Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2023-24

Course Information

Programme	B.Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	6CV301
Course Name	Water Supply and Treatment Technology
Desired Requisites:	Basic hydraulics and Engineering Chemistry

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ESE**	**ISE**	**Total**
Tutorial	-	30	50	20	100
Practical	-				
Interaction	-	**Credits: 3**			

Course Objectives

1	To provide the pertinent knowledge on water supply and treatment systems.
2	To impart necessary skill for the design and operation of water treatment units.
3	To prepare students for higher studies and research in the field of water treatment technology.
4	To familiarize the students with latest trends in water treatment.

Course Outcomes (CO) with Bloom's Taxonomy Level

After completion of the course students will able to

CO1	Explain water quality, water supply system and treatment technologies.	Understand
CO2	Analyze and Solve the problems on water related to quality, quantity, conveyance and treatment.	Apply/ Analyse
CO3	Design water treatment units, and pipeline system.	Create

Module	Module Contents	Hours
I	**Water Demand and Quality** Water supply system: Introduction, Components Water demand: Usage and rates, Governing factors, Variation, Estimation (Present, intermediate and ultimate) Water Quality: Physical, Chemical and biological parameters, IS 10500-2012 Sources: Quantitative and Qualitative study	6
II	**Conveyance of water** Source works: Intake (Types and location), Design of river intake, Jack well, Pumping system, Power and capacity of pump Conveyance system: Types (Gravity, gravity fed and pressure), Materials (Ductile Iron, Mild steel and Plastic), Jointing, Laying, Hydraulic testing, Break pressure tank, Design of gravity fed and pressure pipe, Economic design Appurtenances: Valves, Thrust block	6
III	**Water treatment (Aeration, Mixing and Settling)** Treatment: Philosophy, Unit processes and operations Aeration: Process, Types of aerator, Design of cascade aerator Coagulation: Physics and chemistry, Practice, Design of rapid mixer Flocculation: Theory, Design of slow mixer (hydraulic and mechanical) Settling: Theory, Types, Design of rectangular and circular clarifiers for type 1 settling, High rate	8
IV	**Water treatment (Filtration and Disinfection)** Granular Filtration: Classification, Theory of deep mono and dual bed filter, Components of deep bed filter, Clean filter bed head loss, Filter operation, Design of mono and dual bed filter Disinfection: Types, Ideal and non-ideal disinfectant, Kinetics, Chlorination, Chemistry of chlorination, Chlorine demand, Chlorination practice, UV and Ozone disinfection	6

V	**Treatment for TDS removal** Membrane filtration: Types, Basic concepts, Applications Adsorption: Introduction, Basics of Carbon adsorption Ion Exchange: Theory, Design of softener Point of use purifiers, Package drinking water plant, Water plant residual management	**5**
VI	**Water distribution system and Operation-Maintenance** Water distribution: Methods, System configurations, Hydraulic and functional requirements, Hydraulic analysis, Design, Computer applications Service reservoirs: Necessity, Components, Location, Head, and Capacity Concept of 24×7 supply Leakage : Causes, Detection and Control Water quality in distribution: Causes of deterioration, Source trace, Water age, Nodal constituent concentration Operation and maintenance: Water supply system	**9**

Text Books

1	Modi, P. N., "Water Supply Engineering (Environmental Engineering I)", Standard Book House, 6th Edition, 2018.
2	Raju, B.S.N., "Water Supply and Wastewater Engineering" Tata McGraw Hill Private limited, New Delhi, 2nd Edition, 2000.
3	Garg, S. K. "Water Supply Engineering", Khanna Publishers, 33rd Edition, 2010

References

1	"Manual on Water Supply and Treatment", CPHEEO, Ministry of Housing and Urban Affairs Development, Govt., of India, New Delhi, 1999.
2	Hammer M, J and Hammer M, J, "Water and Wastewater Technology", PHI learning private limited, 7th Edition, 2018
3	Nathanson, J. A., "Basic Environmental Technology", PHI Learning private limited, 5th Edition, 2009.
4	Davis, M, L, and Cornwell, D, A, "Introduction to Environmental Engineering", Tata McGraw Hill Publishing Company, Special Indian Edition, 2010.

