

Techno India NJR Institute of Technology



Course File

Surveying (3CE4- 05)

Session 2022-23

Basant kumar Bansal
(Assistant Professor)
Department of CE



RAJASTHAN TECHNICAL UNIVERSITY, KOTA

SYLLABUS

II Year - III Semester: B.Tech. (Civil Engineering)

3CE4-05: SURVEYING

Credit: 3
3L+0T+0P

Max. Marks: 150 (IA:30, ETE:120)
End Term Exam: 3 Hours

SN	Contents	Hrs.
1	Introduction: objective, scope and outcome of the course.	1
2	LINEAR AND ANGULAR MEASUREMENTS Method of linear measurements, Correction to length measured with a chain/tape, Ranging a survey line; direct and indirect Angular measurement by compass, Designation of bearing, Traversing with tape and compass, Correction to measured bearing, Angular measurement by theodolite; Temporary adjustments, Method of horizontal angle measurement and vertical angle, Traverse computation, plotting of traverse and determining the closing error, Balancing traverse.	14
3	LEVELLING Measurements of elevations methods of levelling; direct/differential, Indirect/Trigonometrical, and Profile/Cross sectional levelling. Digital and Auto level, Errors in levelling, contours and contour lines; methods of contouring; direct and indirect, characteristics, uses, area and vol. measurements.	8
4	CURVE SURVEYING Elements of simple and compound curves, Types of curves, Elements of circular, reverse, and transition curves. Method of setting out simple, circular, transition and reverse curves, Types of vertical curves, length of vertical curves, setting out vertical curves. Tangent corrections.	5
5	TACHEOMETRY AND PHOTOGRAMMETRY SURVEYING Advantages of tacheometric surveying, different systems of tacheometric measurements, Stadia system of tacheometry, distance elevation formulae for horizontal sights. Determination of tacheometric constants, distance and elevation formulae for inclined sights with staff vertical. Introduction to basic concepts perspective geometry of aerial photographs, relief and tilt displacements, Terrestrial Photogrammetry, flight planning	8
6	SETTING OUT WORKS & MODERN FIELD SURVEY SYSTEMS Instruments and methods for laying out buildings, setting out culverts, setting out sewer lines. Principle of E.D.M. (Electronic Distance Measurements), Modulation, Types of E.D.M., Distomat, Total station, parts of total station, advantages and application.	6
	TOTAL	42

Office of Dean Academic Affairs
Rajasthan Technical University, Kota

Course Overview:

In this particular course students are dealing with Chain surveying, Compass surveying, Leveling, Plane table surveying, Contours and areas and volumes.

To introduce the importance of surveying and surveying based on instruments used such as chain surveying, compass surveying, Leveling and plane table surveying. The student should understand the use of various surveying instruments and also the temporary adjustments of the instruments used for surveying. The student should know the various errors and precautions to be taken while carrying out survey.

The student should understand the basic principle of surveying while dealing with practical field problems. The Student should be able to prepare the map with the data collected on field while survey.

Objective:

1. To apply knowledge of mathematics, science and engineering to understand measurement techniques and also, learn different equipment's used in surveying.
2. To determine the relative position of any objects or points of the earth, measure distance and angle between different objects.
3. To prepare a map or plan to represent an area on a horizontal plan.
4. To explore different methods and equipment's to be used in the field of surveying.

Course Outcomes:

CO. NO.	Cognitive Level	Course Outcome
1	Remember	Students will be able to memorize the concepts related to linear surveying used in field.
2	Analysis	Students will learn to analyze levelling problems through various methods of check.
3	Analysis	Students be able to analyzes the problems related to curve surveying in transportation planning.
4	Analysis	Students will be able to experiment horizontal & vertical distances through tachometric method of surveying.
5	Remember	Students be able to define electronic distance method techniques and the concept of Total Station.

