

**GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT**

**COURSE CURRICULUM**

**COURSE TITLE: STRUCTURAL MECHANICS-II  
(Code: 3340601)**

Diploma Programme in which this course is offered	Semester in which offered
Civil Engineering	4 <sup>th</sup> Semester

### 1. RATIONALE

Knowledge and understanding of Structural Mechanics is very important for engineers in order to make Civil Engineering Structures safe and serviceable. The Structural Mechanics –II subject is taught in 4<sup>th</sup> sem. to develop the concept of analysis of determinate structures under various types of transverse &/or direct loading. Analysis of industrial trusses is also incorporated to give an idea of typical structure to the students. In this course, analysis of indeterminate structures under transverse loading, along with analysis of members under direct loading is to be studied. Analysis of structural members under the effect of principal stresses & strains is also incorporated to give an exposure of compound stresses to the students. At diploma level students are expected to study about these aspects of analysis and design of various structures so as to develop their understanding in order to apply their knowledge in construction industry.

### 2. COMPETENCY

The course content should be taught and curriculum should be implemented with the aim to develop different types of skills leading to the achievement of following competency:

- **Analyze various types of beams & Evaluate the Structures.**

### 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.

- Analyze various types of statically indeterminate beams.
- Compute slope and deflection in statically determinate beams.
- Evaluate the structures under direct and eccentric axial loading.

### 4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P) C	Examination Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE	PA	ESE	PA	
03	00	02	05	70	30	20	30	<b>150</b>

**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>Fixed Beam</b>	1a. Distinguish between determinate and indeterminate structures  1b. Draw Shear Force & Bending Moment Diagram for Fixed Beams	1.1 Different types of Determinate & Indeterminate Structures & Structural Components/Elements 1.2 Advantages of fixed beam over simply supported beam 1.3 Concept of analysis by Area Moment method 1.4 $\mu$ and $\mu'$ diagram 1.5 Numerical for SF & BM diagrams for 1.6 fixed beam with central point load &/or 1.7 UDL over Full Span
<b>Unit – II</b> <b>Slope &amp; Deflection</b>	2a. Compute deflection & slope induced in Statically Determinate Beams 2b. Draw deflection curve in different types of beams under different loads and support conditions.	2.1 Slope & Deflection 2.2 Formulae of Slope & Deflection for Cantilever Beam subjected to Point Load at free end , point load not at free end and with UDL along full Span 2.3 Formulae of Slope & Deflection for S.S Beam subjected to Central Point Load and with UDL along full Span 2.4 Numerical problems on Slope and Deflection for 2.2 & 2.3
<b>Unit – III</b> <b>Continuous Beam</b>	3a. Calculate Shear Force & Bending Moment Diagram for Continuous Beam using Theorem of Three Moment  3b. Draw Shear Force & Bending Moment Diagram for Continuous Beam using Theorem of Three Moment  3c. Draw Shear Force & Bending Moment Diagram for Continuous Beam using Moment Distribution Method	3.1 Statically Indeterminate Beam Like Propped Cantilever , Continuous Beam with or without Over Hang Define Free Moment & Fixed End moment diagrams 3.2 Theorem of Three Moment (Clapeyron's Theorem) 3.3 Formulae to find B.M of a continuous beam using theorem of Three Moment Method 3.4 Point of Contra-flexure & its importance 3.5 Numerical to draw S.F & B.M Diagram for two or three span continuous beams having end supports as overhang , fixed and / or hinge and subjected to Central Point Load and/ or U.D.L over full span using Theorem of Three Moment 3.6 Stiffness, flexibility, carry over Factor & Distribution Factor 3.7 Moment Distribution Method 3.8 Numerical to draw S.F & B.M Diagram of two or three span continuous beams having end supports as overhang , fixed and / or hinge and subjected to Central Point Load and/ or U.D.L over full span using Moment Distribution Method

Unit	Major Learning Outcomes (Course Outcomes in Cognitive Domain according to NBA terminology)	Topics and Sub-topics
<b>Unit – IV Combined Direct &amp; Bending Stresses</b>	4a. Calculate Direct & Bending Stresses of various structural components 4b. Check stability of Retaining wall & Dam 4c. Draw stress distribution diagram in retaining wall and dams under different types of loads	4.1. Eccentricity 4.2. Formula for combined Direct & Bending Stresses 4.3. Limit of Eccentricity 4.4. Core of section for Rectangular & Circular ( Hollow & Solid ) 4.5. Formulae for combined stresses on sections subjected to eccentric loads considering Uniaxial & Biaxial eccentricity 4.6. Stress distribution diagrams 4.7. Application of concept of combined stresses to find pressure at base & stability check of Retaining Wall & Rectangular & Trapezoidal Dam 4.8. Numerical for 4.6 & 4.7
<b>Unit – V Principle Stresses &amp; Principle Planes</b>	5a. Calculate Principal Stresses & Principal Plane on a plane in a Strained structural Material	5.1 Formulae for Normal , Tangential & Resultant Stresses due to Direct Orthogonal Stresses & Shear Stress 5.2 Numerical based on 5.1 5.3 Formulae for Principal Stresses and for Location of Principal Planes 5.4 Numerical based on 5.3 5.5 Mohr's Circle and its application for 5.1 & 5.3 5.6 Numerical based on 5.1 , 5.3 Graphically

## 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
I	Fixed Beam	06	01	02	04	07
II	Slope & Deflection	04	01	02	04	07
III	Continuous Beam	12	04	03	14	21
IV	Combined Direct & Bending Stresses	08	03	04	07	14
V	Principle Stresses & Principle Planes	12	02	05	14	21
<b>Total</b>		<b>42</b>	<b>11</b>	<b>16</b>	<b>43</b>	<b>70</b>

**Legends: R = Remember, U = Understand, A= Apply and above Level (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

## 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 (outcomes in psychomotor domain)	Approx. Hrs. Required
1	I	Solve at least five real life problems pertaining to Unit – I	02
2	II	Perform Deflection test on a Simply Supported beam with different sectional properties ( material, c/s dimensions etc)	02
3	II	Perform Deflection test on a cantilever beam with different sectional properties ( material, c/s dimensions etc)	02
4	II	Perform Deflection test on a fixed beam with different sectional properties ( material, c/s dimensions etc)	02
5	II	Solve at least three real life problems pertaining to Unit – II	02
6	II I	Solve at least Six real life problems pertaining to Unit-III	06
7	IV	Solve at Least four real life numerical Problems of Unit-IV	04
8	V	Solve at least Eight real life problems pertaining to Unit – V	08
<b>Total Hours</b>			<b>28</b>

## 8. SUGGESTED LIST OF STUDENT ACTIVITIES

- i. Conduct a mini project in which a group of students will practically verify the effect of cross section , end conditions on the deflection of beams .
- ii. Site Visit to understand Retaining Wall structure , Dam and indeterminate structures

**9. SPECIAL INSTRUCTIONAL STRATEGIES ( If Any )**

- i. Demonstration of Models & Charts of Indeterminate Structures , Dams & retaining wall & field Visits
- ii. Show video films/animations to explain failure of various structures under different load conditions.