Useful Links

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3			1			2			1		1	3	3
CO2		3		1			2			1		1	3	3
CO3			3	1			2			1		1	3	3

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

Assessment

ISE: Assignment on real-life problem pertaining to modules 1 to 3 and evaluated by test/quiz/presentation/oral; Field visit to water treatment plants and evaluated by test/quiz/presentation/oral.
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with 60-70% weightage for course content (normally last three modules) covered after MSE.

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2023-24

Course Information

Programme	B.Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	6CV302
Course Name	Soil Mechanics
Desired Requisites:	Fluid mechanics, Solid Mechanics

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
Practical	-				
Interaction	-	**Credits: 3**			

Course Objectives

1	To provide the knowledge of behaviour of soil under stresses to students
2	To prepare students for competitive examinations and higher studies in the field of geotechnical engineering.

Course Outcomes (CO)

After completion of the course students will able to

CO1	**Explain** soil parameters, **derive** their interrelationships and **classify** the soil based upon them.	Understand Apply
CO2	**Explain** concepts and **solve** problems related to topics of seepage through soil, effective stress in soil and soil compaction	Understand analyse
CO3	**Evaluate** the stiffness of soil using shear strength parameters and ground settlements against time	Evaluate

Module	**Module Contents**	**Hours**
I	**Introduction:** Definitions: soil mechanics, soil engineering, rock mechanics, geotechnical engineering, Three-phase system and phase relationships, Determination of various soil parameters in laboratory	6
II	**Soil Classification** Grain size and hydrometer analysis, Plasticity Characteristics of Soil and their determination, Unified and IS soil classification system.	6
III	**Permeability and Seepage :** One dimensional flow, Darcy's law, laboratory methods for determination of co-efficient of permeability, Seepage through soils - two-dimensional flow, flow nets, uplift pressure, piping, Principle of effective stress, capillarity, seepage force and quicksand condition.	7
IV	**Compaction of Soils:** Theory of compaction, laboratory determination of optimum moisture content and maximum dry density, Compaction in field: specifications and quality control.	6
V	**Compressibility and Consolidation of soils** Comparison between compaction and consolidation, initial, primary & secondary consolidation, spring analogy, Interpretation of consolidation test results, Terzaghi's theory of consolidation, Final settlement of soil deposits	7
VI	**Shear Strength of Soils** Mohr-Coulomb failure criterion, Determination of effective and total shear strength parameters, Stress-Strain characteristics of clays and sand; Stress paths.	7

Text Books

1	Gopal Ranjan and Rao A.S.R., "*Basic and Applied Soil Mechanics*", New Age International Publishers, 3rd Edition, 2016

2	Murthy, V. N. S., "*Textbook of Soil Mechanics and Foundation Engineering Geotechnical Engineering Series*", CBS publishing; 1st edition, 2018
3	Das B. M., "*Principles of Geotechnical Engineering*", Cengage Learning, 7th Edition
4	Gulhati, S. K. and Datta, M., "*Geotechnical Engineering*", Tata McGraw-Hill, 1st Edition, 2005
References	
1	Robert D. Holtz, William D. Kovacs, Thomas C. Sheahan, *"An Introduction to Geotechnical Engineering"*, Pearson, 2nd Edition, 2015
2	Couduto, Donald P. , "*Geotechnical Engineering – Principles and Practices*", Prentice-Hall., 2nd Edition, 2017
3	Budhu M., "*Soil Mechanics and Foundations*", John Wiley & Sons, Inc, 3rd Edition, 2011
Useful Links	
1	https://www.youtube.com/watch?v=Lng0hVDvsu0&list=PLOzRYVm0a65dtbpo_DP7acjsLYdmWT99r
2	https://www.youtube.com/watch?v=V1m3cB-Aqy8&list=PL940DD62E8781E147

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2			1									1	3
CO2	3	3											2	3
CO3	3	3											2	3

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

Assessment

- The assessment is based on MSE, ISE, and ESE.
- MSE shall be typically on modules 1 to 3.
- ISE shall be taken throughout the semester in the form of a teacher's assessment. Mode of assessment can be field visits, assignments, etc., and is expected to map at least one higher-order PO.
- ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
- For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing).