Prerequisites:

1. Student will be able to Handle various survey instrument for a particular survey work.
2. Student will be able to Collect and analysis survey data for preparing drawing and maps.
3. Students will be able to apply check for errors estimation.
4. Students will be able to apply the knowledge, techniques, skills and modern tools of mathematics.
5. Students will be able to Perform basic land surveying instruments and perform related calculations

Course Outcome Mapping with Program Outcome:

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO234.1	3	2	2	2	2	1	1	1	2	1	1	2	1	1	1
CO234.2	2	2	1	1	1	2	1	1	2	2	2	1	1	1	1
CO234.3	3	2	2	2	2	1	1	1	2	1	1	2	1	1	1
CO234.4	2	2	1	1	1	2	1	1	2	2	2	1	1	1	1
CO234.5	3	2	2	2	2	1	1	1	2	1	1	2	1	1	1
CO234 (AVG)	2.6	2	1.6	1.6	1.6	1.4	1	1	2	1.4	1.4	1.6	1	1	1

Course Coverage Module Wise:

Lecture No.	Unit	Topic
1	1	INTRODUCTION: Objective, scope and outcome of the course
2	2	Student should be able to understand Method of linear measurements, Correction to length measured with a chain/tape.
3	2	Student should be able to understand (Contd.) Correction to length measured with a chain/tape
4	2	Student should be able to Numerical based on Correction to length measured with a chain/tape
5	2	Student should be able to understand Ranging a survey line
6	2	Student should be able to understand Direct and indirect Angular measurement by compass, Designation of bearing.
7	2	Student should be able to understand Traversing with tape and compass, Correction to measured bearing
8	2	Student should be able to solve Numerical regarding surveying.
9	2	Student should be able to understand Angular measurement by theodolite; Temporary adjustments
10	2	Student should be able to understand Method of horizontal angle measurement
11	2	Student should be able to understand Method of vertical angle measurement
12	2	Student should be able to understand Numerical based on horizontal and vertical angle measurement
13	2	Student should be able to understand Traverse computation, plotting of traverse and determining the closing error
14	2	Student should be able to understand Balancing traverse, Numerical
15	2	Student should be able to understand Numerical based on Traversing
16	3	Student should be able to understand Measurements of elevations methods of levelling; direct/differential, Indirect/Trigonometrical
17	3	Student should be able to understand Profile/Cross sectional levelling
18	3	Student should be able to understand Digital and Auto level
19	3	Student should be able to understand Errors in levelling & Numerical
20	3	Student should be able to understand contours and contour lines; methods of contouring; direct and indirect

21	3	Student should be able to understand (Contd.) methods of contouring; direct and indirect
22	3	Student should be able to understand Characteristics, uses, area and vol. measurements.
23	3	Student should be able to solve Numerical based on levelling
24	4	Student should be able to understand Elements of simple and compound curves
25	4	Student should be able to understand Types of curves, Elements of circular, reverse, and transition curves
26	4	Student should be able to understand Method of setting out simple, circular, transition and reverse curves
27	4	Student should be able to understand Types of vertical curves, length of vertical curves
28	4	Student should be able to understand Setting out vertical curves. Tangent corrections
29	5	Student should be able to understand Advantages of tachometric surveying, different systems of tachometric measurements
30	5	Student should be able to understand Stadia system of tachometry, distance elevation formulae for horizontal sights
31	5	Student should be able to solve Numerical based on levelling
32	5	Student should be able to Determine of tachometric constants, distance and elevation formulae for inclined sights with staff vertical
33	5	Student should be able to solve Numerical based on levelling
34	5	Student should be able to understand Introduction to basic concepts perspective geometry of aerial Photographs
35	5	Student should be able to understand Relief and tilt displacements
36	5	Student should be able to understand Terrestrial Photogrammetry, flight planning
37	6	Student should be able to understand Instruments and methods for laying out buildings
38	6	Student should be able to understand Setting out culverts, setting out sewer lines
39	6	Student should be able to solve problem based on leveling.
40	6	Student should be able to understand Principle of E.D.M.(Electronic Distance Measurements)
41	6	Student should be able to understand Modulation, Types of E.D.M
42	6	Student should be able to understand Total station, parts of total station, advantages and application

TEXT/REFERENCE BOOKS

1. Surveying Volume I & II by Dr. B. C. Punmia, Laxmi Publications (P)Ltd.
2. Surveying Volume I & II by Dr. K.R. Arora, Standard Book House Delhi.
3. Surveying & Leveling by Subramanian Oxford University Press.