**10. SUGESSTED LEARNING RESOURCES****(A) List of Books:**

S. No.	Title of Books	Author	Publication
1.	Strength of Material & Mechanics of Structures	Dr. B C Punamia	Standard Publication
2.	Strength of Material	S RAMAMURTHAN	Dhanpat Rai Publication
3.	Strength of Material	Timo Shanko	Tata Mcgraw Hill
4.	Theory of Structures	R S KHURMI	S Chand
5.	Theory of Structures – vol I & II	S B Junarkar H J Shah	Charotar Publication

**B. List of Major Equipment/Materials**

1. Cantilever Beam, Fixed & Simply Supported Beam Model to measure deflection

**C. List of Software/Learning Websites**

- i. [www.csiberkeley.com](http://www.csiberkeley.com)
- ii. [www.gtstrudl.gate](http://www.gtstrudl.gate)
- iii. [www.ramint.com](http://www.ramint.com)

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

- Prof. B G Rajgor, H.O.D, App. Mech. , BBIT , V V Nagar
- Prof. K. Venkateshwarlu , H.O.D , T F G , Adipur
- Prof. B. G. Bhankhar, H.O.D, App. Mech. G.P.Ahmedabad
- Prof. J. H. Gabra, I/C H.O.D , App. Mech. , G.P , GODHRA
- Prof. C. H. Bhatt, DR. S.&S.S. Ghandhy College, Surat
- Prof. K. K. Patel, H.O.D , G . P. Rajkot

**Coordinator and Faculty Members from NITTTR Bhopal**

- Prof. M. C. Paliwal, Associate Professor, Civil & Environmental Engineering Department.
- Dr. V.H. Radhakrishnan, Professor, Civil & Environmental Engineering Department.

**GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT**

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

<b>Diploma Programme in which this course is offered</b>	<b>Semester in which offered</b>
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
L	T	P		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 the 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 tacheometry.  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)

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## 7. SUGGESTED LIST OF EXERCISES/PRACTICAL

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*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

**GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT**

**COURSE CURRICULUM**  
**COURSE TITLE: BASIC TRANSPORTATION ENGINEERING**  
**(Code: 3340603)**

<b>Diploma Programme in which this course is offered</b>	<b>Semester in which offered</b>
Civil Engineering	4 <sup>th</sup> Semester

### 1. RATIONALE

As we know that the economy of any country is widely dependent either direct or indirect way on the transportation of various commodities which in turn dependent upon the “How efficiently the transportation system of the country is functioning.”

Therefore, knowledge and understanding of various design, construction and maintenance aspects of roads, railways and bridges are very important for engineers working at site in order to make transportation system safe and efficient. At diploma level, students are expected to study about these aspects of roads, railways and bridges so as to develop their understanding in order to apply their knowledge in improving civil infrastructure for transportation.

### 2. COMPETENCY:

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

- **Supervise construction and maintenance of roads, railways and bridges.**

### 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 outcomes in cognitive, psychomotor and affective domain to demonstrate following course outcomes.

- Explain the importance of transportation system and its geometrical aspects
- Comprehend the concept of construction and maintenance of roads, railways and bridges.
- Perform the tests on the various materials used in the construction work of roads, railways and bridges.

### 4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
L	T	P	C	ESE	PA	ESE	PA	150
3	0	2	5	70	30	20	30	

**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 Introduction and Road Geometric</b>	1a. Discuss various Modes of transportation 1b. Explain the various components of a road section. 1c. Demonstrate the basic requirement of road alignment. 1d. Describe various terms used in road geometry.	1.1 Importance & Classification of roads 1.2 Modes of transportation. 1.3 Requirements of good roads and its advantage. 1.4 Road alignment and their types 1.5 Importance of road alignment. 1.6 Factors affecting the alignment. 1.7 Cross section of road showing its component as per IRC. 1.8 Function of each component. Terms used in road geometry Camber, sight distance, Super elevation, Widening of Road. 1.9 Transition curve and Road Gradient.
<b>Unit – II Road materials and its construction aspects</b>	2a. Describe various types of road construction methods. 2b. Explain various types of failures and maintenance of road. 2c. Explain various types of tests on road materials.	2.1 Types of Pavement. 2.2 Necessity of Soil Stabilization and its methods. 2.3 Types of materials used in road Construction 2.4 Various tests on Aggregate and bitumen. 2.5 Construction of Flexible and Rigid Pavement. 2.6 Types of Failures in roads 2.7 Maintenance of roads and its components
<b>Unit – III Drainage system.</b>	3a. Explain importance of drainage and its maintenance	3.1 Importance of drainage. 3.2 Purpose of drainage. 3.3 Methods of Surface and Sub-surface drainage. 3.4 Maintenance of drainage system.