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Course Information

Programme	B. Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	6CV303
Course Name	Transportation Engineering
Desired Requisites:	Engineering Surveying

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**ISE**	**MSE**	**ESE**	**Total**
Tutorial	-	20	30	50	100
Practical	-				
Interaction	-	**Credits: 3**			

Course Objectives

1	To give exposures to highway planning and designing of geometric elements of roads and rails.
2	To comprehend to geometric standards and various practices adopted for construction of roads and rails.
3	To develop skills of construction and maintenance and traffic management of highways and railways.

Course Outcomes (CO) with Bloom's Taxonomy Level

After the completion of the course students will be able to

CO1	**Explain** and **apply** the principles of planning and designing of various geometric elements of highways and railways.	Understand & Apply
CO2	**Apply** knowledge for selection of construction materials and **select** appropriate methods of construction and maintenance for roads and railways.	Apply
CO3	**Analyse and adopt** various techniques for traffic management of highways and railways and assess the geometric standards of pavements.	Analyse & Evaluate

Module	Module Contents	Hours
I	**Highway Developments** Role and importance of infrastructure development, Various modes of transportation, characteristics and suitability, history of highway engineering, development plans, various organizations involved in highway development, their setups and working, finance options. **Highway Alignment:** basic requirements for an ideal alignment, factors governing highway alignment, highway location surveys and studies.	6
II	**Geometric Design-I:** Cross sectional elements, sight distance, reaction time, analysis of safe sight distance, and analysis of overtaking sight distance, intersection sight distance	6
III	**Geometric Design-II:** Horizontal, vertical and transition curves, super elevation, widening, requirements as per IRC, Basic concepts and methods of pavement design.	7
IV	**Highway Construction:** Materials – Stone aggregates, soil, cement, bitumen properties and their testing. Construction methods for various types of flexible and rigid pavements, Drainage, repairs and maintenance. **Traffic Engineering:** Traffic Surveys, traffic flow and capacity, traffic regulation and control; design of road intersections and parking facilities, Webster method of traffic signal design, Introduction to Traffic Safety	8
V	**Railway Engineering Part I** History, Indian Railways, Permanent Way – components, types, functions, Rails: Coning of wheels and tilting of rails **Geometric Design:** Alignment, Gradients, Horizontal and transition curves, superelevation design, Points and crossings, track junctions, track resistances, tractive effort.	6

VI	**Railway Engineering Part II** **Stations and Yards:** Purpose, location, site selection, types and layouts. **Signalling and Interlocking:** Objectives, types, principle of interlocking, control of train movements. **Construction and Maintenance:** Methods, Materials, special measures for high speed track, maintenance of tracks and traffic operations, Modern trends in railways.	6

	Text Books
1	Bindra S. P., "A Course in Highway Engineering", Dhanpat Rai Publications, 5th Edition 2012.
2	Khanna S. K., Justo C. E. G., Veeraragavan A, "Highway Engineering", Nem Chand & Sons, 10th edition, 2018
3	Arora S. P. and Saxena S. C., "A Textbook of Railway Engineering", Dhanpat Rai Publications Pvt, Ltd, 7th Edition, 2006.

	References
1	Kadiyalai, L. R., "Traffic Engineering and Transport Planning", Khanna Publishers, 8th Edition 2013
2	Mundrey J. S., "Railway Track Engineering", Tata McGraw Hills Publications, 4th Edition, 2009.
3	Wright, Paul H. and Dixon, "Highway Engineering", John Wiley & Sons; 7th Edition 2003.

	Useful Links
1	https://nptel.ac.in/courses/105/101/105101087/
2	https://nptel.ac.in/courses/105/101/105101008/
3	https://nptel.ac.in/courses/105/105/105105107/

CO-PO Mapping

	Programme Outcomes (PO)												PSPO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3												1	
CO2	3												2	
CO3		3	3										2	

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of a teacher's assessment. The mode of assessment can be field visits, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE + ISE + ESE) are needed, and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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Course Information

Programme	B.Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	6CV304
Course Name	Design of steel Structures
Desired Requisites:	Solid Mechanics & Structural Mechanics

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**ISE**	**MSE**	**ESE**	**Total**
Tutorial	-	20	30	50	100
Practical	-				
Interaction	-	**Credits: 3**			

Course Objectives

1	To illustrate various design philosophies and concept of plastic analysis.
2	To impart the knowledge of design of various steel members and their connections.
3	To provide knowledge of design practical steel structures such as industrial sheds, steel buildings etc.

