



Government Polytechnic, Mumbai

Department of Civil Engineering

**P-19 Curriculum
(Sandwich Pattern)**

**Semester-III
(Course Contents)**

GOVERNMENT POLYTECHNIC MUMBAI
(Academically Autonomously Institute, Government of Maharashtra)
Teaching and Examination Scheme (P19)
With effect from AY 2019-20

Programme: Diploma in Civil Engineering (Sandwich Pattern)

Term / Semester - III

Course Code	Course Title	Teaching Hours/Contact Hours				Credits	Examination Scheme (Marks)						
		L	P	TU	Total		Theory			PR	OR	TW	Total
							TH	TS1	TS2				
CE19301	Construction Technology	3	2	--	5	5	60	20	20	--	25*	--	125
CE19302	Transportation Engineering	3	--	--	3	3	60	20	20	--	--	--	100
CE19303	Surveying II	2	4	--	6	6	60	20	20	50*	--	25	175
AM19301	Mechanics of Structures	3	2	--	5	5	60	20	20	--	--	25	125
AM19302	Soil Mechanics	3	2	--	5	5	60	20	20	--	--	25	125
HU19102	Environmental Studies	--	2	--	2	2	--	--	--	--	25	25	50
CE19304	QGIS (16) (Spoken Tutorials)	--	4 [#]	--	4	4 [#]	--	--	--	--	--	--	--
	Total	14	16	--	30	30	300	100	100	50	50	100	700
Student Centered Activity(SCA)					05								
Total Contact Hours					35								

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR-Practical, OR-Oral, TW: Term Work (progressive assessment)

* Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination

Note: Duration of Examination--TS1&TS2 -1 hour , TH- 2 hours 30 minutes, PR/OR – 3 hours per batch , SCA- Library - 1 hour, Sports- 2 hours, Creative Activity-2 hours
Self, on- line learning Mode through MOOCs /Spoken Tutorials / NPTEL / SWAYAM / FOSSEE etc.

Department Coordinator,
Curriculum Development,
Dept. of Civil Engineering

Head of Department
Dept. of Civil Engineering

In-Charge
Curriculum Development Cell

Principal

Programme : Diploma in Civil Engineering (Sandwich Pattern)										
Course Code:CE19301				Course Title: Construction Technology						
Compulsory / Optional: Compulsory										
Teaching Scheme and Credits				Examination Scheme						
L	P	TU	Total	TH (2 Hrs 30 min)	TS1 (1 Hr)	TS2 (1Hr)	PR	OR	TW	Total
03	02	--	05	60	20	20	--	25*	--	125

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR- Practical, OR-Oral, TW: Term Work (progressive assessment) , * Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination
Note: For Minimum passing marks under various heads, refer, examination rule AR 26. Two practical skill test are to be conducted. First skill test at mid term and second skill test at the end of the term.

Rationale:

Building construction is a core course in civil engineering. This course is intended for gaining useful knowledge with respect to facts, concepts, principles and procedures related to building construction system so that student can effectively plan, execute quality building construction work.

The course helps to learn building materials required for construction. It provides necessary knowledge about properties, uses of building materials.

Course Outcomes: Student should be able to

CO1	Identify components of building structures.
CO2	Propose suitable type of foundation for building structures.
CO3	Select suitable type of masonry for building structures.
CO4	Propose relevant means of communications for different types of buildings.
CO5	Select relevant material for finishing works.
CO6	Select appropriate formwork.

Course Content Details:

Unit No	Topics / Sub-topics
1	<p>Introduction :</p> <p>1.1 Classification of Buildings as per National Building Code Group A to I, As per Types of Constructions- Load Bearing Structure, Framed Structure, Composite Structure.</p> <p>1.2 Building Components - Functions of Building Components, Substructure – Foundation, Plinth.</p> <p>1.3 Superstructure – Walls, Partition wall, Cavity wall, Sill, Lintel, Doors and Windows, Floor, Mezzanine floor, Roof, Columns, Beams, Parapet.</p> <p>Course Outcome: CO1 , Teaching Hours : 4 hrs Marks: 04 (R- 2, U-2, A- 0)</p>
2	<p>Construction of Substructure :</p> <p>2.1 Job Layout: Site Clearance, Layout for Load Bearing Structure and Framed Structure by Center Line and Face Line Method, Precautions.</p> <p>2.2 Earthwork: Excavation for Foundation, Timbering and Strutting, Earthwork for embankment, Material for plinth Filling, Tools and plants used for earthwork.</p> <p>2.3 Foundation: Functions of foundation, Types of foundation – Shallow Foundation,</p>

	<p>Stepped Footing, Wall Footing, Column Footing, Isolated and Combined Column Footing, Raft Foundation, Grillage Foundation. Deep Foundation - Pile Foundation, Well foundation and Caissons, Pumping Methods of Dewatering, Deep wells, Well points, Cofferdams (Introduction only)</p> <p>Course Outcome: CO2 Teaching Hours : 8 hrs Marks:12 (R-4 , U- 4 , A- 4)</p>
3	<p>Construction of Superstructure :</p> <p>3.1 Stone Masonry: Terms used in stone masonry- facing, backing, hearting, Through stone, corner stone, cornice. Types of stone masonry: Rubble masonry, Ashlar Masonry and their types. Joints in stone masonry and their purpose. Selection of Stone Masonry, Precautions to be taken in Stone Masonry Construction</p> <p>3.2 Brick masonry: Terms used in brick masonry- header, stretcher, closer, quoins, course, face, back, hearting, bat bond, joints, lap, frog line, level and plumb. Bonds in brick masonry- header bond, stretcher bond, English bond and Flemish bond. Requirements of good brick masonry. Junctions in brick masonry and their purpose and procedure.</p> <p>3.3 Precautions to be observed in Brick Masonry Construction.</p> <p>3.4 Comparison between stone and Brick Masonry. Tools and plants required for construction of stone and brick masonry. Hollow concrete block masonry and composite masonry.</p> <p>Course Outcome:CO3 Teaching Hours :12 hrs Marks:14 (R- 4 , U- 6 , A- 4)</p>
4	<p>Building Communication and Ventilation :</p> <p>4.1 Horizontal Communication: Doors –Components of Doors, Full Panelled Doors, Partly Panelled and Glazed Doors, Flush Doors, Collapsible Doors, Rolling Shutters, Revolving Doors, Glazed Doors. Sizes of Door recommended by BIS.</p> <p>4.2 Windows: Component of windows, Types of Windows - Full Panelled, Partly Panelled and Glazed, wooden, Steel, Aluminium windows, Sliding Windows, Louvered Window, Bay window, Corner window, clear-storey window, Gable and Dormer window, Skylight. Sizes of Windows recommended by BIS. Ventilators.</p> <p>4.3 Fixtures and fastenings for doors and windows- Material used and functions of Window Sill and Lintels, Shed / Chajja.</p> <p>4.4 Vertical Communication: Means of Vertical Communication- Stair Case, Ramps, Lift, Elevators and Escalators. Terms used in staircase-steps, tread, riser, nosing, soffit, waist slab, baluster, balustrade, scotia, hand rails, newel post, landing, headroom, winder. Types of staircase (On the basis of shape): Straight, dog-legged, open well, Spiral, quarter turn, bifurcated, Three quarter turn and Half turn, (On the basis of Material): Stone, Brick, R.C.C., wooden and Metal.</p> <p>Course Outcome:CO4 Teaching Hours :12 hrs Marks:12 (R- 4 , U- 4, A-4)</p>
5	<p>Building Finishes and Wall Finishes :</p> <p>5.1 Floors : Types of Floor Finishes and its suitability- Kota, Marble, Granite, Ceramic Tiles, Vitrified, Chequered Tiles, Paver Blocks, Concrete Floors, wooden Flooring, Skirting and Dado. Process of Laying and Construction, Finishing and Polishing of Floors.</p> <p>5.2 Roofs : Roofing Materials- RCC, Mangalore Tiles, AC Sheets, G.I. sheets, Corrugated G.I. Sheets, Plastic and Fibre Sheets. Types of Roof: Flat roof, Pitched Roof-King Post truss, Queen Post Truss, terms used in roofs.</p> <p>5.3.Plastering : Necessity of Plastering, Procedure of Plastering, Single Coat Plaster, Double Coat Plaster, Rough finish, Neeru Finishing and Plaster of Paris (POP). Special 5.4 Plasters- Stucco plaster, sponge finish, pebble finish. Plaster Board and Wall Claddings. Precautions to be taken in plastering, defects in plastering.</p>