Course Level Problems (Test Items):

CO.NO.	Problem description																		
1	<p>1. The following consecutive readings were taken along AB with a 4m levelling staff on a continuously sloping ground at an interval of 20m. 0.345 on A, 1.450, 2.630, 3.875, 0.665, 1.745, 2.965, 3.945, 1.125, 2.475, 3.885 on B. The first reading was taken on the staff held on the B.M. of R.L. 60.350 m. Calculate the R.L. of the points and also find the gradient of line AB.</p> <p>2. The following staff readings were observed successively with a level, the instrument having been moved after third, sixth and eight readings 2.228, 1.606, 0.988, 2.090, 2.864, 1.262, 0.602, 1.982, 1.044, 2.684 meters. Enter the above readings in a page of a level book and calculate the R L of points if the first reading was taken with a staff held on a bench mark of 432.384m.</p>																		
2	<p>1. Find the amount of local attraction, the corrected and the included angle.</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Line</th> <th>FB</th> <th>BB</th> </tr> </thead> <tbody> <tr> <td>AB</td> <td>59</td> <td>239</td> </tr> <tr> <td>BC</td> <td>139°30'</td> <td>317°</td> </tr> <tr> <td>CD</td> <td>215°15'</td> <td>36°30'</td> </tr> <tr> <td>DE</td> <td>208°</td> <td>29°</td> </tr> <tr> <td>EA</td> <td>318°30'</td> <td>138°45'</td> </tr> </tbody> </table> <p>2. Explain Bowditch's rule for the adjustment of closing error</p>	Line	FB	BB	AB	59	239	BC	139°30'	317°	CD	215°15'	36°30'	DE	208°	29°	EA	318°30'	138°45'
Line	FB	BB																	
AB	59	239																	
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CD	215°15'	36°30'																	
DE	208°	29°																	
EA	318°30'	138°45'																	
3	<ol style="list-style-type: none"> 1. Explain the fundamental principle on which the art of surveying is based. 2. What are the objectives of plane surveying? 3. Describe briefly how plane surveying differs from geodetic surveying? 4. Define the different scales used in surveying. 																		
4	<p>A traverse ABCDA is made in the form of a square taking in clockwise order. If the bearing of AB is 120° 30', find the bearings of other sides.</p> <p>What do you mean by surveying? What are its basic principles and classifications?</p> <p>The observed bearing of a closed traverse are given below. Find the station affected by</p>																		

Assessment Methodology:

1. Practical exam in lab where they have to analyze problem statement. (Once in a week)
2. Assignments one from each unit.
3. Midterm subjective paper based on topics as mentioned in the modules. (Twice during the semester)
4. Final paper at the end of the semester subjective.

Teaching and Learning resources unit-wise:

A. **INTRODUCTION:** Objective, scope and outcome of the course.

Video Tutorials: <https://youtu.be/GJB6TyCzluU>

Theory concepts: <http://pstu.ac.bd/old/uploads/resources/L-021.pdf>

Sample Quiz: <https://www.indiabix.com/civil-engineering/surveying/>

B. Chain Surveying

Video Tutorials: <https://youtu.be/gacGOThVGVY>

Theory concepts: <https://www.civilknowledges.com/chain-surveying/>

Sample ppt: <https://www.sanfoundry.com/basic-civil-engineering-questions-answers-chain-surveying/>

C. Leveling.

Video Tutorials:

<https://youtu.be/PBTX4AFgFhs>

Theory concepts:

https://www.rtu.ac.in/expert/app/documents/prateek.sharma@gitjaipur.com_21225102020114127pm.pdf

Sample Quiz:

<https://www.sanfoundry.com/surveying-questions-answers-methods-levelling/>

D. Trigonometry leveling

Video Tutorials: <https://youtu.be/QSp1b3B7D3E>

Theory concepts

<https://en.wikipedia.org/wiki/Trigonometry#:~:text=In%20land%20surveying%2C%20trigonometry%20is,to%20measure%20distances%20between%20landmarks.>

Sample Quiz:

<https://www.sanfoundry.com/surveying-questions-answers-trigonometrical-levelling/>

E. Contour Survey

Video Tutorials: <https://youtu.be/nalwGHwXOgE>

Theory concepts:

[https://qlddrones.com.au/what-is-a-contour-survey/#:~:text=A%20contour%20survey%20is%20a,topography%E2%80%9D\)%20of%20your%20land.](https://qlddrones.com.au/what-is-a-contour-survey/#:~:text=A%20contour%20survey%20is%20a,topography%E2%80%9D)%20of%20your%20land.)

Sample Quiz:

<https://quizizz.com/admin/quiz/5be2b1a6e36c4e001b4b2c0b/contour-lines-and-relief>

F. Compass Survey

Video Tutorials:

<https://youtu.be/VEXk7J7fkA8>

Theory concepts:

https://en.wikipedia.org/wiki/Prismatic_compass#:~:text=Compass%20surveying%20is%20a%20type,to%20run%20a%20traverse%20line.

Sample Quiz:

<https://www.sanfoundry.com/basic-civil-engineering-questions-answers-compass-surveying/>

MULTIPLE CHOICE QUESTIONS

1. The suitable contour interval for a map with scale 1 : 10000 is
 - (A) 2 m
 - (B) 5 m
 - (C) 10 m
 - (D) 20 m
2. In an adjusted level, when the bubble is central, the axis of the bubble tube becomes parallel to
 - (A) Line of sight
 - (B) Line of collimation
 - (C) Axis of the telescope
 - (D) None of these
3. Ranging is an operation of
 - (A) Reconnaissance
 - (B) Judging the distance
 - (C) Determination of slope
 - (D) Establishing intermediate points between terminals
4. Locating the position of a plane table station with reference to three known points, is known as
 - (A) Intersection method
 - (B) Radiation method
 - (C) Resection method
 - (D) Three point problem
5. If f_1 and f_2 are the distances from the optical centre of a convex lens of focal length 'f' to conjugate two points P1 and P2 respectively, the following relationship holds good
 - (A) $f = f_1 + f_2$
 - (B) $f = \frac{1}{2} (f_1 + f_2)$
 - (C) $\frac{1}{f} = \frac{1}{f_1} + \frac{1}{f_2}$
 - (D) None of these
6. If the intercept on a vertical staff is observed as 0.75 m from a tachometer, the horizontal distance between tachometer and staff
 - (A) 7.5 m
 - (B) 25 m
 - (C) 50 m
 - (D) 75 m
7. Simpson's rule for calculating areas states that the area enclosed by a curvilinear figure divided into an even number of strips of equal width, is equal to
 - (A) Half the width of a strip, multiplied by the sum of two extreme offsets, twice the sum of remaining odd offsets, and thrice the sum of the even offsets
 - (B) One-third the width of a strip, multiplied by the sum of two extreme offsets, twice the sum of remaining odd offsets and four times the sum of the even offsets
 - (C) One-third the width of a strip, multiplied by the sum of two extreme offsets, four times the sum

of the remaining odd offsets, and twice the sum of the even offsets

(D) One-sixth the width of a strip, multiplied by the sum of the two extreme offsets, twice the sum of remaining odd offsets and four times the sum of the even offsets

8. The ratio of the distances at which a stated length can be distinguished by the telescope and the human eye, respectively, is called

(A) Brightness of telescope

(B) Magnification of telescope

(C) Resolving power of telescope

(D) None of these

TECHNO INDIA NJR INSTITUTE OF TECHNOLOGY UDAIPUR

I MID TERM EXAMINATION

II YEAR III SEM

MAX MARKS: 82

SURVEYING

TIME: 2 Hr.