Course Outcomes (CO) with Bloom's Taxonomy Level

CO1	Apply the concept of limit state for design of steel structures.	Apply
CO2	Calculate the strength of steel structural members and connections.	Evaluate
CO3	Design steel structures such as industrial sheds, steel buildings etc.	Create

Module	**Module Contents**	**Hours**
I	**Introduction** Introduction to steel structures, standard rolled steel sections and their properties and designation, Design philosophies, Types of loads acting on structure, Introduction to IS Codes and specifications: IS 875, IS 800. Introduction to Plastic theory- Plastic hinge concept, Plastic collapse load, Plastic moment, Shape factor, Plastic section modulus.	7
II	**Connections** Types of bolts, bolted and welded connections. Concentric and eccentrically loaded connections, simple connection of bracket plates to columns.	6
III	**Tension and Compression Members** Various types of failures such as yielding of gross area, rupture at critical section and block shear. Design of single and double angle sections. Buckling classification of various sections, Buckling curves, Design of single and double angle struts in trusses,	7
IV	**Beams and Girders** Laterally restrained and unrestrained simply supported beams. Design of compound beams and welded plate girder. Selection of section and positioning of stiffeners, Curtailment of flange plates.	7
V	**Columns and Column Bases** Column subjected to Axial load and biaxial bending, built up column sections, laced and battened columns. Column bases: Design of slab base, gusseted base, moment resisting base, Anchor bolts.	6

VI	**Roofing System** Trusses, Purlins. Dead load, Live load and Wind load calculations. Analysis and design of truss. Connections of truss to column. Introduction to Pre-Engineered Buildings (PEB)- Primary Members / Main Frames, Secondary Members / Cold Formed Members, Roof & Wall Panels.	7

Text Books	
1	Duggal S.K., "Limit state design of steel structures", Tata McGraw-Hill Publications, New Delhi, 2nd Edition, 2014.
2	Shiyekar, M. R., "Limit state design in structural steel", PHI learning Pvt.Ltd Publications 2nd Edition 2013.
3	Subramanian N., "Design of steel structures", Oxford University Press, 2010.

References	
1	Dayaratnam, P., "Design of steel structures", S. Chand Publication, New Delhi, 2008.
2	Englekirk, Robert, "Steel structures: controlling behavior through design", John Wiley and Sons, 2003.
3	Gaylord, Edwin and Gaylord, Charles, "Design of steel structures", Tata McGraw Hill Publishing Company Ltd., New Delhi, 3rdEdition, 2010
4	IS 800-2007 "Code of Practice for General Construction in steel", and IS 875-1987 part 1 to 5; "Code of Practice for Design Loads (other than earthquake) for building structures", Bureau of Indian Standards, New Delhi.

Useful Links	
1	https://archive.nptel.ac.in/courses/105/105/105105162/
2	https://onlinecourses.nptel.ac.in/noc19_ce25/preview

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3												1	1
CO2		3											2	2
CO3			3										3	3

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

Assessment

- The assessment is based on MSE, ISE, and ESE.
- MSE shall be typically on modules 1 to 3.
- ISE shall be taken throughout the semester in the form of a teacher's assessment. Mode of assessment can be field visits, assignments, etc., and is expected to map at least one higher-order PO.
- ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
- For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing).

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Course Information

Programme	B. Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Semester V
Course Code	6CV351
Course Name	Water Quality Analysis Laboratory
Desired Requisites:	Engineering Chemistry Laboratory and Water Treatment Technology

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	-	**LA1**	**LA2**	**Lab ESE**	**Total**
Practical	2 h/week	30	30	40	100
Tutorial	-				
Interaction	-	**Credits: 1**			

Course Objectives

1	To provide the students hands-on practice for analyzing physical, chemical and bacteriological quality of water.
2	To develop the skills required for applying knowledge to decide the chemical dose requirements.