	5.4 Pointing: Necessity, Types of pointing and procedure of Pointing. Painting –Necessity, Surface Preparation for painting, Methods of Application. Course Outcome:CO5 Teaching Hours : 6 hrs Marks: 12 (R- 4, U- 4, A- 4)
6	Scaffolding and Shoring: 6.1 Scaffolding: Purpose, Types of Scaffolding, Process of Erection and Dismantling. 6.2 Shoring: Purpose and Types of Shoring, Underpinning. 6.3 Formwork: Definition of Formwork, Requirements of Formwork, Materials used in Formwork, Types of Formwork, Removal of formwork. Scaffolding and Shoring Course Outcome: CO6 Teaching Hours : 3 hrs Marks: 06 (R- 2 , U- 2, A- 2)

Suggested Specifications Table (Theory):

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Introduction	2	2	--	04
2	Construction of Substructure	4	4	4	12
3	Construction of Superstructure	4	6	4	14
4	Building Communication and Ventilation	4	4	4	12
5	Building Finishes Floors and Roofs	4	4	4	12
6	Scaffolding and Shoring	2	4	--	06
Total		22	24	18	60

List of experiments:

/Sr. No.	Unit No	COs	Title of the Experiments	Hours
1	2	CO1	To visit the institute building to study different components of building, types of Structures, etc.	2
2	2	CO2	Observing the models, specimen of different types of foundations.	2
3	2	CO2	To set out Foundation Plan on ground for load bearing structure.	4
4	3	CO2	To set out foundation plan on ground for framed structure.	4
5	3	CO2	To visit building construction site to understand construction of substructure.	6
6	3	CO3, CO5	To visit building construction site to understand construction of super structure, plastering and painting work.	6
7	2&3	CO2, CO3, CO4	To draw different components of building observed in site visit (as built drawing)	2
8	3	CO2, CO3, CO4,	Sketches to be drawn on drawing sketch book(any TWO) A. Brick masonry - Plans & elevation of English bond and Flemish bond for one, one & half, two brick thick wall.	2

		CO5	B. Doors - Plan, elevation & section of fully panelled, glazed, flush, collapsible, revolving doors, rolling shutters C. Window - elevation and section of a louvered window-centrally hung ventilator, glazed window and window with aluminum frame and sliding glass shutter D. Stairs (Plans only) : straight, quarter turn, half turn, open well, doglegged, spiral, bifurcated, circular.	
		CO6	Group activity of model making like scaffolding, formwork, centering. (Any one)	2
Total				30

Note : All experiments are compulsory.

References/ Books:

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Building Construction	S. P. Arora and Bindra., N. N. Basak, Dhanpat Rai Publication, Delhi Edition 2013	ISBN: 9788189928803
2	Building Construction	Sushil Kumar. Standard Publication.edition 2006	ISBN: 8186308024
3	Building Construction	Rangawala, S. C., Charotar Publication, Anand.	ISBN-13: 978-8185594859
4	Building Construction	Punmia B. C., and Jain A. K., ,Firewall Media., 2005	ISBN 9788170080534

E-Reference :

1. <http://www.learningconstruction.com/>
2. <http://www.understandconstruction.com/>
3. <http://www.constructionknowledge.net/>

CO Vs PO and CO Vs PSO Mapping :

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	2	3	3	3	2	3	2	2	3	1
CO2	2	3	3	3	2	3	2	1	3	1
CO3	2	3	3	3	2	3	2	1	3	1
CO4	2	3	3	3	2	3	2	1	3	1
CO5	2	3	3	3	2	3	2	1	3	1
CO6	2	3	3	3	2	3	2	1	3	1

Industry Consultation Committee:

Sr. No	Name	Designation	Institute/Organisation
1	Mr. Rohan Deokar	Deputy Engineer	MMRDA
2	Mr. Sanjay Kulkarni	Surveyor and Consultant	SRKulkarni Pvt.Firm
3	Mr. K.V. Kelgandre	Sr. Lecturer in Civil Engg.	K.J. Somaiya Polytechnic
4	Smt.Meera Anserwadekar	Sr. Lecturer in Civil Engg.	Govt. Polytechnic Mumbai

Coordinator,
Curriculum Development,
Department of _____

Head of Department
Department of _____

I/C, Curriculum Development Cell

Principal



Programme : Diploma in Civil Engineering (Sandwich Pattern)										
Course Code: CE19302				Course Title: Transportation Engineering						
Compulsory / Optional: Compulsory										
Teaching Scheme and Credits				Examination Scheme						
L	P	TU	Total	TH (2 Hrs 30 min)	TS1 (1 Hr)	TS2 (1Hr)	PR	OR	TW	Total
03	--	--	03	60	20	20	--	--	--	100

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR- Practical, OR-Oral, TW: Term Work (progressive assessment) , * Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination
Note: For Minimum passing marks under various heads, refer, examination rule AR 26. Two practical skill test are to be conducted. First skill test at mid term and second skill test at the end of the term

Rationale:

This is a core technology subject which is intended to teach students facts, concepts, principles, procedures, of transportation engineering. system. (Roads, Railways) so that students can use this knowledge to identify types of roads as per IRC recommendations, geometric design features of highways, different tests on road materials, components of railway tracks.

Course Outcomes: Student should be able to

CO1	Identify the types of roads as per IRC recommendations.
CO2	Understand geometrical design features of different highways.
CO3	Know different tests on road materials.
CO4	Understand the components of railway tracks.
CO5	Know the defects in railway tracks.
CO6	Understand importance of waterways & airways.

Course Content Details:

Unit No	Topics / Sub-topics
1	<p>Overview of Highway Engineering</p> <p>1.1 Role of transportation in the development of nation, Scope and Importance of roads in India and its' Characteristics.</p> <p>1.2 Different modes of transportation – land way, waterway, airway. Merits and demerits.</p> <p>1.3 General classification of roads.</p> <p>1.4 Selection and factors affecting road alignment.</p> <p>1.5 Metro : types, necessity, advantages & disadvantages, layout of metro station, high speed metro.</p> <p>Course Outcome: CO1 Teaching Hours : 4 hrs Marks: 06 (R-4, U-2, A-0)</p>
2	<p>Geometric Design of Highway</p> <p>2.1 Camber: Definition, purpose, types as per IRC – recommendations.</p> <p>2.2 Kerbs: Road margin, road formation, right of way.</p> <p>2.3 Design speed and various factors affecting design speed as per IRC – recommendations.</p> <p>2.4 Gradient: Definition, types as per IRC – Recommendations.</p>

	<p>2.5 Sight distance (SSD): Definition, types as per IRC – recommendations.</p> <p>2.6 Curves: Necessity, types: Horizontal, vertical curves.</p> <p>2.7 Necessity of Extra widening of roads.</p> <p>2.8 Super elevation: Definition, formula for calculating minimum and maximum Super elevation and method of providing super-elevation</p> <p>2.9 Standards cross-sections of national highway in embankment and cutting.</p> <p>Course Outcome: CO2 Teaching Hours : 10 hrs Marks: 14 (R-4, U-6, A-4)</p>
3	<p>Construction of Road Pavements</p> <p>3.1 Types of road materials and their Tests – Test on aggregates-Flakiness and Elongation Index tests, Angularity Number test, test on Bitumen- penetration, Ductility, Flash and Fire point test and Softening point test.</p> <p>3.2 Pavement – Definition, Types, Structural Components of pavement and their functions.</p> <p>3.3 Construction of WBM road. Merits and demerits of WBM & WMM road.</p> <p>3.4 Construction of Flexible pavement / Bituminous Road, Types of Bitumen and its properties, Emulsion, Cutback, Tar, Terms used in BR-prime coat, tack coat, seal coat, Merits and Demerits of BR.</p> <p>3.5 Cement concrete road -methods of construction, Alternate and Continuous Bay Method, joints, filler and sealers, merits and demerits of concrete roads. Types of joints.</p> <p>Course Outcome:CO3 Teaching Hours : 10 hrs Marks:10 (R-2, U-4, A-4)</p>
4	<p>Basics of Railway Engineering</p> <p>4.1 Classification of Indian Railways, zones of Indian Railways.</p> <p>4.2 Permanent way: Ideal requirement, Components; Rail Gauge, types, factors affecting selection of a gauge.</p> <p>4.3 Rail, Rail Joints - requirements, types.</p> <p>4.4 Creep of rail: causes and prevention.</p> <p>4.5 Sleepers - functions and Requirement, types - concrete sleepers and their density.</p> <p>4.6 Ballast - function and types, suitability.</p> <p>4.7 Rail fixtures and fastenings – fish plate, spikes, bolts, keys, bearing plates, chairs-types of anchors and anti-creepers.</p> <p>Course Outcome:CO4 Teaching Hours : 8 hrs Marks:12 (R-5, U-5, A-2)</p>
5	<p>Track geometrics, Construction and Maintenance</p> <p>5.1 Alignment- Factors governing rail alignment.</p> <p>5.2 Track Cross sections – standard cross section of single and double line in cutting and embankment. Important terms-permanent land, formation width, side drains.</p> <p>5.3 Railway Track Geometrics: Gradient, curves- types and factors affecting, grade compensation, super elevation, limits of Super elevation on curves, cant deficiency, negative cant, coning of wheel, tilting of rail.</p> <p>5.4 Branching of Tracks, Points and crossings, Turn out- types, components, functions and inspection. Track junctions: crossovers, scissor cross over, diamond crossing, track triangle.</p> <p>5.5 Station -Purpose, requirement of railway station, important technical terms, types of railway station, factors affecting site selection for railway station.</p> <p>5.6 Station yard: Classification- Passenger, goods, locomotive and marshalling yards. Function & drawbacks of marshalling yards.</p> <p>5.7 Track Maintenance- Necessity, Classification, Tools required for track maintenance with their functions, Organisation of track maintenance, Duties of permanent way</p>