Instruction for candidates:

PART-A Attempt all Questions, each question carrying 2 marks.

PART-B Attempt any 4 Questions, each question carrying 8 marks.

PART-C Attempt any 2 Questions, each question carrying 15 marks.

PART-A

Q.1 Define the following terms:

- | | |
|------------------------|-----------------------------|
| (i) Closing Error | (ii) Datum |
| (iii) Mean Sea level | (iv) Latitude & Departure |
| (v) Turning Point | (vi) Contour line |
| (vii) Local Attraction | (viii) Magnetic Declination |
| (ix) Surveying | (x) Fore & Back Sights |
- (10×2=20 MARKS)

PART-B

Q.1 A tape 20 m long of standard length at 84 °F was used to measure a line, the mean temperature during measurement being 70°. The measured distance was 875.10 meters.

The following being the slopes:

[8]

2°10'	For	90 m
4°12'	For	150 m
1°6'	For	50 m
7°48'	For	200 m
3°0'	For	300 m
5°10'	For	80.15 m

Find the true length of the line if the co-efficient of expansion is 65×10^{-7} per 1°F.

P.T.O.

Q.2 (a) Convert the following Whole circle bearing to Quadrantal bearings:

(i) $25^{\circ}45'$ (ii) $160^{\circ}14'$ (iii) $246^{\circ}33'$ (iv) $312^{\circ}56'$

(b) Convert the following Quadrantal bearings to Whole circle bearing:

(i) $N37^{\circ}13'E$ (ii) $S47^{\circ}17'E$ (iii) $S67^{\circ}38'W$ (iv) $N7^{\circ}43'W$

Q.3 The following bearings were observed while traversing with a compass. [8]

Line	AB	BC	CD	DE
F.B	$45^{\circ}65'$	$96^{\circ}55'$	$29^{\circ}45'$	$324^{\circ}48'$
B.B	$220^{\circ}10'$	$277^{\circ}5'$	$209^{\circ}10'$	$144^{\circ}48'$

Mention which stations were affected by local attraction and determine the corrected bearing.

Q.4 A line was measured with a steel tap which was exactly 30 m at a temperature of $20^{\circ}C$ and a pull of 10 kg. The measured length was 1650 m. The temperature during measurement was $30^{\circ}C$ and the pull applied was 15 kg. Find the true length of line, if cross-sectional area of tap was 0.025 cm^2 . The coefficient of expansion is $3.5 \times 10^{-6} / ^{\circ}C$ and modulus of elasticity $E = 2.1 \times 10^6 \text{ kg/cm}^2$.

Q.5 Explain the temporary adjustments of transit theodolite. (8)

Q.6 Discuss about Auto level. (8)

P.T.O.

PART-C

Q.1

The following bearings are taken on a closed traverse: [10]

Line	A B	B C	C D	D E	E A
F . B	80° 10'	120° 20'	170° 50'	230° 10'	310° 20'
B . B	259° 0'	310° 50'	350° 50'	49° 30'	130° 15'

Compute the interior angles and find correct bearings of lines if bearings of CD is correct.

Q.2

Discuss various errors in levelling.

(15 MARKS)

Q.3

The following readings were observed successfully with a levelling instrument. The instrument was shifted after 5th and 11th readings. [16]

- (1) 0.585 (2) 1.010 (3) 1.735 (4) 3.295 (5) 3.775
(6) 0.350 (7) 1.300 (8) 1.795 (9) 2.575 (10) 3.375
(11) 3.895 (12) 1.735 (13) 0.635 (14) 1.605

Draw up a page of level book and determine the R. L. of various points, if R. L. of first point is 136.440m. Use the Rise and Fall method.