Course Outcomes (CO)

After completion of the course students will be able to

CO1	***Apply*** the analysis techniques to determine the physical, chemical and bacteriological water quality parameters.	Apply
CO2	***Design*** experiment/s to address real-life cases pertinent to water quality.	Design
CO3	***Analyze*** and ***interpret*** the results to assess the quality of water for potability.	Analyse

List of Experiments / Lab Activities

List of Experiments:

1. ***Physical and chemical water quality parameters:***
   a. Electrical conductivity and Total Dissolved Solids
   b. Turbidity and Total Suspended Solids
   c. Calcium
   d. Sulphate
   e. Residual chlorine
   f. Fluoride
   g. Iron and Manganese
2. ***Biological water quality parameter***
   a. Most Probable Number (MPN)
3. ***Application of water quality analysis***
   a. Optimal coagulant dose by jar test
   b. Chlorine demand for surface/groundwater
   c. Efficiency of water purifier (reverse osmosis/resin) for hardness removal.
   d. Assessment of river/bore well water pollution through chloride content.
   e. Efficiency of cascade aerator for dissolved oxygen enhancement.

Text Books

1	Metcalf and Eddy, "Wastewater Engineering Treatment and Reuse", Tata McGraw Hill Publication, 5th Edition, 2014.
2	Sawyer. C. N. And McCarty. P. L., "Chemistry for Environmental Engineers", Tata McGraw-Hill Publishing Company Limited, 5th Edition, 2003.

References

1	IS 3025 (Relevant parts), Bureau of Indian Standards.

2	Standard Methods for the Examination of Water and Wastewater, APHA, 23rd Revised Edition, 2017.
Useful Links	
1	https://www.youtube.com/channel/UCXOTUs9n8uhzYzBC8NHeacA

CO-PO Mapping

	Programme Outcomes (PO)												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
CO1				2			1						2		
CO2				2			2						2		
CO3			1	3			2	1		2			2		

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

Assessment

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.

Assessment	Based on	Conducted by	Typical Schedule (for 26-week Sem)	Marks
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab activities, attendance, journal	Lab Course Faculty	During Week 15 to Week 18 Marks Submission at the end of Week 18	40

Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments.

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Course Information

Programme	B.Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	6CV352
Course Name	Soil Mechanics Laboratory
Desired Requisites:	Soil Mechanics

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	-	**LA1**	**LA2**	**Lab ESE**	**Total**
Tutorial	-	30	30	40	100
Practical	2 h/week				
Interaction	-	**Credits: 1**			

Course Objectives

To develop the skills to find Index properties and engineering properties of soil and the classification of soil.

Course Outcomes (CO)

After completion of the course students will able to

CO1	Determine index properties of soil and Classify soil sample	Understand & Apply
CO2	Determine Engineering properties of soils and interpret the behaviour of soils based upon experimental results data.	Understand & Analyse
CO3	Demonstrate use of MS-Excel for data analysis and interpretation	Understand

List of Experiments / Lab Activities

List of Experiments:

1. Identification and classification of soils by field procedures
2. Determination of specific gravity of soil
3. Particle size distribution - Mechanical sieve analysis
4. Determination of consistency limits and indices
5. Determination of coefficient of permeability by constant and variable head method
6. Determination of MDD and OMC for soil by Standard Proctor compaction test
7. Determination of Field density of soil
8. Demonstration of one-dimensional consolidation test
9. Determination of shear strength parameters of soil by direct/box shear test
10. Determination of Unconfined compression test of soil.
11. Demonstration of triaxial compression/shear test
12. Determination of California Bearing Ratio

Text Books

1	Shamsher P. and Jain P. K., "Engineering Soil Testing", 4th edition, 1999
2	Beauro of Indian Standards, IS 2720 (Various sections / parts)
3	Sharma R. K., "A Laboratory Manual on Soil Mechanics: Testing and Interpretation" 2016

References

1	Bowles J. E., "Engineering Properties of Soil & Their Measurement", Tata - McGraw-Hill Publishing Co., 4th Edition, 1992.