<p><b>Unit – IV</b> <b>Introduction to Permanent way.</b></p>	<p>4a. Describe the basic parts of railway track and its functions.</p> <p>4b. Explain the Joints and Gauge.</p> <p>4c. Explain basic knowledge of points and Crossing.</p>	<p>4.1. Typical cross section of various permanent way as per IRS.</p> <p>4.2. Function of Various Components.</p> <p>4.3. Method of fixing the rails with slipper.</p> <p>4.4. Function of Rail joints.</p> <p>4.5. Railway gauge , Types of Rail gauge and uniformity of gauge.</p> <p>4.6. Function of point and crossing.</p> <p>4.7. Factors affecting point and crossing.</p> <p>4.8. Components of Turn outs and types of crossing.</p>
<p><b>Unit – V</b> <b>Yards and Maintenance of railway track</b></p>	<p>5a. Discuss the function of various yards.</p> <p>5b. Explain requirement of track Maintenance</p>	<p>5.1 Classification of Yards.</p> <p>5.2 Function of Various Yards.</p> <p>5.3 Requirement of Track Maintenance.</p> <p>5.4 Daily and periodical Maintenance.</p> <p>5.5 Maintenance of Alignment, Drainage, Track Material and its components, Point and crossing and level crossing.</p>

<b>Unit – VI</b> <b>Introduction,</b> <b>Investigation and</b> <b>Maintenance of</b> <b>Bridges.</b>	6a. Discuss the function of various parts of bridge. 6b. Explain terms related to bridge. 6c. Explain requirement of an ideal bridge 6d. Carry out the maintenance report	6.1. Importance and term used in Bridge. 6.2. Component of Bridge and its function 6.3. Requirement of an ideal bridge 6.4. Classification and types of bridge. 6.5. Bridge Site Characteristics 6.6. Factor affecting the selection of Bridge Site. 6.7. Explain following terms: Scour, Afflux, Runoff, Economic Span, Clearance, Freeboard. 6.8. Classification of Cause Way and its limitations. 6.9. Routine and in depth inspection. 6.10. Requirements of Inspection Report. 6.11. Maintenance of Steel Bridge, Masonry Bridge, Cause Way, Piers, Pilebents, Abutment, Wing Wall, Road Surface, Drainage, Parapet Wall and Bearing.
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### 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
I	Introduction and Road Geometric	8	2	3	5	10
II	Road materials and its construction aspects	9	4	4	7	15
III	Drainage system	4	2	3	5	10
IV	Introduction to Permanent way.	8	2	3	5	10
V	Yards and Maintenance of railway track	5	2	3	5	10
VI	Introduction, Investigation and Maintenance of Bridge.	8	2	5	8	15
<b>Total</b>		42	14	21	35	70

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.



## 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 )	Hrs.
1	I	Draw the dimensional sketches of cross section of road (with function of each part of road) , road junction, road curve and widening	6
2	II	Carry out the following tests. - On Aggregate 1. Impact test. 2. Crushing test. 3. C B R test. - On Bitumen 1. Flash & Fire test. 2. Softening point 3. Penetration test	10
3	IV	Draw the dimensional sketches of cross section of permanent way & points & crossing (with function of each part of road).	6
4	V	Prepare a brief report after visit to Railway track & yards.	3
5	VI	Draw the sketches of various bridges after visiting the bridges in nearby locations.	3
Total			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
1	I	Comparison of different types of Roads
2	IV	Comparison and uniformity of various Guages
3	VI	Comparison of different types of Bridges

**9. SPECIAL INSTRUCTIONAL STRETEGIES (If any)**

- i. Lecture cum demonstration of various types of equipments used in construction of Road , Bridges and Railways (show video clips)
- ii. Field demonstration about the maintenance of Roads , Railways and Bridges
- iii. Show video films/ clips about different features of road, rail and bridge constructions.

**10. SUGGESTED LEARNING RESOURCES****List of Books:**

S. No.	Title of Books	Author	Publication
1	Highway Engineering	S K Khanna & Justo	Khanna publication, Delhi
2	Highway Engineering	S P Bindra	
3	Highway Engineering	L R Kadiyali	
4	Highway Engineering	S C Rangwala	
5	Transport engineering	Vazirani & Chandola	
6	Road Railway Bridges & Tunnel Engineering	T D Ahuja & Birdie	
7	Road Railway Bridges & Tunnel Engineering	B L Gupta & A K Gupta	

**(B) List of Major Equipment/Materials**

---No equipments or Materials required-----

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

- i. [www.waterbouw.tudelft.nl/](http://www.waterbouw.tudelft.nl/)
- ii. [www.learnrstv.com](http://www.learnrstv.com)
- iii. [www.shiksha.com](http://www.shiksha.com) , IIT, Roorkee
- iv. [www.blackwellpublishing.com](http://www.blackwellpublishing.com)
- v. [www.hrpwa.org](http://www.hrpwa.org)
- vi. [www.creativeworld9.com](http://www.creativeworld9.com)
- vii. [nptel.iitm.ac.in](http://nptel.iitm.ac.in)
- viii. [www.Indian.rail.com](http://www.Indian.rail.com)

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

- **Prof. N. J. Patel** Lecturer in Civil Engineering, Shri K J Polytechnic Bharuch
- **Prof .D. P. Rao** Lecturer in Civil Engineering, Dr. S & S S Gandhi Engg. College Surat

**Coordinator and Faculty Members from NITTTR Bhopal**

- **Dr. Subrat Roy**, Professor, Department of Civil and Environmental Engineering
- **Prof M. C. Paliwal**, Associate Professor, Department of Civil and Environmental Engineering

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**GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT****COURSE CURRICULUM  
COURSE TITLE: WATER RESOURCES MANAGEMENT  
(Course Code: 3340604)**

<b>Diploma Programme in which this course is offered</b>	<b>Semester in which offered</b>
Civil engineering	4 <sup>th</sup> Semester

**1. RATIONALE:**

Knowing extremity of water crisis, we must appreciate water as “Nature’s greatest gift”. Our water requirement is rapidly increasing due to vast industrial development, population growth and changing life style. We are mostly dependent on rains as a predominant source of water. The other important source of water is the ground water which also depends to great extent on rainfall in previous years. We know that ground water table is declining rapidly due to its excessive use and misuse and also due to insufficient rainfall every year. To stress upon the concept of water management and simultaneously to create the awareness about the proper use and conservation of water, this course is specially designed for the students of Diploma in Civil Engineering. An attempt has been made to develop theoretical knowledge with emphasis on certain aspects of water resources management. The topics viz. hydrology, runoff, watershed management, recharging etc. have been specifically dealt in the curriculum.

**2. COMPETENCY:**

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:

- **Design the appropriate rain water harvesting scheme and required structures for managing water resources under given conditions**

**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.

- Discuss basic concepts of “Water Resources Management”.
- Estimate the surface runoff from given precipitation data.
- Describe various types of survey investigations for reservoir planning
- Design the appropriate rain water harvesting scheme and required structures for given conditions.

