

**GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT**

**Course Curriculum**

**SURVEYING  
(Code: 3330605)**

| <b>Diploma Programme in which this course is offered</b>                                     | <b>Semester in which offered</b> |
|--|----------------------------------|
| Civil Engineering, Environmental Engineering, Mining Engineering, Transportation Engineering | 3 <sup>rd</sup> Semester         |

**1. RATIONALE**

Before development and planning process for any civil engineering or mining project, at first field survey of that area is carried out and various type of survey maps are prepared. These maps and drawing are used for taking various decisions regarding the planning, designing, estimation, execution and construction process etc.

The diploma pass outs/technicians should therefore know the various methods and instruments required for surveying. They should also have the skill and information to handle and operate the needed survey instruments. It is also important for them to be well aware about the use of advance surveying instrument such as total station, GPS and related software to enhance the knowledge and abilities required for surveying in field.

This course is therefore one of the core courses required for civil, mining, environmental and transportation engineers. Students are advised to master the desired skills which are expected from them for survey related works.

**2. COMPETENCIES (Programme Outcomes according to NBA Terminology):**

The course content should be taught and with the aim to develop different types of skills so that students are able to acquire following competencies.

- 1. Carry out civil engineering survey to prepare drawings & maps**
- 2. Interpret the drawings and maps for calculating different physical quantities like length, area, volume, elevations etc.**

**3. TEACHING AND EXAMINATION SCHEME**

| <b>Teaching Scheme<br/>(In Hours)</b> |          |          | <b>Total Credits<br/>(L+T+P)</b> | <b>Examination Scheme</b> |           |                        |           |                        |
|---------------------------------------|----------|----------|----------------------------------|---------------------------|-----------|------------------------|-----------|------------------------|
|                                       |          |          |                                  | <b>Theory Marks</b>       |           | <b>Practical Marks</b> |           | <b>Total<br/>Marks</b> |
| <b>L</b>                              | <b>T</b> | <b>P</b> | <b>C</b>                         | <b>ESE</b>                | <b>PA</b> | <b>ESE</b>             | <b>PA</b> |                        |
| 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

#### 4. COURSE DETAILS

| <b>Unit</b>  | <b>Major Learning Outcomes<br/>(Course Outcomes in<br/>Cognitive Domain according<br/>to NBA terminology)</b>  | <b>Topics and Sub-topics</b>   |
|--|--|--|
| <b>Unit – I</b><br><br><b>Introduction<br/>and Scale</b> | 1.a Explain the basics of surveying.<br><br>1.b Apply various types of scale as per needs.   | 1.1 Definitions<br>1.2 Objective and uses of surveying<br>1.3 Plain and Geodetic Survey<br>1.4 Classification of Survey<br>1.5 Principals of Survey<br>1.6 Types of Scale and selection of scale<br>1.7 Construction of diagonal scale   |
| <b>Unit – II</b><br><br><b>Chain Survey</b>              | 2.a Explain procedure for linear measurements.<br><br>2.b Prepare drawing as per recorded measurements in the field book.  | 2.1 Introduction<br>2.2 Instruments used in chain survey<br>Metric Chain, Tapes, Arrow, Tapes, Ranging rod, Offset rod, Open cross staff, optical square<br>2.3 Technical terms related with chain survey Survey Station, Base line, Check line, Tie line, Offset, Tie station<br>2.4 Method of Chaining<br>2.5 Errors in length due to incorrect length and related problems.<br>2.6 Obstacles in chaining<br>2.7 Ranging<br>-Direct Ranging & Indirect Ranging<br>2.8 Types of offsets<br>-Perpendicular & Oblique<br>2.9 Location Sketch of survey station and running measurements of building.<br>2.10 Conventional Signs<br>2.11 Recording of measurements in a field book |
| <b>Unit – III</b><br><br><b>Compass<br/>Survey</b>       | 3.a Explain procedure for angular measurements.<br>3.b Record bearing accurately<br><br>3.c Prepare drawing as per recorded and corrected measurements of bearings with chain and compass survey | 3.1 Introduction<br>- Triangulation Survey & Traversing<br>3.2 Components of Prismatic Compass<br>3.3 Functions of different parts of prismatic compass<br>3.4 Differentiate Prismatic and Surveyor compass<br>3.5 Method to use Prismatic Compass<br>3.6 Technical Terms<br>- True Meridian & Bearing,<br>- Magnetic Meridian & Bearing,<br>- Arbitrary Meridian & Bearing,<br>- Dip of Magnetic needle<br>- Declination,<br>- Fore Bearing & Back Bearing<br>3.7 Whole Circle Bearing System and   |