	inspector, gang mate Course Outcome:CO5 Teaching Hours : 10 hrs Marks:12 (R-4, U-4, A-4)
6	Waterway & Airways : 6.1 Scope of waterways & airways 6.2 Importance of waterways & airways 6.3 Uses of waterways & airways 6.4 Route alignment, Signaling system. Course Outcome:CO6 Teaching Hours : 3 hrs Marks: 06 (R-2, U-4, A-0)

❖ **Note : Students should visit roads, railway station and road material testing laboratory and prepare a report based on site visit.**

Suggested Specifications Table (Theory):

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Overview of Highway Engineering	4	2	0	06
2	Geometric Design of Highway	4	6	4	14
3	Construction of Road Pavements	2	4	4	10
4	Basics of Railway Engineering	5	5	2	12
5	Track geometrics, Construction and Maintenance	4	4	4	12
6	Waterways & Airways	2	4	0	06
Total		21	25	14	60

References/ Books:

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Transportation Engineering	L.R. Kadiyali Khanna Publishing House, New Delhi	ISBN: 978-9382609-858 Edition 2018
2	Highway Engineering	Khanna S.K., Justo, C E G and Veeraragavan Nem Chand and Brothers, Roorkee.	ISBN : 8185240779, 9788185240770
3	Transportation Engineering	Arora, N. L. Khanna Publishers, Delhi.	ISBN-13 978-93-87394-29-2
4	A Textbook of Railway Engineering	Saxena S. C. and Arora S. P. Dhanpat Rai Publication.	ISBN-13: 978-8189928834
5	Road, Railways, Bridge and Tunnel Engg	Birdi, Ahuja Standard Book House, New Delhi.	ISBN-13: 978-8189401337

E-References:

- 1) <https://www.engineeringcivil.com>
- 2) www.youtube.com/watch?v=2g6s4euVoWo&list
- 3) <http://civildigital.com>
- 4) <http://www.quora.com>
- 5) www.railway-technical.com
- 6) <http://www.nationallibrary.gov.in>

CO Vs PO and CO Vs PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	--	--	1	3	2	2	3	1	--
CO2	3	2	3	--	3	2	3	3	2	2
CO3	3	3	1	3	--	1	3	3	2	3
CO4	3	3	2	2	3	3	3	3	2	2
CO5	3	3	3	1	3	3	3	3	3	3

Industry Consultation Committee:

Sr. No	Name	Designation	Institute/Organisation
1	Mr. Rohan Deokar	Deputy Engineer	MMRDA
2	Mr. Sanjay Kulkarni	Surveyor and Consultant	SRKulkarni Pvt.Firm
3	Mr. K.V. Kelgandre	Sr. Lecturer in Civil Engg.	K.J. Somaiya Polytechnic
4	Ms. S. M. Male	Lecturer in Civil Engg.	Govt. Polytechnic Mumbai

Coordinator,
Curriculum Development,
Department of Civil Engg.

Head of Department
Department of Civil Engg.

I/C, Curriculum Development Cell

Principal

Programme : Diploma in Civil Engineering (Sandwich Pattern)										
Course Code:CE19303				Course Title: Surveying II						
Compulsory / Optional: Compulsory										
Teaching Scheme and Credits				Examination Scheme						
L	P	TU	Total	TH (2 Hrs 30 min)	TS1 (1 Hr)	TS2 (1Hr)	PR	OR	TW	Total
02	04	--	06	60	20	20	50*	--	25	175

Abbreviations: TH- Theory; PR-Practical; TU-Tutorial; TS1 and TS2- Term Tests; OR-Oral Exam; TW: Term Work (progressive assessment), * Indicates assessment by External Examiner else internal assessment
Note: For Minimum passing marks under various heads, refer, examination rule AR26.

Rationale:

Development and planning process for any civil engineering project needs survey of that area to be carried out and various types of survey maps are to be prepared. In the era of globalization today, the technology has brought the significant advancements in surveying instruments and techniques. This results in the availability of the precise digital surveying instruments like Electronic Distance Meter (EDM), Micro Optic Theodolite, Total Station Instrument, and Global positioning System (GPS) which are being used currently due to its accuracy, speed and easy operation of the same. Since, Remote sensing and Geographic Information System (GIS) is a vital discipline and being widely used for plotting and storing spatial information, it is expected the students should know the basics of the same to apply it in field. Therefore, the content of this course are designed to deal with the concepts and the principles related to the various advanced digital surveying instruments and the techniques to operate the same to get the desired out put in a short period with highest accuracy. Through this course students will develop the desired skills and competencies which are expected from them for survey related works. This course is therefore one of the core courses required for Civil Engineers.

Course Outcomes: Student should be able to

CO1	Use Theodolite to perform survey.
CO2	Prepare plan of the areas using Theodolite
CO3	Find distance and elevations using Tacheometer
CO4	Set out simple circular curves
CO5	Prepare plan of the areas using Total Station instrument
CO6	Locate coordinates of stations using GPS

Course Content Details:

Unit No	Topics / Sub-topics
1	Theodolite Surveying : 1.1 Types and uses of Theodolite; Component parts of transit Theodolite and their functions, Reading the Vernier of transit Theodolite 1.2 Technical terms- Swinging, Transiting, Face left, Face right 1.3 Fundamental axes of transit Theodolite and their relationship 1.4 Temporary adjustment of transit Theodolite 1.5 Measurement of horizontal angle- Direct and Repetition method, Measurement of

	<p>vertical Angle. 1.6 Measurement of magnetic bearing of a line, deflection angle.</p> <p>Course Outcome: CO1 , Teaching Hours : 5 hrs Marks: 10 (R-4, U-6, A- --)</p>
2	<p>Theodolite Traversing And Computations 2.1 Traverse Parameters- Open Traverse, Closed Traverse. 2.2 Theodolite traversing by included angle method and deflection angle method. Check in open and closed traverse, Calculations of bearing from angles. 2.3 Traverse computation-Latitude, Departure, Consecutive coordinates, Independent coordinates, Balancing the traverse by Bowditch's rule and Transit rule. 2.4 Gale's Traverse table computation. 2.5 Calculation of area from total Latitudes and Departures.</p> <p>Course Outcome: CO2 Teaching Hours :8 hrs Marks:14 (R-2 , U- 4 , A- 8)</p>
3	<p>Tacheometric surveying : 3.1 Definition , Principle of tacheometry, tacheometer and its component parts, Characteristics of tacheometer. 3.2 Tacheometric formula for horizontal distance with telescope horizontal and staff vertical. 3.3 Field method for determining constants of tacheometer, 3.4 Determining horizontal and vertical distances with tacheometer by fixed hair method when line of sight is inclined and staff held vertical.(Simple Numerical Problems) 3.5 Limitations of tacheometry.</p> <p>Course Outcome:CO3 Teaching Hours : 4 hrs Marks:10 (R- 2, U- 2 , A- 6)</p>
4	<p>Curve setting : 4.1 Introduction, Types of curves used in roads and railway alignments. Relation between degree and radius of curve. 4.2 Elements of simple circular curve. Designation of curve by radius and degree of curve. 4.3 Setting of simple circular curve by offsets from long chord and Rankine's method of deflection angle. 4.4 Simple numerical problems on above.</p> <p>Course Outcome:CO4 Teaching Hours : 4 hrs Marks:10 (R-2 , U-2, A-6)</p>
5	<p>Advanced surveying equipment : 5.1 Principle of Electronic Distance Meter (E.D.M), use of E.D.M., Construction and use of One Second Micro Optic Theodolite, Electronic Digital Theodolite. 5.2 Construction and Use of Total Station. Temporary adjustments of Total Station. 5.3 Use of function keys. Measurements of Horizontal angles, vertical angles, distances and Coordinates using Total Station. 5.4 Traversing, Profile Survey and Contouring with Total Station. 5.5 LiDAR survey (introduction) 5.6 Study and use of Digital Planimeter.</p> <p>Course Outcome:CO5 Teaching Hours :6 hrs Marks:10 (R- 2 , U- 4 , A- 4)</p>
6	<p>Remote sensing and GIS : 6.1 Introduction to Remote sensing, Remote sensing system- Active and Passive system, Applications of remote sensing. 6.2 Construction and Use of Global Positioning System (G.P.S.) 6.3 Geographic Information System (GIS): Definition, Components and Applications in</p>

surveying.
Course Outcome:CO6 Teaching Hours :3 hrs Marks:06 (R- 2 , U- 4 , A- --)