THE END

- (b) A line was measured with a steel tap which was exactly 30 m at a temperature of 20°C and a pull of 10 kg. The measured length was 1650 m. The temperature during measurement was 30°C and the pull applied was 15 kg. Find the true length of line, if cross-sectional area of tap was 0.025 cm². The coefficient of expansion is $3.5 \times 10^{-6}/^{\circ}\text{C}$ and modulus of elasticity $E = 2.1 \times 10^6 \text{ kg/cm}^2$.

16

UNIT - II

- 2 (a) Given below are the bearings observed in a traverse survey conducted with a prismatic compass at a place where local attraction was suspected :

<i>Line</i>	<i>Fore bearing</i>	<i>Back bearing</i>
AB	124° 30'	304° 30'
BC	68° 15'	246° 00'
CD	310° 30'	135° 15'
DA	200° 15'	17° 45'

At what stations do you suspect local attraction. Find the correct bearings of the lines and the included angles.

- (b) Define : True meridian, magnetic meridian, angle of dip, local attraction and angle of magnetic declination.

16

OR

- 2 (a) Does local attraction at a point affect the magnitude of an angle computed from magnetic bearing read at that point. Explain.
- (b) Find out the bearing of the lines of an equilateral triangle ABC running clockwise if the bearing of the line AB is 60° 30'.

UNIT - III

3 (a) Enlist the source of errors in a theodolite traverse survey. How is the closing error of a traverse adjusted graphically ?

(b) What is meant by balancing a traverse ? State various rules used to do this.

16

OR

3 (a) What do you mean by latitude and departure ? State the checks to be applied in case of closed and open traverse.

(b) The bearings of two inaccessible stations A and B taken from a station C were $250^{\circ} 00'$ and $153^{\circ} 26'$ respectively. The co-ordinates of A and B were as follows :

Station	Easting	Northing
A	300 m	200 m
B	400 m	150 m

Calculate the independent co-ordinates of 'C'.

16

UNIT - IV

4 Differentiate between the following pairs :

- (a) Back sight and fore sight
- (b) Line of collimation and axis of telescope
- (c) Profile levelling and cross-sectioning.
- (d) Curvature and Refraction

- 4 (a) Explain how the procedure of reciprocal levelling eliminates the effect of refraction and curvature as well as the error of collimation.
- (b) The reduced level of ground at four points A, B, C and D are 54.35, 54.30, 54.20, 54.30 m respectively. A sewer is to be laid so that its invert is 3.048 m below the ground at A and it falls with uniform gradient of 1 in 340 to D. The distances AB, AC and AD are 35.845 m, 80.742 m and 134.7 m respectively. Find the invert level and depth of trench at B, C and D.

16

UNIT - V

- 5 (a) Define a contour. State the various characteristics of contour lines.
- (b) Discuss in detail, the methods of direct and indirect contouring.

16

OR

- 5 Describe concisely the components of a plane table outfit. Explain how would you set up and orient the plane table. State the errors in plane tabling. Describe with sketches, the methods of plane table surveying.

16

TECHNO INDIA NJR INSTITUTE OF TECHNOLOGY, UDAIPUR

DEPARTMENT OF CIVIL ENGINEERING

B. TECH 2nd – YEAR (III SEM.) – MT-III

Surveying (3CE4-05)

Time: 2 Hr

Max. Marks: 70

Note:

- 1) The paper is divided into 2 parts: Part-A & Part-B.
- 2) Part-A contains 10 questions and carries 2 mark each.
- 3) Part-B contains 5 questions. Each question is having two options and carries 10 marks each.