| Unit                                     | Major Learning Outcomes<br>(Course Outcomes in<br>Cognitive Domain according<br>to NBA terminology)   | Topics and Sub-topics  |
|--|---|--|
|  |   | Reduced Bearing System & examples on conversion of given bearing to another bearing (from one form to another)<br>3.8 Method of finding included angles from bearings & examples<br>3.9 Local attraction and Closing error with relevant examples<br>3.10 Errors in compass survey and elimination of errors   |
| <b>Unit – IV</b><br><br><b>Levelling</b> | 4.a Explain different methods and their procedure for levelling.<br>4.b Explain procedure for using the instruments and levelling staff and entering level in proper table<br>4.c Carryout corrections for errors in levelling records if any<br>4.d Prepare contour maps by calculating Reduce level as per data book. | 4.1 Introduction<br>4.2 Basic terminology related with levelling like Level surfaces, Horizontal & vertical surfaces, Datum, Bench Marks, Reduced Level, Rise, Fall, Line of collimation, Axis of Telescope, Axis of bubble tube, Station, Back sight, Fore sight, intermediate sight, Change point, Height of instruments, Focusing and parallax, etc.<br>4.3 Types of Level<br>Dumpy Level, Tilting Level, Auto Level, Digital Level<br>4.4 Components of Dumpy Level with neat sketch<br>4.5 Types of Levelling Staffs<br>Self-reading staff & Target staff<br>4.6 Temporary adjustment of Level<br>4.7 Classification of Levelling<br>- Simple Levelling, Differential Levelling, Fly Levelling, Profile Levelling, Reciprocal Levelling and Precise Levelling<br>4.8 Examples & methods of finding out the R. L. in Level Book by H.I. Methods and Rise & Fall Methods with necessary check.<br>4.9 Correction for Curvature and refraction and related examples<br>4.10 Errors in Levelling<br>4.11 Contour<br>4.12 Uses of contours<br>4.13 Characteristics of contours<br>4.14 Methods of Contouring |

| Unit   | Major Learning Outcomes<br>(Course Outcomes in<br>Cognitive Domain according<br>to NBA terminology)  | Topics and Sub-topics   |
|--|--|---|
|  |  | 4.15 Interpolation of contours<br>4.16 Preparing drawing & estimation of gradients<br>4.17 Calculation of capacity of reservoirs & related examples   |
| <b>Unit – V</b><br><b>Plane Table Survey</b>                               | 5.a Explain procedure for plain table survey<br>5.b Prepare drawing as per field conditions and requirements.<br>5.c Find the areas from prepared drawings | 5.1 Introduction to Plane Table surveying<br>5.2 Equipments and accessories of plane table survey<br>5.3 Advantages and disadvantages of plane table survey<br>5.4 Orientation of plane table survey<br>5.5 Methods of setting up plane table over the station<br>5.6 Points to be kept in mind during plane table surveying<br>5.7 Errors in plane table surveying |
| <b>Unit – VI</b><br><b>Introduction to Global Positioning System (GPS)</b> | 6.a Appreciate the applications of GPS in civil engineering  | 6.1 Introduction to GPS<br>6.2 Maps & types of digital map<br>6.3 Fundamentals of GPS<br>6.4 Uses of GPS<br>6.5 GPS Receivers(Hand Held GPS Receivers)<br>6.6 Field procedures of GPS<br>6.7 Observations and applications in Civil Engineering   |

### 5. 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            | Introduction and Scale                          | 04             | 00                           | 04        | 03        | 07          |
| 2            | Chain Survey                                    | 06             | 02                           | 02        | 06        | 10          |
| 3            | Compass Survey                                  | 08             | 04                           | 04        | 06        | 14          |
| 4            | Levelling                                       | 14             | 04                           | 10        | 12        | 26          |
| 5            | Plane Table Survey                              | 06             | 03                           | 03        | 03        | 09          |
| 6            | Introduction to Global Positioning System (GPS) | 04             | 02                           | 02        | 00        | 04          |
| <b>Total</b> |   | <b>42</b>      | <b>15</b>                    | <b>25</b> | <b>30</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 a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

## 6. SUGGESTED LIST OF EXERCISES/PRACTICAL

The practical/exercises should be properly designed and implemented with an attempt to develop different types of practical skills (**Course 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 course outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of **Programme Outcomes/Course Outcomes in affective domain** as given in a common list at the beginning of curriculum document for this programme. Faculty should refer to that common list and should ensure that students also acquire those programme outcomes/course outcomes related to affective domain.