Suggested Specifications Table (Theory):

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Theodolite Surveying	4	6	-	10
2	Theodolite Traversing And Computations	2	4	8	14
3	Tacheometric surveying	2	2	6	10
4	Curve setting	2	2	6	10
5	Advanced surveying equipment	2	4	4	10
6	Remote sensing and GIS	2	4	-	06
Total		14	22	24	60

List of experiments:

Sr. No.	Unit No	COs	Title of the Experiments	Hours
1	1	CO1	Demonstrate the functional utility of Transit Theodolite and Perform temporary adjustments of Transit Theodolite	2
2	2	CO2	Use transit theodolite to carry out Survey Project for closed traverse having minimum 5 sides.	8
3	3	CO3	Use theodolite as a tachometer to compute reduced levels and horizontal distances correctly	2
4	4	CO4	Set out a circular curve by offsets from long chord method.	2
5	5	CO5	Demonstrate the functional utility of the components of Total Station and the function of keys and perform its temporary adjustments.	2
6	6	CO6	Use GPS to locate the coordinates of a station correctly	2
7	1	CO1	Use transit theodolite to measure Horizontal and Vertical angle correctly by direct method	2
8	1	CO1	Use transit theodolite to measure Horizontal angle correctly by method of Repetition	6
9	2	CO2	Prepare Gale's traverse table and Plot the traverse on A1 size imperial drawing sheet for the output of Survey Project mentioned at practical no.2	6
10	4	CO4	Set out a circular curve by Rankine's method of Deflection angles	2
11	5	CO5	Use Total station instrument to measure horizontal distance, horizontal angle and vertical angle.	6
12	5	CO5	Use Total station instrument to carry out Survey Project for closed traverse having minimum 5 sides.	8
13	5	CO5	Plot the traverse on A1 size imperial drawing sheet for the output	6

			of Survey Project mentioned at practical no.12	
14	5	CO5	Use One Second Micro Optic Theodolite / Digital Theodolite to Measure Horizontal angle by direct method	4
15	5	CO5	Use Digital Planimeter to measure area of any irregular figure.	2
Total				60

Note : All experiments are compulsory.

References/ Books:

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Surveying and Levelling	N. N. Basak Tata McGraw Hill Education Private Ltd. New Delhi , 33 rd reprint2010	ISBN 93-3290-153-8
2	Surveying and Levelling volume I & II	Kanetkar, T. P.; Kulkarni, S. V. Pune Vidyarthi Gruh Prakashan	ISBN 978-81-858-2511-3 & ISBN 13: 9788185825007
3	Surveying and Levelling	Subramanian, R. Oxford University Press.	ISBN 13:978-0-19-808542-3
4	Survey I and Surveying II	Duggal, S. K. McGraw Hill Education Private Ltd. New Delhi,	ISBN 978-00-701-5137-6 and ISBN-13: 978-1259029837
5	Surveying Vol.I and Vol. II	Punmia B.C., Jain Ashok Kumar; Jain Arun Kumar Laxmi Publications., New Delhi.	ISBN: 8-17-008853-4 ISBN 13: 9788170088837

E-References:

- https://www.youtube.com/watch?v=n_EMrTbDZak
- <https://www.youtube.com/watch?v=H2AQq2jshgg>
- <https://www.youtube.com/watch?v=C8UKJtZIAWE>
- https://www.youtube.com/watch?v=J6j_sJyyudI
- <http://www.asnu.com.au>
- www.oupinheonline.com
- <http://www.nationallibrary.gov.in>

CO Vs PO and CO Vs PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	3	3	2	1	1	2	2	2	3
CO2	3	3	3	2	2	1	2	2	2	3
CO3	3	3	2	2	2	1	2	2	2	3
CO4	3	3	3	2	2	2	2	2	2	3

CO5	3	3	3	3	2	1	2	2	2	3
CO6	3	2	3	3	2	1	2	2	2	2

Industry Consultation Committee:

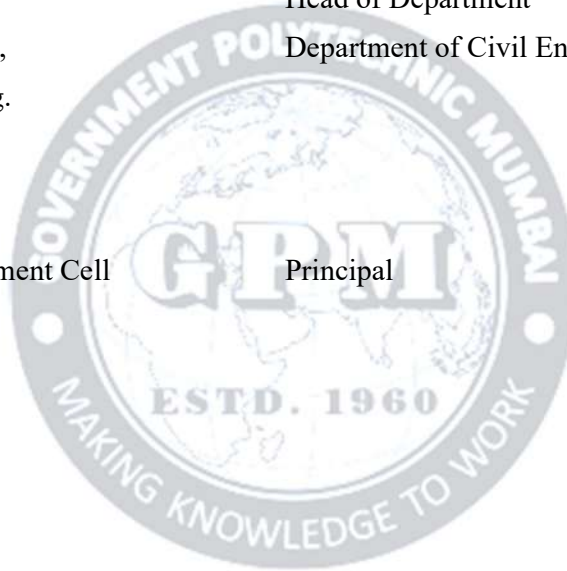
Sr. No	Name	Designation	Institute/Organisation
1	Mr. Rohan Deokar	Deputy Engineer	MMRDA
2	Mr. Sanjay Kulkarni	Surveyor and Consultant	SRKulkarni Pvt.Firm
3	Mr. K.V. Kelgandre	Sr. Lecturer in Civil Engg.	K.J. Somaiya Polytechnic
4	Mr. D. K. Fad	Sr. Lecturer in Civil Engg.	Govt. Polytechnic Mumbai

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I/C, Curriculum Development Cell

Principal



Programme: Diploma in Civil Engineering (Sandwich Pattern)										
Course Code: AM19301				Course Title: Mechanics of Structures						
Compulsory / Optional: Compulsory										
Teaching Scheme and Credits				Examination Scheme						
L	P	TU	Total	TH (2 Hrs 30 min)	TS1 (1 Hrs)	TS2 (1Hrs)	PR	OR	TW	Total
03	02	--	05	60	20	20	--	--	25	125

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR- Practical, OR-Oral, TW: Term Work (progressive assessment) , * Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination
 Note: For Minimum passing marks under various heads, refer, examination rule AR 26. Two practical skill test are to be conducted. First skill test at mid term and second skill test at the end of the term

Rationale:

Understanding the concept and approach of strength of Material is to induce the knowledge of loading applied and corresponding deformation by the students. In addition to analysis and design of structure, it is needs to understand the material properties and their behaviour. The students enable to analyse the structures/bodies under the action of direct and transverse loading and stress condition. The approach of teaching this course is to think critically and apply their skills while solving the problems. The experiments are expected to perform in the laboratory by acquiring knowledge with required skill of material features.

Course Outcomes: Student should be able to

CO1	Compute the Moment of Inertia of symmetrical and asymmetrical structural sections.
CO2	Know the material properties, deformation and stress induced under different loadings
CO3	Determine the elastic constants and volumetric strain subjected to different loadings
CO4	Compute shear force and bending moment along with their distribution diagrams.
CO5	Estimate the shear and bending stresses along with their distribution diagrams.
CO6	Calculate the combined stresses subjected to direct load and bending moment.