**4. SCHEME OF STUDIES AND EXAMINATIONS:**

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
			C	ESE	PA	ESE	PA	150
3	0	2	5	70	30	20	30	

**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 Introduction</b>	1a. Discuss the concepts and importance of Water Resources Management (WRM).  1b. Identify various agencies associated with Water Resource Management.	1.1 Scope of W.R.M. 1.2 Necessity of W.R.M. 1.3 Role of various agencies in W.R.M.: - Agriculturists - Meteorologists - Geologists - Industrialists - Scientists - Biologists - Water quality Control (Authority) - Mechanical Engg. - Electrical engg. - Economists - Social workers- NGO's - Politicians - General Public
<b>Unit-II Hydrology</b>	2a. Explain Hydrological cycle. 2b. Describe various forms and types of precipitation. 2c. Explain various types of rain gauges. 2d. Compute average precipitation by various methods. 2e. Compute runoff using empirical formula. 2f. Describe evaporation process and factors	2.1 Define Hydrology 2.2 Hydrological cycle 2.3 Forms of precipitation 2.4 Precipitation occupancy & its types. 2.5 Measurement of rain fall 2.5.1 Rain gauges Non Recording Recording - Float type - Tipping bucket - weighing bucket 2.5.2 Methods of determining average rainfall b. Arithmetic average method

	affecting it.	<p>c. Thiessen polygon method d. Isohytel method</p> <p>2.5.3 Determine optimum no. of rain gauges for given catchment area.</p> <p>2.6 Runoff</p> <p>2.6.1 Factors affecting runoff 2.6.2 Runoff calculation using empirical formula only</p> <p>2.7 Evaporation, Transpiration &amp; Evapo - transpiration</p> <p>2.7.1 Factors affecting evaporation.</p>
<b>Unit-III Ground Water</b>	<p>3a. Identify various sources of water.</p> <p>3b. Describe various terms related to “ground water”</p> <p>3c. Explain various types of wells with their features.</p> <p>3d. Discuss necessity of recharging ground water.</p> <p>3e. Describe various methods of recharging ground water.</p>	<p>3.1 Sources of water</p> <p>3.2 Importance of ground water and present scenario</p> <p>3.3 Terms related to groundwater engineering: Aquifer, Aquiclude, Aquifuge, Aquitard, porosity, Specific yield, Specific retention, storage coefficient, coefficient of permeability, coefficient of transmissibility, Yield, specific yield</p> <p>3.4 Types of well</p> <ul style="list-style-type: none"> <li>- Open, Tube and flowing well</li> <li>- concept, location and importance</li> </ul> <p>3.5 Necessity of recharging</p> <p>3.5.1 Artificial recharging as today’s need.</p> <p>3.5.2 Types of artificial recharge</p> <ul style="list-style-type: none"> <li>- Spreading method.</li> <li>- Pit method / khet-talavadi</li> <li>- Induced recharge method</li> <li>- Recharge well method.</li> <li>- Sub-surface dam.</li> <li>- Check dam series</li> <li>- Ponds</li> <li>- Unlined canals</li> </ul>
<b>Unit-IV Storage Works</b>	4a. Describe various surveys / investigations to be carried out in storage works including their classification.	<p>4.1. Survey and investigations.</p> <p>a. Investigations for hydrologic data</p> <p>b. Geological data.</p> <p>c. Topographic investigations.</p> <p>d. Collection of legal data, water right.</p>

	<p>4b. Compute reservoir capacity and losses.</p> <p>4c. Discuss purpose of various storage zones of reservoir.</p> <p>4d. Draw cross-sections of gravity and earthen dam at various points.</p>	<p>e. Investigation of reservoir site, land acquisition Environmental considerations</p> <p>f. Economical data - Benefit cost ratio.</p> <p>4.2. Site selection for reservoir</p> <p>4.3. Methods of estimating reservoir capacity</p> <p>4.4. Storage zones</p> <p>4.5. Reservoir losses</p> <p>4.6. Reservoir sedimentation and its control</p> <p>4.7. Classification of storage works .</p> <p>4.8. Factors for selecting type of dam</p> <p>4.9. Concept of low and high dam</p> <p>4.10. Component parts of gravity and earthen dam</p>
<p><b>Unit-V</b> <b>Distribution Works</b></p>	<p>5a. Explain purpose of distribution works</p> <p>5b. Differentiate between barrage and weir by means of a diagram</p> <p>5c. Describe silt control structures</p> <p>5d. Classify canals based on their functions.</p> <p>5e. Explain factors affecting canal alignment</p> <p>5f. Discuss suitable construction techniques, materials &amp; equipments for "canal lining."</p> <p>5g. Explain the causes, effects &amp; prevention of water logging.</p>	<p>5.1 Purpose of distribution works</p> <p>5.2 Component parts &amp; sketches.</p> <p>5.3 Barrage.</p> <p>5.4 Weir</p> <p>5.4.1 Comparison of weir and barrage.</p> <p>5.4.2 Causes of failure of weir and remedial measures</p> <p>5.5 Safe exit gradient</p> <p>5.6 Control of silt entry Scouring sluices, silt excluder, silt ejector, head regulator.</p> <p>5.7 Classifications of canal</p> <p>-Ridge and contour</p> <p>Functions of each according to network.</p> <p>Line diagram of network of canal.</p> <p>5.8 Canal Alignment Factors influencing canal alignment .</p> <p>5.9 Regime &amp; semi-regime conditions.</p> <p>5.10 Canal lining.</p> <p>a. Advantages.</p> <p>b. Types of canal lining materials</p> <p>c. Methods of canal lining.</p> <p>5.11 Regulation works.</p> <p>5.12 C.D. Works. -Types , functions &amp; sketches</p> <p>5.13 Outlets. - types, situation, functions &amp; sketches</p> <p>5.14 Water-logging, effects, causes &amp;</p>

		prevention
<b>Unit –VI Watershed Development</b>	6a. Describe important characteristics of "water shed". 6b. Evolve strategies of enhancing people's participation in watershed management.	6.1. Concept of 'watershed' 6.2. Characteristic of watershed, size, shape, physiography, slope, climate, drainage, land use, vegetation, geology, hydrology, hydrogeology, socio-economics. 6.3. Watershed management & people's participation.. 6.4. Role of co-operative society in watershed management.
<b>Unit-VII Water Harvesting Structures</b>	7a. Describe necessity and importance of rain water harvesting . 7b. Discuss various 'rain water harvesting' methods, structures and their suitability in various conditions.	7.1 Necessity of Rain water harvesting 7.2 Importance of Rain water harvesting 7.3 Rain water harvesting methods - Check dams. - Nala / Gully plugging - Percolation tank. - Khet-talawadi - Roof harvesting - Vegetation and plantation

