Techno India NJR Institute of Technology

Course File

Surveying (3CE4- 05)

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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

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, Levelling 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:

To apply knowledge of mathematics, science and engineering to understand measurement techniques and also, learn different equipment's used in surveying.

1. To determine the relative position of any objects or points of the earth, measure distance and angle between different objects.
2. To prepare a map or plan to represent an area on a horizontal plan.
3. To explore different methods and equipments to be used in the field of surveying.

Course Outcomes:

CO. NO.	Cognitive Level	Course Outcome
1	Application	Student will be able to Handle various survey instrument for a particular survey work.
2	Design	Student will be able to Collect and analysis survey data for preparing drawing and maps.
3	Application	Students will be able to apply check for errors estimation.
4	Application	Students will be able to apply the knowledge, techniques, skills and modern tools of mathematics, science, engineering, and technology to solve well-defined surveying problems appropriate to the discipline
5	Analysis	Students will be able to Perform basic land surveying instruments and perform related calculations.

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:

Surveying I															
Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO244.1	3	2	2	2	2	1	1	1	2	1	1	2	2	2	2
CO244.2	2	2	1	1	1	2	1	1	2	2	2	1	1	2	2
CO244.3	3	2	2	2	2	1	1	1	2	1	1	2	2	2	2
CO244.4	2	2	1	1	1	1	1	1	1	2	2	1	1	2	2
CO244.5	2	1	1	1	1	2	1	1	2	2	1	1	1	2	2
CO244 (AVG)	2.667	2	1.667	1.667	1.667	1.33	1	1	2	1.33	1.333	1667	1.667	2	2

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 inclinedsights 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 & Levelling by Subramanian Oxford University Press.

Course Level Problems (Test Items):

<table>
<tr><th>CO.NO.</th><th>Problem description</th></tr>
<tr><td>1</td><td>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.
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.</td></tr>
<tr><td>2</td><td>1. Find the amount of local attraction, the corrected and the included angle.
<table><tr><td>Line</td><td>FB</td><td>BB</td></tr><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></table>2. Explain Bowditch’s rule for the adjustment of closing error</td></tr>
</table>

3	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	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. What do you mean by surveying? What are its basic principles and classifications? The observed bearing of a closed traverse are given below. Find the station affected by

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/uploadfiles/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. Levelling.

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 levelling

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.

Sample Quiz: https://quizizz.com/admin/quiz/5be2b1a6e36...4b2c0b/contour-lines-and-relief

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(Principal)

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/

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(Principal)

Important Question:

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°45' **(ii) 160°14'** **(iii) 246°33'** **(iv) 312°56'**

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

(i) N37°13'E **(ii) S47°17'E** **(iii) S67°38'W** **(iv) N7°43'W**

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

Line	AB	BC	CD	DE
F.B	45°65′	96°55′	29°45′	324°48′
B.B	220°10′	277°5′	209°10′	144°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°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 cm^2. The coefficient of expansion is 3.5×10^{-6} /°C and modulus of elasticity $E = 2.1 \times 10^6$ 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

4E4114

Roll No. _____ Total No. of Pages : 4

4E4114

B. Tech. IV-Sem. (Main & Back) Exam; April-May 2017

Civil Engineering

4CE4A Surveying - I

Time : 3 Hours

Maximum Marks : 80
Min. Passing Marks : 26

Instructions to Candidates :-

*Attempt any **five questions**, selecting **one question** from **each unit**. All Questions carry **equal** marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used / calculated must be stated clearly.*

Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1. NIL 2. NIL

UNIT - I

1 Differentiate between the following terms :

(a) Chainage and offset

(b) Base line and check line

(c) Main station and tie station

(d) Cumulative and Compensating error. 16

OR

1 (a) Define surveying. What are the principles of surveying ? Explain them.

(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 cm^2. The coefficient of expansion is 3.5×10^{-6} / °C and modulus of elasticity E = 2.1×10^6 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 :

Line	*Fore bearing*	*Back bearing*
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 beaning 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'.

16

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° 00' and 153° 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 correction.

16

OR

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**

01/07/2016

4E4114

Roll No. _____ Total No of Pages: 4

4E4114

B.Tech. IV-Sem (Main & Back) Exam; June-July 2016
Civil Engineering
4CE4A Surveying-I

Time: 3 Hours

Maximum Marks: 80
Min. Passing Marks (Main & Back): 26
Min. Passing Marks (Old Back): 24

Instructions to Candidates:-

*Attempt any **five questions**, selecting **one question** from **each unit**. All Questions carry **equal** marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly.*

Units of quantities used/ calculated must be stated clearly.

Use of following supporting material is permitted during examination.

1. NIL 2. NIL

UNIT-I

Q.1 (a) What is surveying? How it is useful for civil Engineers? [8]

(b) Distinguish between plain and geodetic surveying. [8]

OR

Q.1 (a) Briefly explain sources of errors in surveying. [6]

(b) Explain different corrections to take measurements. [10]

UNIT-II

Q.2 (a) Explain with a neat sketch working of a prismatic compass. [8]

(b) During a traverse survey ABCDA, the following interior angles were measured with a compass:- [8]

$\angle A = 75°$, $\angle B = 120°$, $\angle C = 80°$ and $\angle D = 85°$

If the bearing of the line AB is 99°. What are the bearings of the remaining lines of traverse?

OR

Q.2 (a) Differentiate between:-

(i) Line of collimation and line of sight [2]

(ii) Face left and Face right condition. [2]

(iii) Altitude level axis and plate level axis. [2]

(b) Explain the temporary adjustment of transit theodolite. [10]

UNIT-III

Q.3 (a) What is a traverse? Discuss different uses of traverse surveying. [6]

(b) Differentiate between:- [10]

(i) Open traverse and closed traverse.

(ii) Bowditch's rule and transit rule.

(iii) Latitude and departure.

OR

Q.3 The following bearings are taken on a closed traverse: [16]

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.

UNIT-IV

Q.4 (a) Differentiate between simple levelling and differential levelling. [8]

(b) What are temporary adjustments of dumpy levels? How they are performed? [8]

OR

Q.4 The following readings were observed successfully with a levelling instrument. The instrument was shifted after 5^{th} and 11^{th} 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.

UNIT-V

Q.5 (a) What are different methods of plane table survey? Discuss intersection method with its suitability. [8]

(b) Explain the two points problem and its solution. [8]

OR

Q.5 (a) What is contour interval? Explain the factors to be considered in deciding the contour interval. [8]

(b) What are different uses of contour maps? Explain. [8]