| Unit No.         | Practical/Exercise (Course Outcomes in Psychomotor Domain according to NBA terminology)   | Approx. Hrs. Required |             |
|------------------|---|-----------------------|-------------|
|                  |   | For lab./Field        | For Project |
| II and III       | Perform ranging and chaining operations in different field conditions.  | 04                    |             |
|                  | Perform chaining and ranging where different types of obstructions are present.   | 04                    |             |
|                  | Take offsets (Perpendicular and Oblique) in different field conditions.   | 04                    |             |
|                  | Perform temporary adjustments of Prismatic Compass  | 04                    |             |
|                  | Determine bearings of different survey lines by using Prismatic Compass   | 04                    |             |
|                  | Determine included angles from measured bearings.   | 04                    |             |
|                  | Project in chain, tape and compass Survey: survey the given area /field and prepare the drawing sheet<br>- Minimum Five Station                           |                       | 08          |
| IV               | Perform temporary adjustments of Level  | 04                    |             |
|                  | Take and record the level reading in the level book   | 04                    |             |
|                  | Determine Reduced level using both methods by applying checks   | 04                    |             |
|                  | Carry out fly levelling in different field conditions.  | 04                    |             |
|                  | Carry out profile levelling in different field conditions   | 04                    |             |
|                  | Project in Profile Levelling: Carry out the levelling survey on an undulated ground and prepare the drawing sheet (minimum area under survey 100m X 60 m) |                       | 12          |
| V                | Set plane table by different orientation methods on given survey station  | 04                    |             |
|                  | Project in Plane Table Survey:<br>- Prepare map of open vacant land (min 1000 sq.m) using any plane table method  |                       | 12          |
| VI               | Demonstrate use of Global Positioning System (GPS)  | 04                    | --          |
| <b>Total(84)</b> |   | <b>52</b>             | <b>32</b>   |

## 7. 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.

|   | Unit No. | Student Activities   |
|---|----------|--|
| 1 | I        | Prepare a list of tools and equipment used in chain and Tap survey |
| 2 | II       | Interpret the old map/drawing prepared using compass survey        |
| 3 | III      | Practice for temporary adjustment of Level                         |
| 4 | IV       | Read and interpret the old field book data of fly levelling survey |
| 5 | V        | Handle the GPS under supervision of teachers                       |

## 8. SPECIAL INSTRUCTIONAL STRATEGIES (If Any)

- a. Lecture cum demonstration of handy tools of surveying
- b. Field demonstration
- c. Hands on experience
- d. Case study of old survey maps and contours

## 9. SUGGESTED LEARNING RESOURCES

### A. List of Books:

| S. No. | Title of Books                | Author                                 | Publication                    |
|--------|-------------------------------|--|--------------------------------|
| 1      | Surveying and levelling Vol-I | T. P. Kanetkar & S. V. Kulkarni        | Puna Vidyarthi Griha Prakashan |
| 2      | Surveying and Levelling Vol-I | Dr. B. C. Punmia                       | Laxmi Publications Pvt. Ltd.   |
| 4      | Surveying and Levelling Vol-I | Hussain & Nagrani                      | S. Chand New Delhi             |
| 5      | Surveying                     | Mimi Das Saikia                        | PHI Learning Pvt. Ltd          |
| 6      | Fundamentals of Surveying     | S. K. Roy                              | PHI Learning Pvt. Ltd          |
| 7      | CD Programme on GPS and GIS   | Learning Materials Development Project | NITTTR, Taramani, Chennai      |

### B. List of Major Equipment/Materials:

- i. Metric Chain, Tapes, Open Cross staff, Optical Square, Prismatic Compass, Surveyor's
- ii. Compass, Dumpy Level, Tilting Level, Auto Level, Levelling Staff, Target Staff, Plane Table And its accessories, GPS, 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)

**10. COURSE CURRICULUM DEVELOPMENT COMMITTEE****Faculty Members from Polytechnics**

1. **Dr. K. G. Mehta**, Principal, Merchant Engg. College, Visnagar
2. **Prof. Prakash Kalyani**, L.C.E, Tolani FG Polytechnic, Adipur
3. **Prof. Prakash D. Gohil**, L.C.E, Sir B. P. T. I., Bhavanagar
4. **Prof. Vyom B. Pathak**, L.C.E, BVPIT (DS) Umarakh Ta-Bardoli

**Coordinator and Faculty Members from NITTTR Bhopal**

1. **Dr. J. P. Tegar**, Professor & Head Department of Civil and Environment Engineering
2. **Dr. K. K. Pathak**, Professor, Department of Civil and Environmental Engineering