## 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
I.	Introduction	3	2	3	2	7
II.	Hydrology	8	4	3	7	14
III.	Ground Water	7	3	5	6	14
IV.	Storage Works	8	3	4	7	14
V.	Distribution Works	6	2	2	3	7
VI.	Water Shed Development	6	3	2	2	7
VII.	Water Harvesting Structures	4	3	2	2	7
		<b>42</b>	<b>20</b>	<b>21</b>	<b>29</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.



## 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 (Outcomes' in Psychomotor Domain)	Approx Hrs. Required
1		<b>Draw the following Sketches :</b>	
	II	Hydrological Cycle	16
	II	Types of Precipitation	
	II	Rain gauges	
	III	Various methods of artificial recharge	
	IV	Component parts of earthen and Gravity dam	
	V	Diversion head works	
	V	Cross Drainage Works	
	VII	Various types of rainwater harvesting structures	
2		<b>Solve Numerical from given data:</b>	12
	II	Calculate average precipitation for given catchment area using various methods.	
	II	Calculate Runoff for given catchment area using empirical formula.	
	II	Compute optimum number of rain gauges for given catchment area.	
	III	Compute yield of a well	
	VII	Design a check dam	
3		<b>Field Visit and Report :</b>	08
	I	Arrange field Visit to irrigation / W.R.I department for collecting existing W.R. data of your district with respect to Importance and necessity of WRM	

S. No.	Unit No.	Practical/Exercise (Outcomes' in Psychomotor Domain)	Approx Hrs. Required
	II	Visit to meteorological department, collect precipitation data, observe, and interpret.	
		Collect data of your district regarding various types of water sources available and prepare a report	
		Suggest various methods of Artificial recharge of ground water in your district	
		Collect data of various storage works in your district	
		Visit to water harvesting Structure nearby your polytechnic and prepare a report	
4.		<b>Seminar</b>	04
	I to VII	Select one topic as a Seminar and present it using modern teaching aids before teachers & students.	
Total Hours			40

### 8. SUGGESTED STUDENT'S ACTIVITIES

- i. Prepare prototype/ model of rainwater harvesting structure in the polytechnic/ suggested premises.

### 9. SPECIAL INSTRUCTIONAL STRATEGIES (If Any)

- i. Show the video/animation films of various types of dams and their structures.
- ii. Arrange visit to nearby water bodies

### 10. SUGGESTED LEARNING RESOURCES

#### (A) List of Books:

S. No.	Title of Books	Author	Publication
1.	Irrigation, Water Resources & Water Power Engg.	Dr. P.N. Modi	Standard Book House, Delhi.
2.	Hydrology & Water Resources	R.K. Sharma	Dhanpat Rai & Sons, Delhi.
3.	Ground water assessment, Development & management	K.R. Karanth	Tata Mc Graw Hill Pub. Co. Ltd., New Delhi.
4.	Ground water	H.M.Ragunath	New Age international Ltd., New Delhi.
5.	Hydrology & Water Resources Engg.	S.K.Garg	Khanna Pub., Delhi.

6.	Watershed management in India	J.V.S. Moorthy	Willey Eastern Ltd.
7.	Design of small dams.	U.S.B.R.	
8.	Irrigation theory & practice	A.M.Mitchel	Vikas Pub. House Pvt. Ltd, Delhi.
9.	Water vision 2050 Narmada	W.R. & water supply deptt., Gandhinagar	
10.	Water Resources Engg- Principles & Practice	C. Satyanarayan Murthy	New Age International Ltd., New Delhi
11.	Relevant IS codes		

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

- i. Rain gauge
- ii. Working models of storage works
- iii. Models of cross drainage works
- iv. Models of rain water harvesting structures.

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

**11. COURSE CURRICULUM DEVELOPMENT COMMITTEE**

**Faculty Members from Polytechnics**

- **Prof. S. M. Mistry**, H.O.D.Civil Engg., Dr. S. & S. S. Ghandhy College of Engg and Tech., Surat
- **Prof. P. N. Patel**, Sr.Lecturer, Civil Engg., Deptt., G. P. Dahod
- **Prof. A. K. Popat**, Sr.Lecturer, Civil Engg., Deptt., G. P. Dahod
- **Prof. D. V. Jariwala**, Lecturer, Civil Engg., Deptt., G.P.Valsad

**Coordinator and Faculty Members from NITTTR Bhopal**

- **Dr. V. H. Radhakrishnan**, Professor, Department of Civil and Environmental Engineering
- **Prof M. C. Paliwal**, Associate Professor, Department of Civil and Environmental Engineering

**GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT**

**COURSE CURRICULUM  
COURSE TITLE: SOIL MECHANICS  
(Code: 3340605)**

Diploma Programme in which this course is offered	Semester in which offered
Civil Engineering, Transportation Engineering	4 <sup>th</sup> Semester

**1. RATIONALE**

Knowledge and understanding of soil and its engineering properties are very important for engineers working at site in order to make Civil Engineering Structures safe and serviceable. In INDIA, from region to region soil varies in properties and characteristics. Under different loading conditions soil is subjected to various stresses and problems like water logging, liquefaction of soil, seepage through soil and settlement. At diploma level students are expected to study about these aspects of soil so as to develop their understanding in order to apply their knowledge in construction industry

**2. COMPETENCY**

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

- Conducting different laboratory tests for determining engineering properties / parameters of a soil, evaluate engineering properties / characteristics of soil for their suitability to construction of engineering structures

**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.

- Explain various engineering properties / characteristics of soil with respect to construction and engineering applications
- Conduct different laboratory tests for determining engineering properties /parameters of a soil.
- Evaluate engineering properties / characteristics of soil for their suitability to construction of engineering structures.
- Explain essential features and requirements of site investigation with respect to soil.

