

## GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

### COURSE CURRICULUM COURSE TITLE: ADVANCED SURVEYING (Code: 3340602)

Diploma Programme in which this course is offered	Semester in which offered
Civil Engineering, Transportation Engineering	4th Semester

#### 1. RATIONALE

Field survey is the basic requirement for preparing any engineering maps or drawings. Field survey can be professionally carried out only when various steps involved in the survey work are known with skills of operating modern survey equipments. At diploma level, students are expected to study about these aspects so as to develop their understanding, performance oriented abilities in order to apply their knowledge in construction industry.

#### 2. COMPETENCIES

The course content should be taught and the curriculum should be implemented with the aim to develop different types of skills so that students are able to acquire following competency:

- Prepare survey maps/drawing after carrying out different kinds of field surveys using advance surveying equipments.
- Find out various physical quantities like length, area, volume, elevations, angles, latitude, departure, etc by interpreting survey drawings.

#### 3. COURSE OUTCOMES

The theory should be taught and practical should be carried out in such a manner that students are able to acquire different learning out comes in cognitive, psychomotor and affective domain to demonstrate following course outcomes.

- Use Theodolite for the measurement of horizontal and vertical angle
- Calculate the height of objects through a trigonometrical levelling.
- Explain the principles and various methodologies involved in techeometry
- Retrieving the data and generate the drawings using advanced surveying equipment & application software.

#### 4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	PA	ESE	PA	250
3	0	6	9	70	30	60	90	

**Legends:** L - Lecture; T - Tutorial/Teacher Guided Student Activity; P - Practical; C - Credit; ESE - End Semester Examination; PA - Progressive Assessment

## 5. COURSE DETAILS

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
<b>Unit – I</b> <b>Theodolite</b>	1a. Explain the basic function of different parts theodolite.  1b. Operate theodolite and read horizontal and vertical angle.  1c. Determine the altitude and departure of given points on <b>the</b> ground.	1.1 Introduction to theodolite 1.2 Uses of theodolite 1.3 Sketch and parts of Transit Vernier theodolite 1.4 Reading of main and vernier scale on horizontal and vertical plate 1.5 Temporary adjustment of a theodolite 1.6 Permanent adjustment of theodolite (Fundamental axis of theodolite and their relationship) 1.7 Definitions and various technical terms 1.8 Methods of measuring horizontal angles and vertical angles 1.9 Use theodolite for measuring a magnetic bearing, prolong a line, ranging a line 1.10 Measuring direct and deflection angles 1.11 Errors in theodolite work 1.12 Theodolite Traversing 1.13 Traverse computations 1.14 Closing errors, Balancing the traverse 1.15 Gale's Traverse Table 1.16 Related examples
<b>Unit – II</b> <b>Trigonometrical Levelling</b>	2a. Determine relative elevations and angular measurements for given different conditions of instruments.  2b. Calculate the height of objects through a trigonometrical levelling.	2.1 Introduction  2.2 Methods of observations (Direct and Reciprocal)  2.3 Methods of determining the elevation of a particular point 2.4 when base of the object is accessible 2.5 when base of the object is inaccessible  2.6 Related examples using all methods
<b>Unit – III</b> <b>Tacheometry</b>	3a. Explain the principles and various methodologies involved in techeometry.  3b. Calculate R.L. and horizontal distance	3.1 Introduction 3.2 Purpose and Principles of tacheometric surveying 3.3 Instruments used in Tacheometry 3.4 Theory of Stadia Tacheometry 3.5 Anallatic Lens, advantages & disadvantages. 3.6 Methods of determining constants of a