Course Content Details:

Unit No	Topics / Sub-topics
1	<p>Moment of Inertia</p> <p>1.1 Concept of moment of inertia for plane bodies, radius of gyration, section modulus, expression for moment of inertia about centroidal axes for regular plane figures such as rectangular, triangular, circular, semicircular and quarter circular sections.</p> <p>1.2 Theorems of Moment of Inertia, Parallel axis theorem, perpendicular axis theorem, polar moment of inertia, Numerical problems on Moment of inertia of composite sections for sections as mentioned in sub-topics 1.1 only.</p> <p>Course Outcome: CO1, Teaching Hours: 06 hrs, Marks:10 (R-2, U-4, A- 4)</p>
2	<p>Simple Stresses and Strains</p> <p>2.1. Definition of elastic, plastic and rigid bodies, concept of deformation, stresses and strains, different properties of Engineering materials.</p> <p>2.2. Axial tensile and compressive load, Hooke's Law, Young's modulus, axial stress, axial</p>

	<p>strain, lateral strain, modulus of elasticity, Poisson's ratio, problems on bars of uniform and stepped cross section.</p> <p>2.3. Behavior of mild steel under tensile loading, stress-strain curve along with important points such as limit of proportionality, yield stress, ultimate stress, breaking stress. Factor of safety, safe stress, working stress.</p> <p>2.4. Concept of composite section, conditions for composite sections, advantages and limitations of composite section (Simple numerical problems asked in the examination).</p> <p>2.5. Concept of temperature stresses and strains, nature of stresses, simple problems on temperature stresses on homogenous sections only.</p> <p>Course Outcome: CO2, Teaching Hours: 10 hrs, Marks:10 (R-2, U-4, A-4)</p>
3	<p>Elastic Constants and Strain Energy</p> <p>3.1. Concept of shear load, shear stress & strain, modulus of rigidity, simple shear, complementary shear, punching shear.</p> <p>3.2. Volumetric strain, bulk modulus, Concept of "uni-axial stress, equation of total strain in Uni-axial direction, elastic constants, relation between elastic moduli (No derivations of these relations). Simple numerical problems.</p> <p>3.4. Concept of strain energy, resilience, proof resilience, modulus of resilience, strain energy stored due to gradual, sudden and impact loadings, simple numerical problems.</p> <p>Course Outcome:CO3, Teaching Hours :06 hrs, Marks:10 (R-2, U-4, A-4)</p>
4	<p>Shear Force and Bending Moment</p> <p>4.1 Concept and definition of shear force and bending moment, sign convention, relation between bending moment, shear force and rate of loading.</p> <p>4.2 Shear force and bending moment diagram for simply supported, cantilever and overhanging beams subjected to concentrated load, uniformly distributed load and couple, point of zero shear, point of contra flexure, simple numerical problems.</p> <p>Course Outcome:CO4, Teaching Hours: 08 hrs, Marks:12 (R-2, U-4, A-6)</p>
5	<p>Shear and Bending Stresses</p> <p>5.1 Concept of pure bending, assumptions in pure bending theory, stress distribution diagram, bending or flexure equation (derivation not required), section modulus, moment of resistance.</p> <p>5.2 Numericals on moment of resistance for symmetrical beam sections. Simple numerical problems on standard sections (No problems built up section)</p> <p>5.3 Shear stress equation with meaning of each terms (Derivation not required)</p> <p>5.4 Shear stress distribution for solid and hollow rectangular section, solid and hollow circular section, I section, T section, Numerical problems on circular and rectangular section only.</p> <p>Course Outcome:CO5, Teaching Hours: 08 hrs, Marks:10 (R-0, U-2, A-8)</p>
6	<p>Direct and Bending Stresses</p> <p>6.1 Concept of direct and eccentric load, eccentricity about one principal axis, different nature of stresses, stress distribution diagram.</p> <p>6.2 Condition for no tension, limit of eccentricity, maximum and minimum stresses core section for rectangular and circular sections, stress distribution diagram at base.</p> <p>6.3 Numerical problems on rectangular and circular column sections subjected to eccentric load on any one principal axis.</p> <p>Course Outcome:CO6, Teaching Hours :07 hrs, Marks:08 (R-0, U-2, A-6)</p>

Suggested Specifications Table (Theory):

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Moment of Inertia	2	4	4	10
2	Simple Stresses and Strains	2	4	4	10
3	Elastic Constants	2	4	4	10
4	Shear Force and Bending Moment	2	4	6	12
5	Shear and Bending Stresses	--	2	8	10
6	Direct and Bending Stresses	--	2	6	08
Total		08	20	32	60

List of experiments:

Sr. No.	Unit No	COs	Title of the Experiments	Hours
1	2	CO2	List the various parts and their functions of Universal Testing Machine along with brief introduction of other test to be conducted on UTM.	2
2	2	CO2	Tension test on mild steel or TMT specimen as per IS 432 (part I) or HYSD or Fe500 steel specimen as per IS 1608 & 1139. Also, draw the stress strain curve by showing important points on it.	2
3	2	CO2	Hardness test on mild steel, Aluminium, copper, brass, cast iron (any two metals).	2
4	2	CO2	Compression test on timber along the grain and cross the grain as per IS 2408.	2
5	5	CO1 & CO5	Flexure test on timber beam of rectangular section as per IS 1708 and IS 2408.	2
6	3	CO3	Izod impact load test & Charpy impact test on aluminium, copper, mild steel, brass, cast iron as per IS 1598 (any two metals).	2
7	5	CO2 & CO5	Water absorption and flexural test on flooring or roofing tiles as per IS 1237, IS 13630, IS 654, IS 2690.	3
8	2	CO2	Water absorption and compression test on wet bricks as per IS 3495 (part II), IS 1077.	3
9	2	CO2	Abrasion test on flooring tiles as per IS 13630 (part 7).	2
10	3	CO3	Shear test on mild steel, Aluminium, copper, brass, cast iron as per IS 5242 (any two metals).	2
11	2	CO2	Neoprin test on rubber to check deformation of rubber.	2

12	4	CO4 & CO6	<p>a) Plot shear force and bending moment diagram for cantilever, simply supported and overhanging beams loaded by concentrated and uniformly distributed loads (two problem on each beam types on A4 graph paper).</p> <p>b) Draw the labeled core section diagram for rectangular and circular sections (use A4 graph paper)</p> <p>c) Draw the three probable labeled stress distribution diagrams at base of a rectangular section subjected to eccentric load about one principal axis (use A4 graph paper).</p>	6
Total				30

Note : All experiments are compulsory.

References/ Books:

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Mechanics of Material	Beer and Jonson Tata McGraw hill	ISBN 9781259097171
2	Strength of material	Singer and Pytel Harper &Raw	ISBN-10 0060453133
3	Mechanics of structures, Volume-I	Junnarkar, S. B. , Charotar Publishing House, Anand.	ISBN :9789385039270988 ISBN 978-93-85039-02-7
4	Strength of Material	S. Ramamurtham Dhanpat Rai and sons	ISBN-10: 818743354X
5	Strength of Material	R. K. Bansal S Chand	ISBN 9789385401961
6	Strength of Material	B. K. Sarkar Tata McGraw hill	ISBN 0070494843
7	Mechanics of structure	Y. N Walavalker Everest pub-House, Pune 30	ISBN NO: EPH-0-89- 890925-17
8	Strength of Material	S.S Bhavikatti Vikas Publishing House Pvt.Ltd	ISBN 8125912193

CO-PO and CO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	2	2	1	--	3	2	2	3
CO2	3	2	2	2	2	1	2	3	2	3
CO3	2	3	3	3	2	1	2	2	2	2
CO4	3	2	3	2	--	--	3	3	2	2
CO5	3	3	3	3	--	--	2	2	2	3
CO6	3	3	3	3	--	--	3	2	3	2

Industry Consultation Committee:

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2	Mr. Sanjay Kulkarni	Surveyor and Consultant	SRKulkarni Pvt.Firm
3	Mr. K.V. Kelgandre	Sr. Lecturer in Civil Engg.	K.J. Somaiya Polytechnic
4	Dr. S.M. Dumne	Sr. lecturer in APM	Govt. Polytechnic Avasari

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Head of Department
Department of Civil Engineering.

I/C, Curriculum Development Cell

Principal



Programme : Diploma in Civil Engineering (Sandwich Pattern)										
Course Code: AM19302				Course Title: Soil Mechanics						
Compulsory / Optional: Compulsory										
Teaching Scheme and Credits				Examination Scheme						
L	P	TU	Total	TH (2Hrs 30 min)	TS1 (1 Hr)	TS2 (1Hr)	PR	OR	TW	Total
03	02	--	05	60	20	20	--	--	25	125

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR- Practical, OR-Oral, TW: Term Work (progressive assessment) , * Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination
Note: For Minimum passing marks under various heads, refer, examination rule AR 26. Two practical skill test are to be conducted. First skill test at mid term and second skill test at the end of the term

Rationale :

Soil Mechanics engineering is important for every structure, since all structures rest on soil. The stability of these structures depends upon behavior of soil and bearing capacity of soil to carry loads under different loading conditions.