**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	150
03	00	02	05	70	30	20	30	

**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>Introduction</b>	1a. Discuss soil formation cycle & general characteristics of soil. 1b. List structures where soil is used as Construction material. 1c. Describe soil-formation in Geological cycle 1d. State the types of failures due to soil in Civil Engineering structure	1.1 History 1.2 List structures where soil is used as construction material 1.3 Soil-formation in Geological cycle 1.4 State the types of failures due to soil in Civil Engineering structure 1.5 General characteristics of different types of soils 1.6 Overview of different types of soils in Gujarat / India.
<b>Unit – II</b> <b>Index Properties &amp; Interrelationship</b>	2a. Explain phase diagram of Soil 2b. Discuss various index properties of soil for the purpose of their classification & Use 2c. Describe interrelationship between different index properties	2.1 Three phase diagram 2.1.1 State three constituents of soil 2.1.2 Sketch showing three i. phases of soil ii. phase diagram 2.1.3 Assumptions in drawing a ii. phase diagram 2.2 Properties of soil like Density, Field density, Dry density, Saturated density, Void ratio, Porosity, Specific Gravit, Degree of saturation, Moisture conten, Density Index 2.3 Derive the following relations for a soil sample from fundamentals 2.3.1 $e = n/n-1, n=e/1+e$ 2.3.2 $w \times G = e \times s_r$ 2.3.3 $\gamma_d = \gamma_b / 1+w$ 2.3.4 $\gamma_b = (G+e.s_r) \gamma_w / (1+e)$ 2.3.5 $\gamma_{sat} = (G+e) \gamma_w / (1+e)$ 2.3.6 $\gamma_d = G \gamma_w / 1+e$ 2.4 Numerical on 2.3

<p><b>Unit – III</b></p> <p><b>Soil Classification</b></p>	<p>3a. Discuss methods of Classification</p> <p>3b. Describe method of I.S. Classification of Soil</p> <p>3c. Classify Soil based on Consistency Limits</p>	<p>3.1 Classification of soil (Grain size) as per Indian Standard</p> <p>3.1.1 Basis /criteria of classification</p> <ol style="list-style-type: none"> <li>i. of soils</li> <li>ii. Three main categories of soils</li> <li>iii. Scale for classifying soil</li> <li>iv. on the basis of grain size</li> </ol> <p>3.2 Mechanical Analysis of soil</p> <p>3.2.1 Difference between course grained and fine grained Soil on the basis of range of grain size and engineering properties</p> <p>3.2.2 Sieves designation as per</p> <ol style="list-style-type: none"> <li>i. I.S. code</li> </ol> <p>3.2.3 Coarse &amp; Fine Sieve analysis,</p> <ol style="list-style-type: none"> <li>b. sedimentation analysis</li> </ol> <p>3.3 Grading Curves and different coefficients i.e. CU and CC</p> <ol style="list-style-type: none"> <li>a. Clay, silt, sand and gravel as per particle size</li> <li>b. Consistency Limits like Liquid limit, Plastic limit, Shrinkage</li> </ol> <p>3.4 Limit and Plasticity Index`</p>
<p><b>Unit – IV</b></p> <p><b>Compaction</b></p>	<p>4a. Comprehend the principle and methods of compaction of soil</p> <p>4b. Differentiate between compaction and consolidation with examples</p> <p>4c. Determine MDD &amp; OMC of soil by conducting appropriate test</p>	<p>4.1. Compaction and its Application</p> <p>4.1.1 Effects of compaction on different soil properties like permeability, shear strength, soil settlements-stability of embankments.</p> <p>4.2. Maximum dry density and O.M.C.</p> <p>4.2.1 Typical compaction curve</p> <p>4.2.2 Optimum moisture content (OMC), Maximum dry density (MDD)</p> <p>4.3. Proctor test</p> <ol style="list-style-type: none"> <li>4.3.1 Light compaction</li> <li>4.3.2 Heavy compaction test</li> <li>4.3.3 Light compaction test on a given soil sample</li> </ol> <p>4.4. Factors affecting compaction like water content, nature of soil (fine or course grained), Grading of soil, compaction energy, thickness of layer</p> <p>4.5. Compaction and Consolidation</p> <p>4.6. Role of O.M.C in the field</p> <p>4.7. Methods of Field Compaction &amp; various Equipment for compaction</p>

<p><b>Unit – V</b></p> <p><b>Permeability &amp; Seepage</b></p>	<p>5.a Explain concept of permeability &amp; its implications with respect to use of soil.</p> <p>5.b Determine 'permeability' of given soil.</p> <p>5.c Comprehend the concept of Seepage Analysis in relation to 'quick sand condition' with examples.</p>	<p>5.1 5.1 Permeable and Impermeable soils</p> <p>5.1.1 Permeability and Impermeability</p> <p>5.1.2 Flow of water through pipe and Through soil</p> <p>5.2 Factors affecting the permeability</p> <p>5.2.1 The factors affecting permeability of soil</p> <p>5.2.2 Factors used to control the permeability of soil to desired extent in various Civil engineering structures</p> <p>5.3 Methods to find Coefficient of Permeability</p> <p>5.3.1 Constant Head Method</p> <p>5.3.2 Falling Head Method</p> <p>5.4 Coefficient of permeability</p> <p>5.4.1 Numerical based on</p> $K = (Q \times L) / (t \times h \times A)$ $K = (2.3 \times a \times L) / (A \times t) \log_{10} h_1 / h_2$ <p>5.5 Seepage pressure</p> <p>5.1 Seepage pressure.</p> <p>5.2 Quick sand condition.</p> <p>5.3 Flow net, its characteristics and application.</p>
<p><b>Unit-VI</b></p> <p><b>Shear Strength</b></p>	<p>6a. Explain different terms used in the context of 'shear strength' of soil.</p> <p>6b. Evaluate shear parameters of various types of soil, with their practical significance</p>	<p>6.1. Definition</p> <p>6.1.1 Define: (a) Cohesion (b) internal friction (c) Shear strength</p> <p>6.1.2 Coulomb's law for shear strength <math>S = C + \sigma_n \tan \phi</math></p> <p>6.2. Shear strength of soil</p> <p>6.2.1 Different shear tests used to determine shear strength of soil in laboratory</p> <p>6.2.2 Procedure of direct shear test (Box shear test)</p> <p>6.3. Types of soil C-soil, <math>\phi</math>-soil, C-<math>\phi</math> soil.</p> <p>6.3.1 Draw failure envelope by drawing Mohr's circle from the data obtained during direct shear test</p> <p>6.3.2 Calculate the values C and <math>\phi</math></p> <p>i. from the failure envelope of</p> <p>ii. direct shear test on soil</p>