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
	between object and instruments.	Tacheometer 3.7 Related examples on tacheometer constants 3.8 Methods of Tacheometry (Stadia & Tangential ) 3.9 Method of Fixed Hair : - When line of sight is horizontal and staff held vertically - When line of sight is inclined and staff held vertically (Angle of Elevation & Depression) 3.10 Advantages and disadvantages of Tangential method 3.11 Related examples of Tacheometer using all methods.
<b>Unit – IV</b>  <b>Curves</b>	4a. Describe different elements of curves.  4b. Calculate necessary data required to setting out curve on field.	4.1 Introduction 4.2 Types of circular curves 4.3 Definitions and notations 4.4 Designation of curve 4.5 Relation between Radius and degree of curve 4.6 Elements of simple circular curve 4.7 Setting out simple circular curve 4.8 Methods of setting out simple circular curves 4.9 Transition curves - Requirements and purpose of it. 4.10 Vertical curves 4.11 Related examples of curves.
<b>Unit – V</b>  <b>Advanced Survey Equipments</b>	5a. Explain the principles of total station.  5b. Record data on total station as well as on computer.  5c. Retrieving the data and generate the drawings using application software.	5.1 Introduction 5.2 Basics of Digital Theodolite 5.3 Introduction and Principles of E.D.M. 5.4 Introduction and Basics of Total station - Parts of Total station - Advantages, disadvantages and uses of Total Station - Types of Total Station - Advancement in Total Station Technology - Automatic Target Recognition ATR 5.5 Surveying using Total Station - Flow chart of data collection - Fundamental Parameters of Total Station 5.6 Precautions to be taken while using Total Station 5.7 Field equipments 5.8 Set up of Total Station

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
		- Centering, Levelling , back-sight, Azimuth Marks 5.9 Measurement with Total Station 5.10 Total Station Initial Setting 5.11 Field Book recording 5.12 Radial Shooting 5.13 Total Station Traversing 5.14 Survey Station description 5.15 Occupied Point Entries 5.16 Data Retrieval 5.17 Field Generated Graphics 5.18 Construction layout using Total Station 5.19 Overview of Computerized Survey Data System 5.20 Equipment Maintenance 5.21 Maintaining Battery Power 5.22 Total Station Job Planning and Estimating 5.23 Total Survey system errors Sources and how to avoid them 5.24 Controlling errors

## 6. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	Theodolite	12	05	05	11	21
2	Trigonometrical Levelling	06	02	02	05	09
3	Tacheometry	08	04	06	06	16
4	Curves	08	03	04	07	14
5	Advanced Survey Equipments	08	03	03	04	10
<b>Total</b>		<b>42</b>	<b>17</b>	<b>20</b>	<b>33</b>	<b>70</b>

Legends: R = Remember; U = Understand; A = Apply and above levels (Bloom's revised taxonomy)

**Note:** This specification table shall be treated as general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

## 7. SUGGESTED LIST OF EXERCISES/PRACTICAL

The practical/exercises should be properly designed and implemented with an attempt to develop different types of skills (**outcomes in psychomotor and affective domain**) so that students are able to acquire the competencies/programme outcomes. Following is the list of practical exercises for guidance.

*Note: Here only outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of certain outcomes in affective domain which would in turn lead to development of **Course Outcomes** related to affective domain. Thus over all development of **Programme Outcomes** (as given in a common list at the beginning of curriculum document for this programme) would be assured.*

*Faculty should refer to that common list and should ensure that students also acquire outcomes in affective domain which are required for overall achievement of Programme Outcomes/Course Outcomes.*

S. No.	Unit No.	Practical/Exercise/Project (Outcomes in Psychomotor Domain)	Approx. Hrs. for Practical	Approx. Hrs. for Project
1	I	Theodolite: (1) Identify various parts of the theodolite (2) Measure the hori. angle by Repetition, Reiteration (3) Measure the vertical angle (4) Measure the deflection angle (5) Calculate the data for Gale's table Theodolite Traversing: - To Carry out the project for a closed traverse 4 to 5 stations and prepare the drawing sheet using Gale's Table	04 08 02 02 02	06
2	III	Tacheometry: (1) Determine the tacheometric constant (2) Determine the distance and R.L. of a point when line of sight is horizontal. (3) Determine the distance and R.L. of a point when line of sight is inclined for an angle of elevation (4) Determine distance and R.L. of a point when line of sight is inclined for an angle of depression Tacheometry Survey: - To Carry out the project for a 3 to 4 stations for closed traverse on undulating/hills regions and prepare the drawing sheet	02 04 04 04	12
3	IV	Curve : (1) Determine the elements of simple circular curve (2) Determine the data for setting out curve from offset of long Chord	02 02	