2	Das B. M. , "Soil Mechanics Laboratory Manual", 6th edition
3	Lambe T.W., "Soil Testing", Willey Eastern Ltd., New Delhi, 1st edition, 1978
Useful Links	
1	https://research.iitgn.ac.in/stl/labmanual/
2	https://onlinecourses.nptel.ac.in/noc21_ce54/preview
3	https://smfe-iiith.vlabs.ac.in/

CO-PO Mapping

	Programme Outcomes (PO)												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
CO1				3									1	3	
CO2				3									1	3	
CO3					3								2		

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High

Assessment

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.

Assessment	Based on	Conducted by	Typical Schedule (for 13-week Sem)	Marks
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab activities, attendance, journal	Lab Course Faculty	During Week 13 to Week 18 Marks Submission at the end of Week 13	40

Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 13-week semester. The actual schedule shall be as per academic calendar.

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Course Information

Programme	B. Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	6CV353
Course Name	Highway Materials and Traffic Engineering Laboratory
Desired Requisites:	Highway Engineering

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	-	**LA1**	**LA2**	**Lab ESE**	**Total**
Tutorial	-	30	30	40	100
Practical	2 hrs/week				
Interaction	-	**Credits: 1**			

Course Objectives

1	To explain parameters governing the selection of best pavement construction material.
2	To develop ability to assess various properties of highway materials and various practices adopted for construction.
3	To demonstrate the method of design of bituminous mixes for flexible pavement.
4	To give the exposure of various tests adopted on field to characterise the road construction materials and management of traffic.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, students will be able to,

CO1	**Apply** practices to examine the properties of road construction material for their use in road construction and to manage the road traffic.	Apply
CO2	**Interpret** the test results of materials and **compare** the values with Indian standard codal provision to decide the suitability of road construction material	Analyse
CO3	**Comprehend** concept of bituminous mix design for flexible pavements.	Understand

List of Experiments / Lab Activities

List of Experiments:

1. Specific Gravity of Bitumen
2. Penetration Test on Bitumen
3. Viscosity of Cutback Bitumen
4. Softening Point of Bitumen
5. Flash and Fire Point of Bitumen
6. Ductility of Bitumen
7. Bituminous Extraction Test
8. Spot Speed Study
9. Intersection Traffic Volume Study
10. Impact and Abrasion test of Aggregate
11. Demonstration of Marshall Stability Test

Text Books

1	Khanna S. K., Justo C. E. G., Veeraragavan A, "Highway Engineering", Nem Chand & Sons, 10th edition, 2018

2	Khanna S. K., Justo C. E. G., Veeraragavan A, " Highway Materials And Pavement Testing", Nem Chand & Sons, 2013

References	
1	IS 1201 to 1220 (1978). "Methods for testing tar and bituminous materials." Bureau of Indian Standards (BIS), New Delhi, India.
2	IS 73 (2013). "PAVING BITUMEN — SPECIFICATION" Bureau of Indian Standards (BIS), New Delhi, India
3	MORTH Specifications for Road and Bridge Works, Indian Roads Congress (IRC) 5th Revision 2013, New Delhi, India

Useful Links	
1	https://ts-nitk.vlabs.ac.in/List of experiments.html

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1				3					1	1			1	
CO2				3					1	1			2	
CO3			3		1				1	1			2	

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

Assessment

There are three components of lab assessment, LA1, LA2, and Lab ESE
IMP: Lab ESE is a separate head of passing. Lab ESE is treated as End Semester Exam and is based on all experiments/lab activities.

Assessment	Based on	Conducted by	Typical Schedule	Marks
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab Performance and documentation	Lab Course faculty	During Week 13 to Week 18 Marks Submission at the end of Week 18	40

Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments.

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Course Information

Programme	B.Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	6CV355
Course Name	Presentation and Report Writing
Desired Requisites:	-

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	-	**LA1**	**LA2**	**Lab ESE**	**Total**
Tutorial	-	30	30	40	100
Practical	2 h/week				
Interaction	-	**Credits: 1**			

Course Objectives

1	To enhance students' communication skills.
2	To expose students to ethical and professional conduct in technical writing.
3	To provide necessary knowledge to write different types technical reports.