The design of foundation of buildings, dams, Tower, embankments, roads, railways retaining walls, bridges is mainly governed by the knowledge of soil characteristics, stress distribution under loading on soil. Bearing capacity of soil etc. The content of this subject are useful to every engineer in the design, execution and stability analysis of structures.

Course Outcomes: Student should be able to

CO1	Know the Origin & Field applications of Soil.
CO2	Know the physical properties and behavior of Soils.
CO3	Classify the soil as per IS classification and to know grading & consistency of Soil.
CO4	State the necessity of compaction and consolidation of soil with it techniques.
CO5	Know & understand factors affecting permeability of soil, and Shear Strength of Soil.
CO6	Know importance of bearing capacity and Know the techniques of stabilization of soil.

Course Content Details:

Unit No	Topics / Sub-topics
1	<p>Introduction to Soil Mechanics :</p> <p>1.1 IS definition of soil, Origin of soil, Formation of soil, Soil-formation in Geological cycle</p> <p>1.2 General characteristics of different types of soils, Overview of different types of soils in India.</p> <p>1.3 Importance of soil in Civil Engineering as construction material in Civil Engineering Structures, such as foundation bed for structures.</p> <p>1.4 Field application of Soil Mechanics for foundation design pavement design, design of earth retaining structures, applications in design of earthen dams in Maharashtra and India.</p> <p>Course Outcome: CO1 Teaching Hours : 3 hrs Marks: 4 (R- 2, U-2, A-0)</p>

2	<p>Physical Properties of Soil :</p> <p>2.1 Soil as Three Phase System. Water content, determination of Water Content by oven drying method as per IS 2720 (part II).</p> <p>2.2 Physical properties: Void ratio, porosity & degree of saturation, density index, unit wt. of Soil mass - Sp. Gravity, bulk density, dry density, Water content</p> <p>2.3 Relation between: Void ratio and porosity. Void ratio, sp. gravity & degree of saturation. (No derivations) .Concept of various index properties of soil for the Purpose of their classification & Use.</p> <p>2.4 Determination of specific gravity by Pycnometer.</p> <p>2.5 Determination of bulk unit weight and dry unit weight by Core Cutter method (Simple Numerical problems on physical properties only)</p> <p>Course Outcome: CO2 Teaching Hours: 8 hrs Marks: 12 (R -4, U- 4, A- 4)</p>
3	<p>Grading & Consistency of soil :</p> <p>3.1 Particle size distribution, mechanical sieve analysis as per IS code, partial distribution curve, Uniformity coefficient and coefficient of curvature graded and uniformly graded soils, IS. Classification of soil. IS : 460</p> <p>3.2 Consistency of soil: stages of consistency, Atterberg's limits of consistency viz. Liquid limit, plastic limit and shrinkage limit, Plasticity index, Consistency index.</p> <p>3.3 Determination of Liquid limit, Plastic limit and Shrinkage limit as per IS code.</p> <p>Course Outcome: CO3 Teaching Hours: 9 hrs Marks: 12 (R- 2, U- 6, A- 4)</p>
4	<p>Compaction & Consolidation :</p> <p>4.1 Concept of compaction & consolidation, difference between consolidation and compaction.</p> <p>4.2 Compaction: Light and Heavy compaction, zero air void line, O.M.C, Std. Proctor test. Modified Proctor test. Factors affecting compaction.</p> <p>4.3 Field methods of Compaction – rolling, ramming and vibration and Suitability of various compaction equipment’s-smooth wheel roller, sheep foot roller, pneumatic typed roller, Rammer and Vibrator.</p> <p>Course Outcome: CO4 Teaching Hours: 10 hrs Marks: 12 (R-4 ,U- 4, A- 4)</p>
5	<p>Permeability & Shear strength of soil :</p> <p>5.1 Definition & concept of permeability. Darcy’s law of permeability, coefficient of permeability, factors affecting permeability, determination of coefficient of permeability by constant head and falling head Permeability tests.</p> <p>5.2 Types of Filters. Use of Geofabric as Filters.</p> <p>5.3 Concept and definition of shear strength of soil. Constituents of shear resistance of soil, definition of Cohesion, internal friction. Angle of shearing resistance.</p> <p>5.4Coulomb's equation & failure envelope, significance of "C" and “ϕ” soils. Types of soil C-soil, ϕ-soil, C-ϕ soil.</p> <p>5.5 Introduction to determination of shearing strength of soil in laboratory by direct Shear test (drained & un drained).</p> <p>Course Outcome: CO5 Teaching Hours: 10 hrs Marks: 12 (R- 2, U- 6, A- 4)</p>
6	<p>Bearing Capacity and Stabilization of Soil :</p> <p>6.1 Concept & definition of bearing capacity, ultimate bearing capacity, safe bearing capacity and allowable bearing Capacity, effect of water table on bearing capacity.(No Numerical)</p> <p>6.2 Factors effecting bearing capacity and methods to improve Bearing capacity of soil.</p> <p>6.3 Explain the concept & occurrence mechanism& effect of ‘Liquefaction’ of soil.</p> <p>6.3 Dynamic Plate load test - procedure, and limitations of test only.</p>

6.4 Soil stabilization: Scope & purpose. 6.5 Methods of soil stabilization – Mechanical soil stabilization – GGBS, fly ash, glass slag, lime stabilization, cement stabilization, bitumen stabilization, fly-ash stabilization. California bearing ratio. 6.6 Uses of Geosynthetic. Course Outcome: CO6 Teaching Hours: 5 hrs Marks: 8 (R- 4, U- 2, A- 2)

Suggested Specifications Table (Theory):

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Introduction to Soil Mechanics	2	2	--	04
2	Physical Properties of Soil	4	4	4	12
3	Grading & Consistency of soil	2	6	4	12
4	Compaction & Consolidation	4	4	4	12
5	Permeability & Shear strength of soil	2	6	4	12
6	Bearing Capacity and Stabilization of Soil	4	2	2	08
Total		18	24	18	60

List of experiments:

Sr. No.	Unit No	COs	Title of the Experiments	Hours
1	02	CO2	Determine water content of given soil sample by oven drying method as per I.S. 2720 part- II	04
2	01	CO1	Introduction to Soil Mechanics and study various field application.	02
3	02	CO1	Determine specific gravity of soil by pycnometer method as per I.S. 2720 part- III	02
4	03	CO2	Determine grain size distribution of given soil sample by Mechanical sieve analysis as per I.S.. 2720 part- IV	02
5	04	CO4	Determine MDD and OMC by Standard proctor test (OR Study of Modified proctor test).	04
6	05	CO5	To determine Coefficient of permeability by Constant head method (OR Falling head test as per I.S.	04
7	06	CO6	Determine shear strength of soil by direct shear test (OR Vane Shea: Test)	04
8	02	CO2	Determine bulk dry unit weight at soil by core cutter method as per I.S. 2720 part-XXIX.	02
9	03	CO3	Determine Liquid Limit of given soil sample as per I.S. 2720 part- V.	02
10	03	CO3	Determine Plastic Limit of given soil sample as per I.S.. 2720 part- V.	02
11	04	CO4	Study of Shrinkage Limit.	02
Total				30

Note : All experiments are compulsory.

References/ Books:

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Soil Mechanics & Foundations Engg.	K.R Arora , Standard Publisher Distributors	ISBN-10: 8180141128; ISBN-13: 978-8180141126
2	Introduction to Soil Mechanics	B.J.Kasmalkar Pune Vidyarthi Grila Prekashan	ISBN 9781407029252
3	Soil Mechanics & Foundations Engg	Gopal Rajan & A.S.R.Rao. New Age international Publisher	ISBN. 978-81-224-1223-9
4	Soil Mechanics	B.C. Punmia Standard Book House,New Delhi	ISBN-10: 8180141128; ISBN-13: 978-8180141126
5	Soil Mechanics	V.N.S Murthy Sai Kripa 'Tectnical Consultants	ISBN-10: 8180141128; ISBN-13: 978-8180141126
6	Geotechnical Engineering (Soil Mechanics)	T.N.Ramanurthy & T.G.Sitharam S Chand and Company Ltd.	ISBN 10: 812192457X
7	Is 2809-1972-Glossary of Terms and Symbols Relating To Soil Engineering.	BIS, New Delhi	
8	Is 1892-1979-Cocce oOf Practice For Sub Surface Investigation of Foundation	BIS, New Delhi	
9	Is 2720-Test For Soil Part 1-1983	BIS, New Delhi	

E-References:

1. https://en.wikipedia.org/wiki/Soil_mechanics
2. <https://www.nap.edu/read/11558/chapter/9>
3. <https://ascelibrary.org/doi/pdf/10.1061/9780784412886.bm02>
4. <https://www.springer.com/journal/11204>
5. <http://www.nationallibrary.gov.in>