S. No.	Unit No.	Practical/Exercise/Project (Outcomes in Psychomotor Domain)	Approx. Hrs. for Practical	Approx. Hrs. for Project
		(3) Determine the data for setting out curve By Rankine (one theodolite) method Curve Setting: - To carry out the project by Rankine's methods	02	04
4	IV	Total Station: (1) Identify the parts of the Total Station (2) Set out the total station on a station (3) Set out station by setting up a back sight (4) Set out station by setting up a Azimuth Mark (5) Measure the horizontal Angle (6) Measure the vertical angle (7) Measure the deflection angle Total Station survey: - To carry out the project for small traverse on a ground and prepare the drawing sheet	02 02 02 02 04 04	06
		Total	56	28

## 8. SUGGESTED LIST OF STUDENT ACTIVITIES

Following is the list of proposed student activities like: Course/topic based seminars, internet based assignments, teacher guided self learning activities, course/library/internet/lab based mini-projects etc. These could be individual or group-based.

S. No.	Unit No.	Student Activities
i.	I	Comparison between different angular measurement equipments
ii.	IV	Visit the area having horizontal and vertical curves
iii.	V	Collecting, transferring and processing field data and preparing drawings through computer software.

## 9. SPECIAL INSTRUCTIONAL STRETEGIES (If any)

- i. Lecture cum demonstration of equipments of advanced surveying
- ii. Field demonstration
- iii. Software based preparing of maps.

## 10. SUGGESTED LEARNING RESOURCES

### 1. List of Books:

S. No.	Title of Books	Author	Publication
1	Surveying and levelling Vol-I & II	T. P. Kanetkar & S. V. Kulkarni	Pune Vidyarthi Griha Prakashan
2	Surveying and Levelling Vol-I & II	Dr. B. C. Punmia	Laxmi Publications Pvt. Ltd.
3	Surveying and Levelling Vol-I & II	S.K.Hussain, M.S. Nagaraj	S. Chand and Co.
4	Surveying and Levelling Vol-I & II	S. K. Duggal	Tata Mc Graw Hill
5	Surveying and Levelling	N. N. Basak	Tata Mc Graw Hill
6	Fundamentals of Surveying	S. K. Roy	PHI Learning Pvt. Ltd
7	CD Programme on EDM and Total Station	Learning Materials Development Project	Taramani, Chennai NITTTR, Bhopal

### (B) List of Major Equipment/Materials:

- i. Transit Theodolite,
  - a. Digital Theodolite,
- ii. Levelling Staff,
- iii. Techeometer,
- iv. Total Station and its accessories,
  - a. other misc. equipments, etc.

### (C) List of Software/Learning Websites

- i. [www.Autodesk.com](http://www.Autodesk.com)
- ii. [www.drawingnow.com](http://www.drawingnow.com)
- iii. [www.learn-to-draw.com](http://www.learn-to-draw.com)
- iv. [www.sitetopo.com](http://www.sitetopo.com)
- v. [www.surfer.com](http://www.surfer.com)

## 11. COURSE CURRICULUM DEVELOPMENT COMMITTEE

### Faculty Members from Polytechnics

- **Prof. B. V. Modi**, Principal – BVPIT(DS) Umarakh Ta-Bardoli
- **Prof. P. D. Gohil**, Sr. L.C.E. - Sir B. P. T. I., Bhavanagar
- **Prof. H. K. Rana**, L.C.E. - Government Polytechnic, Valsad

### Coordinator and Faculty Members from NITTTR Bhopal

- **Dr Subrat Roy**, Professor Department of Civil and Environmental Engineering
- **Dr J.P Tegar**, Professor and Head Department of Civil and Environmental Engineering