Course Outcomes (CO)

After completion of the course students will able to

CO1	Demonstrate presentation skills.	Apply
CO2	Use of modern tools for effective technical writing.	Apply
CO3	Prepare Engineering and other reports	Create

Lab Activities

1. Standard Practice of technical writing (Ethics, Plagiarism, Citation and Referencing Conventions)
2. Presentation on
    a. General Topic (Non-Engineering)
    b. Technical Topic
    c. Case Study
3. Study and presentation on Technical Articles (min. 2) (Research papers from reputed journals)
4. Use of Mendeley Desktop, Grammerly and Quillbot
5. Study of
    a. Detailed project report (DPR) for an engineering project
    b. Research Proposal
6. Preparation Engineering Reports
7. Preparation of Resume and Statement of Purpose (SOP)
8. Study on Ethics, Copyright and Intellectual Property Right

Text Books

1	Anderson P. V. "Technical Communication: A Reader-Centered Approach" CENGAGE , 8th Ed. 2014
2	Turk C. and Kirkman J. "Effective Writing: Improving Scientific, Technical, and Business Communication" Routledge, Chapman & Hall, New York, 2nd edition, 1989
3	

References

1	Smith D., Worthington and Jefferson S. "Technical Writing for Success", 4th edition, CENGAGE, 2017
2	Rhodes M. W. and David R. Topolewski "Writing in Engineering: A Brief Guide"

Useful Links	
1	

CO-PO Mapping														
	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1					2	1		2		3		1		1
CO2					2			2		1		1		
CO3					2	1		2		3		1		1
The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High														

Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.				
Assessment	**Based on**	**Conducted by**	**Typical Schedule (for 13-week Sem)**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab activities, attendance, journal	Lab Course Faculty	During Week 13 to Week 18 Marks Submission at the end of Week 13	40
Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 13-week semester. The actual schedule shall be as per academic calendar.				

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Course Information

Programme	B. Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	6CV311
Course Name	Professional Elective 1: Remote Sensing and GIS
Desired Requisites:	Surveying, Transportation Engineering

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
Practical	-				
Interaction	-	**Credits: 2**			

Course Objectives

1	Introduce students the necessary knowledge and concepts in the field of RS and GIS and their civil engineering significance. To develop the sense of Applications of Spatial technology among civil engineering students.
2	Introduce the technique of interpreting, classifying and applying various RS and GIS data in Civil Engineering decision making
3	Enable students in decision making to manage the Civil Engineering related spatial problems before preparing and implementing any civil engineering action plans

Course Outcomes (CO) with Bloom's Taxonomy Level

After completion of the course students will able to

CO1	Identify and describe the fundamentals of Remote Sensing and photogrammetry.	Understand
CO2	Demonstrate, Classify and Interpret spatial data to extract maximum information.	Analyse
CO3	Investigate, and generate spatial database.	Apply

Module	**Module Contents**	**Hours**
I	**Introduction of Remote Sensing** Definition and principles of remote sensing, Electromagnetic spectrum and interaction with Earth's surface, Platforms and sensors used in remote sensing, Image acquisition and interpretation, Early history of aerial photography, simple camera, aerial camera, types of aerial photographs , taking vertical aerial photograph and flight planning	4
II	**Remote Sensing Data** Types of remote sensing data (optical, thermal, radar, LiDAR, etc.), Image characteristics and properties, Data formats and preprocessing techniques, Radiometric and geometric corrections	4
III	**Image Interpretation and Analysis** Visual interpretation of images, Digital image processing techniques, Image enhancement and classification, Change detection and time-series analysis	4
IV	**Introduction to GIS** Definition and principles of GIS, Components of a GIS (hardware, software, data, methods), Spatial data models (vector and raster), Coordinate systems and map projections	5
V	**Data Management and Analysis in GIS** Data input, storage, and retrieval, Map design principles, Symbolization and map elements, Map layout and composition	4

VI	**Applications of Remote Sensing and GIS:** Land use and land cover mapping, Environmental monitoring and assessment, Urban planning and management, Natural resource management and conservation	5