CO Vs PO and CO Vs PSO Mapping (CIVIL ENGINEERING)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	2	3	1	1	1	1	1	--	2	1
CO2	2	3	3	3	2	2	2	--	2	1
CO3	2	3	3	3	2	2	2	--	2	1
CO4	1	3	2	2	2	1	1	--	2	1
CO5	2	3	3	2	2	1	1	--	2	1

CO6	2	2	2	2	2	1	1	--	2	1
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I/C, Curriculum Development Cell

Principal



Programme : Diploma in CE/EE/EC/CO/IT/IS/LG/LT (Sandwich pattern)										
Course Code: HU19102				Course Title: Environmental Studies						
Compulsory / Optional: Compulsory										
Teaching Scheme and Credits				Examination Scheme						
L	P	TU	Total	TH (2 Hrs 30 min)	TS1 (1 Hr)	TS2 (1Hr)	PR	OR	TW	Total
--	02	--	02	--	--	--	--	25	25	50

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR- Practical, OR-Oral, TW: Term Work (progressive assessment) , * Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination
 Note: For Minimum passing marks under various heads, refer, examination rule AR 26. Two practical skill test are to be conducted. First skill test at mid term and second skill test at the end of the term

Rationale:

Technicians working in industries or elsewhere essentially require the knowledge of environmental Studies so as to enable them to work and produce most efficient, economical and eco-friendly finished products. Solve various engineering problems applying ecosystem to produce eco – friendly products. Use relevant air and noise control method to solve domestic and industrial problems. Use relevant water and soil control method to solve domestic and industrial problems. To recognize relevant energy sources required for domestic and industrial problems. Solve local solid and e-waste problems.

Course Outcomes: Student should be able to

CO1	Understand the ecosystem and terminology and solve various engineering problems applying ecosystem knowledge to produce eco – friendly products.
CO2	Understand the suitable air, extent of noise pollution, and control measures and acts.
CO3	Understand the water and soil pollution, and control measures and acts.
CO4	Understand different renewable energy resources and efficient process of harvesting.
CO5	Understand Solid Waste Management & E Waste Management, ISO 14000, 45001 & Environmental Management.

Course Content Details:

Unit No	Topics / Sub-topics
1	Ecosystem 1.1 Structure of ecosystem, biotic & Abiotic components 1.2 Food chain and food web 1.3 Aquatic (Lentic and Lotic) and terrestrial ecosystem 1.4 Carbon, Nitrogen, Sulphur, Phosphorus cycle 1.5 Global warming -Causes, effects, process, Green House Effect, Ozone depletion Course Outcome: CO1 Teaching Hours : 6 hrs Marks: 03 (R- NA, U-NA, A- NA)
	Air and Noise Pollution 2.1 Definition of pollution and pollutant, Natural and manmade sources of air pollution (Refrigerants, I.C., Boiler) 2.2 Air Pollutants: Types, Particulate Pollutants: Effects and control (Bag filter, Cyclone

	<p>separator, Electrostatic Precipitator)</p> <p>2.3 Gaseous Pollution Control: Absorber, Catalytic Converter, Effects of air pollution due to Refrigerants, I.C., Boiler</p> <p>2.4 Noise pollution: sources of pollution, measurement of pollution level, Effects of Noise pollution</p> <p>Course Outcome: CO2 Teaching Hours : 6 hrs Marks: 05 (R- NA, U-NA, A- NA)</p>
3	<p>Water and Soil Pollution</p> <p>3.1 Sources of water pollution, Types of water pollutants, Characteristics of water pollutants Turbidity, pH, total suspended solids, total solids BOD and COD: Definition</p> <p>3.2 Waste Water Treatment: Primary methods: sedimentation, froth floatation, Secondary methods: Activated sludge treatment, Trickling filter, Bioreactor, Tertiary Method: Membrane separation technology, RO (reverse osmosis)</p> <p>3.3 Causes, Effects and Preventive measures of Soil Pollution : Causes – Excessive use of Fertilizers, Pesticides and Insecticides, Irrigation, E-waste</p> <p>3.4 Mangroves : Importance, benefits.</p> <p>Course Outcome:CO3 Teaching Hours : 6 hrs Marks: 05 (R- NA, U-NA, A- NA)</p>
4	<p>Renewable sources of Energy</p> <p>4.1 Solar Energy: Basics of Solar energy. Flat plate collector (Liquid & Air). Theory of flat plate collector. Importance of coating. Advanced collector. Solar pond. Solar water heater, solar dryer. Solar stills.</p> <p>4.2 Biomass: Overview of biomass as energy source. Thermal characteristics of biomass as fuel. Anaerobic digestion. Biogas production mechanism. Utilization and storage of biogas</p> <p>4.3 Wind energy: Current status and future prospects of wind energy. Wind energy in India. Environmental benefits and problem of wind energy</p> <p>4.4 New Energy Sources: Need of new sources. Different types new energy sources. Applications of (Hydrogen energy, Ocean energy resources, Tidal energy conversion) Concept, origin and power plants of geothermal energy</p> <p>Course Outcome:CO4 Teaching Hours : 6 hrs Marks:05 (R- NA, U-NA, A- NA)</p>
5	<p>Solid Waste Management OR E- Waste Management, ISO 14000 & Environmental Management For Civil Engineering :</p> <p>5.1 Solid waste generation- Sources and characteristics of : Municipal solid waste, E- waste, biomedical waste.</p> <p>5.2 Metallic wastes and Non-Metallic wastes (lubricants, plastics, rubber) from industries. Collection and disposal: MSW (3R, principles, energy recovery, sanitary landfill), Hazardous waste</p> <p>5.3 Air quality act 2004, air pollution control act 1981 and water pollution and control act1996. Structure and role of Central and state pollution control board.</p> <p>5.4 Concept of Carbon Credit, Carbon Footprint.</p> <p>5.5 Environmental management in fabrication industry.</p> <p>5.6 ISO14000: Implementation in industries, Benefits, ISO 45001:2018</p> <p>5.7 Role of MPCB in factory permit.</p> <p>5.8 Green pro IGBC certification, its benefits</p> <p style="text-align: center;">OR</p> <p>For Computer Engineering & Information Technology :</p> <p>5.1 E-Waste Electronic products which have become unwanted, non-working, obsolete</p> <p>5.2 E-Waste Management Services</p> <p>5.3 Separation of E-Waste from other waste</p>

	<p>5.4 Categorization of E-Waste into old working equipments, old computers, non-working components</p> <p>5.5 Authorized Recycling Facilities</p> <p>5.6 Refurbishing</p> <p style="text-align: center;">OR</p> <p>For Electrical Engineering :</p> <p>5.1 Various e-waste sources, their constituents, and health impacts</p> <p>5.2 e-Waste Problem in India</p> <p>5.3 Initiatives on building awareness in e-waste management.</p> <p>5.4 Current Status of e-Waste Management & Environmental (Protection) Act 1986</p> <p>5.5 Development of waste recycling technologies.</p> <p>5.6 Opportunities of e-Waste Management in India</p> <p>5.7 e-Waste Management techniques</p> <p style="text-align: center;">OR</p> <p>For Electronics Engineering & Instrumentation Engineering :</p> <p>5.1 Solid waste generation- Sources and characteristics of : E- waste, biomedical waste.</p> <p>5.2 Toxicity due to hazardous substances in E waste and their impact</p> <p>5.3 Metallic wastes and Non-Metallic wastes (lubricants, plastics, rubber) from industries. Collection and disposal: MSW (3R, principles, energy recovery, sanitary landfill), Hazardous waste</p> <p>5.4 Domestic E waste disposal and E waste management</p> <p>5.5 Air quality act 2004, air pollution control act 1981 and water pollution and control act1996. Structure and role of Central and state pollution control board.</p> <p>5.6 Concept of Carbon Credit, Carbon Footprint.</p> <p style="text-align: center;">OR</p> <p>For Leather Technology/ Leather Goods & Footware Technology :</p> <p>5.1 Solid waste generation- Sources and characteristics of : Municipal solid waste, E- waste, biomedical waste.</p> <p>5.2 Metallic wastes and Non-Metallic wastes (lubricants, plastics, rubber) from industries. Collection and disposal: MSW (3R, principles, energy recovery, sanitary landfill), Hazardous waste</p> <p>5.3 Air quality act 2004, air pollution control act 1981 and water pollution and control act1996. Structure and role of Central and state pollution control board.</p> <p>5.4 Concept of Carbon Credit, Carbon Footprint.</p> <p>5.5 Environmental management in fabrication industry.</p> <p>5.6 ISO14000: Implementation in industries, Benefits.</p> <p>5.7 Solid waste management in leather and footwear industries</p> <p>Course Outcome:CO5 Teaching Hours : 6 hrs Marks:07(R- NA, U-NA, A- NA)</p>
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Note : Chapter 5 should be teach as per department mentioned.