<b>VII</b>  <b>Bearing Capacity of soil</b>	7a. Explain concept of bearing capacity of soil. 7b. Describe various methods to determine bearing capacity of soil. 7c. Explain the concept & occurrence mechanism & effect of 'Liquefaction' of soil.	7.1 Bearing capacity of soil 7.1.1 Net Bearing capacity 7.1.2 Safe Bearing Capacity 7.1.3 Ultimate Bearing Capacity 7.1.4 Bearing Capacity of various soil 7.2 Methods – Plate Load Test, Penetration Test & using $C - \Phi$ parameters for determining bearing capacity of soil and to improve bearing capacity of soil 7.2.1 Foundation on soils of various bearing Capacity 7.3 Liquefaction 7.4 Definition 7.5 Occurrence & effect Effects of Liquefaction Remedial for Liquefaction
<b>VIII</b>  <b>Soil Investigation &amp; Exploration</b>	8a. Discuss various methods & appropriate use for investigation & exploration of soil.	8.1 Purposes of exploration of soil. 8.2 Planning of exploration program 8.3 Soil samples and collection. 8.4 Field penetration Test:SPT 8.5 Introduction to geophysical methods

#### 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
I	Introduction	02	02	00	00	02
II	Index Properties & Interrelationships	07	02	04	08	14
III	Classification of Soil	07	04	02	08	14
IV	Compaction of Soil	06	03	03	04	10
V	Permeability & Seepage	06	03	03	04	10
VI	Shear Strength	05	02	02	03	07
VII	Bearing Capacity of soil	05	02	02	03	07
VIII	Soil Investigation & Exploration	04	02	01	03	06
<b>Total</b>		<b>42</b>	<b>20</b>	<b>17</b>	<b>33</b>	<b>70</b>

Legends: R = Remember, U = Understand, A= Apply and above Level (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

#### 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.

Sr. No.	Unit No.	Practical/Exercise (Outcomes' in Psychomotor Domain)	Approx Hrs Required.
1	I	Determine field moisture content of soil	02
2	I	Determine bulk density and dry density of soil by core cutter method	02
3	I	Determine specific gravity of sand by pycnometer	02
4	I	Determine bulk density and dry density of soil by sand replacement method	04
5	I	Conduct Sieve analysis of given soil for its classification	04
6	I	Determine consistency Limits i.e. Liquid limit, Plastic limit, Shrinkage limit	04
7	V	Determine permeability of soil by constant head method	02
8	V	Determine permeability of soil by falling head method	02
9	V	Determine shear parameters of soil by box shear test	02
10	I	Determine OMC and MDD by Proctor Test	04
Total Hours			<b>28</b>

#### 8. SUGGESTED LIST OF STUDENT ACTIVITIES

- i. Collect few samples & find out different characteristics/properties of Soil from nearby site
- ii. Undertake site visit related to road compaction& consolidation and prepare report
- iii. Undertake site visit related to SPT on field & prepare report
- iv. Visit to Soil Testing Laboratory for awareness related to other Soil Testing Equipment, Soil Testing Report.

#### 9. SPECIAL INSTRUCTIONAL STRATEGIES (If Any)

- i. Show Video Clips of Soil Testing and interact with students by asking questions
- ii. Show Picture Clips through Power Point regarding Testing of soil and its commercial report
- iii. Video programs on soil engineering tests – by NITTTR – Bhopal
- iv. Video/animation films on soil behavior during earthquake

## 10. SUGGESTED LEARNING RESOURCES

### (A) List of Books:

S. No.	Title of Books	Author	Publication
1.	Soil Mechanics & Foundation	Dr. B C Punamia	Standard Book House
2.	Modern Geo Technical Engineering	Dr. Alam singh	Jodhpur University
3.	Textbook of Soil Mechanics & Foundation Engineering	V N S Murthy	UBS Publisher
4.	Soil Sampling & Testing Manual	Dr A K Duggal	NITTTR , Chandigarh
5.	IS 2720 , IS 1892 , IS 2132 & IS 2809	----	BIS , New Delhi

### B. List of Major Equipment/Materials

- i. Core Cutter
- ii. Hot Air Oven
- iii. Sand Pouring Cylinder
- iv. Pyconometer Bottle
- v. Permeability Apparatus
- vi. Set of IS Sieves
- vii. Casgrande Apparatus
- viii. Direct Shear Apparatus
- ix. Electronic Weighing Balance
- x. Heavy & Light Proctor Test Apparatus

### C List of Software/Learning Websites

- i. [www.issnge.org](http://www.issnge.org)
- ii. [www.springer.com](http://www.springer.com)
- iii. [www.britannica.com](http://www.britannica.com)
- iv. [www.trb.org](http://www.trb.org)

## 11. COURSE CURRICULUM DEVELOPMENT COMMITTEE

### Faculty Members from Polytechnics

- **Prof. B. G. Rajgor**, H.O.D, App. Mech. , BBIT , V. V. Nagar
- **Prof. K. Venkateshwarlu** , H.O.D , T F G Polytechnic, Adipur
- **Prof. C. H. Bhatt**, Lecturer Dr. S. & S.S. Ghandhy College, Surat
- **Prof. K. K. Patel**, H.O.D, G. P Rajkot

### SCoordinator and Faculty Members from NITTTR Bhopal

- **Dr. V H Radhakrishnan** , Professor, Department of Civil and Environmental Engineering

## GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

### COURSE CURRICULUM COURSE TITLE: COMPUTER AIDED DRAWING (Code: 3340606)

Diploma Program in which this course is offered	Semester in which offered
Civil Engineering, Transportation Engineering	4 <sup>th</sup> Semester.