Part- A (20 Marks)

A. Explain what the types of bearing systems are.	CO1
B. Explain what you mean by Mean sea level.	CO1
C. Write what is Rise and fall method of levelling.	CO2
D. Explain the meaning of Contours	CO2
E. Write the elements of a simple circular curve	CO3
F. Explain what the types of curve are.	CO3
G. What do you understand by photogrammetric surveying?	CO4
H. Write the formula for distance and elevation for horizontal sights through tachometric method.	CO4
I. What do you understand by Electronic Distance measurements (E.D.M)?	CO5
J. Explain parts of Total station instrument.	CO5

CO1- 04, CO2- 04, CO3-04, CO4-04, CO5-04

Part- B (50 Marks)

1. A compass traverse PQRSTP was run anticlockwise and following readings were obtained. Local attraction was suspected. Determine the correct bearing of the traverse line. <table border="1" data-bbox="594 1335 984 1549"><thead><tr><th>Line</th><th>FB</th><th>BB</th></tr></thead><tbody><tr><td>PQ</td><td>149° 50'</td><td>330° 15'</td></tr><tr><td>QR</td><td>78° 53'</td><td>255° 43'</td></tr><tr><td>RS</td><td>42° 45'</td><td>222° 45'</td></tr><tr><td>ST</td><td>301° 53'</td><td>124° 53'</td></tr><tr><td>TP</td><td>212° 17'</td><td>32° 02'</td></tr></tbody></table>	Line	FB	BB	PQ	149° 50'	330° 15'	QR	78° 53'	255° 43'	RS	42° 45'	222° 45'	ST	301° 53'	124° 53'	TP	212° 17'	32° 02'	CO1
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RS	42° 45'	222° 45'																	
ST	301° 53'	124° 53'																	
TP	212° 17'	32° 02'																	
OR																			
1. The following bearing were observed with a compass. Calculate the interior angles. <table border="1" data-bbox="334 1654 675 1877"><thead><tr><th>LINES</th><th>FORE BEARING</th></tr></thead><tbody><tr><td>AB</td><td>60° 30'</td></tr><tr><td>BC</td><td>122° 0'</td></tr><tr><td>CD</td><td>46° 0'</td></tr><tr><td>DE</td><td>205° 30'</td></tr><tr><td>EA</td><td>300° 0'</td></tr></tbody></table>	LINES	FORE BEARING	AB	60° 30'	BC	122° 0'	CD	46° 0'	DE	205° 30'	EA	300° 0'	CO1						
LINES	FORE BEARING																		
AB	60° 30'																		
BC	122° 0'																		
CD	46° 0'																		
DE	205° 30'																		
EA	300° 0'																		

2. The following readings were observed successfully with a levelling instrument. The instrument was shifted after 5 th and 11 th readings: 0.585, 1.010, 1.735, 3.295, 3.775, 0.350, 1.300, 1.795, 2.575, 3.375, 3.895, 1.735, 0.635, 1.605. Draw up a page of level book and determine the R. L. of various points, if R. L. of first point is 136.440m. Use the Rise and Fall method.	CO2
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OR

2. The area enclosed by the contours in a lake are as follows: Calculate the volume of water between the contours 280m and 300 m by: (a) Trapezoidal Formulae, (b) Prismoidal Formula.	CO2												
<table border="1"> <tr> <td>Contour (m)</td> <td>280</td> <td>285</td> <td>290</td> <td>295</td> <td>300</td> </tr> <tr> <td>Area (m²)</td> <td>8400</td> <td>16300</td> <td>24600</td> <td>31500</td> <td>39300</td> </tr> </table>	Contour (m)	280	285	290	295	300	Area (m²)	8400	16300	24600	31500	39300	
Contour (m)	280	285	290	295	300								
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3. Explain what a simple curve is and write its elements with neat sketch.	CO3
OR	
3. Explain the Offsets/Ordinates from the long chord method of setting out of curve.	CO3

4. Deduce the formulae for distance elevation through the concept of tachometric measurements.	CO4
OR	
4. Deduce the formulae for distance elevation for inclined sites with staff vertical.	CO4

5. Explain the concept of Electronic Distance Measurement.	CO5
OR	
5. Write a short note on usage of Total Station.	CO5

CO1- 10, CO2- 10, CO3-10, CO4-10, CO5-1