List of tutorials:

Sr. No.	Unit No	COs	Title of the Experiments	Hours
1	1,2,3, 4,5	CO1,CO2, CO3,CO4, CO5	Prepare a write up on each unit (altogether 5 in number) that summarizes the whole unit and presents important points on it.	14
2	2,3	CO2,CO3	Visit to a local polluted site : Urban/Rural/Industrial/Agricultural and prepare a report	4

			based on visit.	
3	4	CO4	Visit to biomass plant and prepare a report based on visit.	6
4	5	CO5	Visit to municipal solid waste management organization or an authorized e-waste recycling plant and prepare a report based on visit.	6
Total				30

References/ Books:

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Environmental Studies	S.C. Sharma & M.P. Poonia Khanna Publishing House, New Delhi	ISBN: 978-93-86173-09-6
2	Understanding Chemistry	C.N.Rao Universities Press(India) Pvt. Ltd. 2011	ISBN:13-9788173712500
3	Waste water treatment for pollution control and reuse	Arceivala, Soli Asolekar, Shyam Mc-Graw Hill Education India Pvt. Ltd. New york, 2007	ISBN:978-07-062099
4	Elements of Environmental Pollution control	O.P.Gupta Khanna Publishing House, New Delhi	ISBN:13-9789382609667

E-References:

- 1) www.eco-prayer.org
- 2) www.teriin.org
- 3) www.cpcp.nic.in
- 4) www.cpcp.gov.in
- 5) www.indiaenvironmentportal.org.in
- 6) www.whatis.techtarget.com
- 7) www.sustainabledevelopment.un.org
- 8) www.conserve-energy-future.com
- 9) <http://www.nationallibrary.gov.in>

CO Vs PO and CO Vs PSO Mapping (Civil Engineering)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	2	1	3	3	3	--	--	1
CO2	3	3	2	2	3	3	3	--	1	1
CO3	3	3	2	2	3	3	3	--	1	1
CO4	3	3	2	2	3	3	3	--	1	1
CO5	3	3	2	2	3	3	3	--	1	1

CO Vs PO and CO Vs PSO Mapping (Electrical Engineering)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	2	1	3	3	3	--	--	3
CO2	3	3	2	2	3	3	3	--	--	2
CO3	3	3	2	2	3	3	3	--	--	2
CO4	3	3	2	2	3	3	3	--	--	2
CO5	3	3	2	2	3	3	3	--	--	2

CO Vs PO and CO Vs PSO Mapping (Electronics Engineering)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	2	1	3	3	3	--	--	2
CO2	3	3	2	2	3	3	3	--	--	--
CO3	3	3	2	2	3	3	3	--	--	--
CO4	3	3	2	2	3	3	3	--	--	2
CO5	3	3	2	2	3	3	3	--	--	1

CO Vs PO and CO Vs PSO Mapping (Instrumentation Engineering)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	2	2	1	3	3	3	--	--
CO2	3	3	2	2	3	3	3	--	--
CO3	3	3	2	2	3	3	3	--	--
CO4	3	3	2	2	3	3	3	--	--
CO5	3	3	2	2	3	3	3	--	--

CO Vs PO and CO Vs PSO Mapping (Computer Engineering)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	2	1	3	3	3	--	--	--
CO2	3	3	2	2	3	3	3	--	--	--
CO3	3	3	2	2	3	3	3	--	--	--
CO4	3	3	2	2	3	3	3	--	--	--
CO5	3	3	2	2	3	3	3	--	--	--

CO Vs PO and CO Vs PSO Mapping (Information Technology)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	2	1	3	3	3	--	3	--
CO2	3	3	2	2	3	3	3	--	2	--
CO3	3	3	2	2	3	3	3	--	2	--
CO4	3	3	2	2	3	3	3	--	2	--
CO5	3	3	2	2	3	3	3	--	3	--

CO Vs PO and CO Vs PSO Mapping (Leather Technology)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	2	1	3	3	3	--	--	1
CO2	3	3	2	2	3	3	3	--	--	--
CO3	3	3	2	2	3	3	3	--	--	--
CO4	3	3	2	2	3	3	3	--	--	--
CO5	3	3	2	2	3	3	3	--	--	--

CO Vs PO and CO Vs PSO Mapping (Leather Goods & Footwear Technology)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	2	1	3	3	3	--	--	1
CO2	3	3	2	2	3	3	3	--	--	--
CO3	3	3	2	2	3	3	3	--	--	--
CO4	3	3	2	2	3	3	3	--	--	--
CO5	3	3	2	2	3	3	3	--	--	--

Industry Consultation Committee:

Sr. No	Name	Designation	Institute/Organisation
1	Mr. Rohan Deokar	Deputy Engineer	MMRDA
2	Mr. Sanjay Kulkarni	Surveyor and Consultant	SRKulkarni Pvt.Firm
3	Mr. K.V. Kelgandre	Sr. Lecturer in Civil Engg.	K.J. Somaiya Polytechnic
4	Ms. S. M. Male	Lecturer in Civil Engg.	Govt. Polytechnic Mumbai

Coordinator,
Curriculum Development,
Department of Civil Engg.

Head of Department
Department of Civil Engg.

I/C, Curriculum Development Cell

Principal



CE 19304 QGIS

1. Installation of QGIS (Foss: QGIS – English)

Outline: System requirements to install QGIS Add QGIS repositories on Ubuntu Linux OS Installation of QGIS on Ubuntu Linux OS Visit the Official QGIS Website Download QGIS installer for..

2. Downloading GIS Datasets

Outline: Basic introduction to GIS Download open source vector datasets from Natural Earth Data website About geospatial data About vector data View vector data in QGIS Save the map i..

3. Coordinate Reference Systems

Outline: Add layers to the projections in QGIS Change the color of the layer Resize the panels on the canvas View metadata information for layers in QGIS Save selected features from a l..

4. Digitizing Map Data

Outline: Create Point and Polygon shape files Digitize Point and Polygon shape files About Toggle editing and Add Feature tools Open attribute table for Point feature Open attribute tab..

5. Importing Spreadsheets

Outline: Import spreadsheets in CSV format to create a Point layer Convert Point layer to a Polyline layer About QGIS Geoalgorithm About WMS layers Select a WMS map from Bhuvan website ..

6. Vector Data Styling

Outline: Load vector data in QGIS Open attribute table for the layer Learn to style vector layers using, Single symbol styling Categorized styling Grada..

7. Geometric Properties of Vectors

Outline: Show attribute table for a shapefile layer Show selected features from attribute table on the map Change the CRS of the layer Add columns to the attribute table Calculate stati..

8. Raster Data Styling

Outline: Information about download and save example files from the Code files link Change Coordinate Reference System for the given layer Use Identify Features tool to view the pixel va..

9. Creating a Map

Outline: Information on how to download the example files given in Code files link Add vector layer on canvas Show labels for the cities on the map About Print Composer tool Show how t..

10. Creating Dataset Using Google Earth Pro

Outline: About Google Earth Pro program. Download and install Google Earth Pro on Ubuntu Linux 16.04. Navigate Google Earth Pro. Create a point dataset for a few locations in Maharash..

11. Plugins

Outline: Information about the Plugins Enable Core Plugins Install an External Plugin Locate a Plugin on QGIS interface Install QuickMapServices Plugin Download OpenStreetMap data Us..

12. Table Joins and Spatial Joins

Outline: Load vector layer on QGIS canvas Open attribute table for the layer About different types of combining attribute data Add Delimited Text Layer on QGIS canvas Join the attribu..

13. Nearest Neighbour Analysis

Outline: Open shape files showing locations of volcanoes and cities on QGIS canvas Open attribute table for the layers About Nearest Neighbour Analysis Statistical analysis using Distanc..

14. DEM Analysis

Outline: About Digital Elevation Model (DEM) analysis Open Shuttle Radar Topography Mission (SRTM) data website Download DEM data from SRTM data website Save DEM data from SRTM data webs..

15. Create Contour Lines

Outline: Add DEM on QGIS map canvas Clip area in DEM using Clipper tool About contour lines Show contour lines for the DEM Change the color of the contour lines Open attribute table fo..

16. Interpolation

Outline: About Interpolation Methods of interpolation Load the vector layer on QGIS canvas Label the Point features on the map Enable Interpolation Plugin About Inverse Distance Weight..