#### 1. RATIONALE

Computer Aided Design (CAD) is a good example of technological innovation that has had a significant impact on the drawing preparation and in civil engineering industry and other fields. Drawing is the tool by which civil engineer can express engineering detailing like layout of site, plan, elevation, section with interior details and design output to be used by marketing office, client, concern authority for execution, approval and for other works.

Formerly, such drawing were prepared manually, which resulted in time consuming process, repetition of work for editing again resulted in wastage of stationary and time of human resources.

Due to advancement in computer and development of versatile software like AutoCAD, civil engineers and architects are using computers and graphical software to generate necessary drawings with high precision and using less time compared to manual drafting and it has therefore become a necessity to have CAD skills among the engineers to improve the efficiency of drafting procedures. Keeping this in mind, the curriculum is framed to develop basic skills and competency required.

#### 2. COMPETENCY

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

- **Prepare detailed engineering and construction designs and drawings required for civil engineering activities using advanced CAD software.**

#### 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 outcomes in cognitive, psychomotor and affective domain to demonstrate following course outcomes.

- i. Apply basic CAD command to develop 2D and 3D drawings of residential & commercial building using AutoCAD.
- ii. Prepare detailed engineering and construction drawings and designs required for civil engineering activities.
- iii. Use advanced CAD commands for edit/modification of existing drawings as per needs and suggestions and print the same.

#### 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	100
00	00	04	04	00	00	40	60	

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

## 5. COURSE DETAILS

**Note:** There are no separate classes for theory as given below. The relevant theory has to be discussed before the practical during the practical sessions.

Unit	Major Learning Outcomes ( in Cognitive Domain )	Topics and Sub-topics
<b>Unit – I</b> <b>Introduction to AutoCAD</b>	1a. Demonstrate the basics of AutoCAD software and its important commands  1b. Prepare a simple building drawing file using basic draw and modify commands	1.1 File menu of AutoCAD with New, Open, Save, Save as and Close 1.2 Basic 2D commands like Line, Circle, Ellipse, Multi Line ,Construction Line, Polyline, Point, Donut, Ellipse, Polygon, Rectangle, Arc 1.3 Erase, Snap, Redraw, Regenerate , Zoom, Pan
<b>Unit – II</b> <b>Editing of AutoCAD Drawing</b>	2a. Explain the applications of Edit commands 2b. Modify existing AutoCAD Drawing 2c. Apply advanced command for edit /modification of drawing	2.1 Modify Properties of Drawing Entity 2.2 Copy, Move, Rotate, Mirror , Offset , 2.3 Array, Scale, Stretch, Lengthen, Trim, 2.4 Extend , Break, Chamfer , Fillet 2.5 Block, WBlock, Insert and Explode , Area and Volume with Civil Engineering 2.7 Application
<b>Unit – III</b> <b>Advanced 2D Commands</b>	3a. Prepare typical Drawings using Different Layers  3b. Develop final Drawings with Dimension and Text and Hatching	3.1 Application of LAYER command in Civil Engineering 3.2 Layer command with its all sub commands, Line type, Color  3.3 Dimension command – linea , aligned, arc length, radius, Diameter, Centre, Leader, Baseline and Continuous Dimensioning, tolerance, override and Dimension updates Text and DTEXT commands with Text Style Hatch command
<b>Unit – IV</b> <b>3D Commands of AutoCAD</b>	4a. Use 3D commands to generate 3d view from 2D drawing  4b. Prepare 3D Drawings using 3D Commands of AutoCAD  4c. perform rendering/shading on 3d drawing	4.1 Units, Elevation, Thickness, UCS and UCS Icon  4.2 Viewports , Extrude , 3D Solids – Sphere, Box, Cylinder, Cone, Wedge, Interference  4.3 3D Surface – Revolved, Tabulated and Ruled Surfaces  4.4 Hide, Render and Shade of 3D drawings

Unit	Major Learning Outcomes (in Cognitive Domain )	Topics and Sub-topics
<b>Unit – V Plot of 2D &amp; 3D Drawings</b>	5a. Setup printer , plotter for printing of drawings  5b. Plot 2D and 3D Civil Engineering Drawings as per requirement on different scale and sizes	5.1 PLAN , ELEVATION and 3D Views of Residential and Commercial Building  5.2 PLOT and its Sub Command for Plotting Drawing on A1, A2 and A3 Size Paper using Printer and / or Plotter

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

Not Applicable

#### 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 (outcomes in psychomotor domain )	Approx Hours Reqd.
1	I	Draw Basic 2D objects such as line circle, polygon - (at least 04 objects)	04
2	II	Draw simple plan of a rectangular room or layout of given dimensions -- 02 drawings	08
3	III	Draw a drawing of a plan of two BHK house	14
4	IV	Draw Four 3D Geometrical Figures	12
5	V	Develop PLAN , ELEVATION and 3D Views of One Residential and One Commercial Building	18
Total Hours			<b>56</b>

#### 8. SUGGESTED LIST OF STUDENT ACTIVITIES

- Visit to architect/civil engineering firm for understating the CAD and its applications and study of typical drawings prepared by AutoCAD
- Collect different types of civil drawings in hard copy from architects , builders, and practicing engineers for preparing the same using CAD software

**9. SPECIAL INSTRUCTIONAL STRATEGIES (If Any):**

- i. Use projector to explain and demonstrate the use of AutoCAD commands. and students must have computer with software
- ii. CAD tutorial can be given to the students (available on internet)
- iii. Collect and provide different drawings prepared through AutoCAD and will show to students to motivate to prepare such type of Drawings.

**10. SUGGESTED LEARNING RESOURCES****A. List of Books:**

S. No.	Title of Books	Author	Publication
1.	AutoCAD Manual	-----	Microsoft AutoDesk
2.	AutCAD – A problem solving Approach – 2013 & Beyond	Shamtikoo	AutoDesk
3.	Mastering AutoCAD	George Omura	Wily India
4.	AutoCAD	Rubenstein	Delmar

**B. List of Major Equipment/Materials**

- i. Computer system -Intel Core 2 Dual with 32 MB RAM 200mb hard disk and Mouse and Key Board
- ii. Printer and/or Plotter as per printing requirement

**C List of Software/Learning Websites**

- i. Authentic AutoCAD version 2006 or Higher can be down loaded from AICTE website
- ii. Autodesk web site

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- **Dr. Subrat Roy**, Professor, Dept. of Civil and Environmental Engineering