-C

Answer **two** questions, Each Question carries **five** marks **2x5 = 10 Marks**

- 7(a) The areas of cross-sections of a road embankment taken at 20 m intervals are given below:

Chainage (m)	0	20	40	60
Area (m ²)	12	18	24	30

Calculate the volume of earthwork using:

- a) Trapezoidal rule
- b) Prismoidal rule

(OR)

7 (b) The reduced levels of two points A and B, which are 40 m apart, are 102.4 m and 96.8 m respectively.

- i) Determine the position of the 100 m contour from point A using linear interpolation.
- ii) If the contour interval is 2 m, calculate the horizontal distance between successive contours along line AB.

8 (a) A simple circular curve is to be set out to connect two straight lines having an intersection angle of 30° . The radius of the curve is 300 m. Calculate:

- a) Length of the curve
- b) Tangent length
- c) Length of long chord

(OR)

8 (b) Explain the transit theodolite with the help of a neat sketch. Describe its main parts, functions, and applications in engineering surveying.

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Model Question paper

DCE I semester End Semester Examination

Course Code: CE-106

Duration:2hours

Course Name: Surveying

Max.Marks:40 M

PART – A

8 x 01 =8 Marks