Text Books	
1	Reddy M. A., "Remote Sensing & Geographical Information System", BS Publications, Hyderabad, 2002
2	Lillesand T. M. & Kiefer R., "Remote Sensing and Image Interpretation" , John Villey, 1999
3	Longley P. A., Goodchild M. F., David J. Maguire, and David W. Rhind. "Geographic Information Science and Systems"
References	
1	Jensen J. R. "Remote Sensing & Digital Image Processing", Department of Geography University of South Carolina Columbia, 2003
2	Panda B C, "Principles of Remote Sensing", Viva Books Private Limited, 2002

CO-PO Mapping

	Programme Outcomes (PO)												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
CO1	2													2	
CO2		2		1	3								2	2	
CO3				1	3									1	

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

Assessment

- The assessment is based on MSE, ISE, and ESE.
- MSE shall be typically on modules 1 to 3.
- ISE shall be taken throughout the semester in the form of a teacher's assessment. Mode of assessment can be field visits, assignments, etc., and is expected to map at least one higher-order PO.
- ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
- For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing).

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Course Information

Programme	B. Tech. Civil Engineering
Class, Semester	Third Year B. Tech., Semester V
Course Code	6CV312
Course Name	Professional Elective 1: Plastic and Electronic Waste Management
Desired Requisites:	-

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 2			

Course Objectives

1	To provide students with a comprehensive understanding of the environmental and health impacts associated with plastic and e-waste, and the urgency of effective management.
2	To explore policy frameworks, regulations, and initiatives related to plastic and e-waste management, including extended producer responsibility (EPR) programs and circular economy approaches.
3	To acquaint students with the sources, types, and generation patterns of plastic and e-waste, and the challenges associated with their collection, recycling, and disposal.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO1	Explain the environmental and health impacts of plastic and e-waste, and the need for sustainable management practices.	Understand
CO2	Perceive policy frameworks, regulations, and initiatives related to plastic and e-waste management, and propose effective strategies for implementing extended producer responsibility (EPR) programs and promoting circular economy practices.	Understand
CO3	Identify the sources, types, and generation patterns of plastic and e-waste, and the challenges and opportunities in their collection, recycling, and disposal.	Analyse

Module	**Module Contents**	**Hours**
I	**Introduction to Plastic and E-Waste Management** Understanding the environmental and health impacts of plastic and e-waste, Overview of the global plastic and e-waste crisis, Introduction to plastic and e-waste management approaches, Policies and regulations related to plastic and e-waste management	4
II	**Plastic Waste Management** Sources and types of plastic waste, Plastic waste collection methods and technologies, Sorting and segregation techniques for plastic waste, Recycling and reprocessing of plastic waste, Innovations and initiatives in plastic waste management	5
III	**E-Waste Generation and Sources** Sources of e-waste: consumer electronics, IT equipment, appliances, etc., Understanding the composition and hazardous components of e-waste, E-waste generation trends and patterns, E-waste collection methods and systems	4
IV	**E-Waste Recycling and Disposal** Recycling technologies for e-waste: dismantling, shredding, and separation, Hazardous substance management in e-waste recycling, Resource recovery from e-waste: precious metals, rare earth elements, etc., E-waste disposal methods: landfilling, incineration, and their environmental impacts	5
V	**Extended Producer Responsibility (EPR) and Policy Framework**	4

Acknowledge CP

	Overview of Extended Producer Responsibility (EPR) programs, EPR policies and regulations for plastic and e-waste management, International and national initiatives to promote EPR, Case studies on successful EPR implementation	
VI	**Circular Economy and Sustainable Practices** Design for sustainability: eco-design and product life extension, Promoting repair, refurbishment, and resale of electronics, Circular economy approaches for plastic and e-waste management, Future trends and innovations in circular economy practices	4

Textbooks	
1	Chandrappa R. and Das D. B, "Solid Waste Management: Principles and Practice" 2012
2	Tchobanoglous G., Theisen H., Vigil S. "Integrated Solid Waste Management", 2014
3	Subramanian M. N. "Plastics Waste Management: Processing and Disposal", Wiley publications, 2nd Edition, 2019

References	
1	Pope K. "Global Waste Management: Models for Tackling the International Waste Crisis", Kogan Page publishing, 1st Edition, 2020
2	Williams E., Hieronymi K., Kahhat R. "E-waste Management From Waste to Resource", Tayler and Francis, 2012.
3	Letcher T. "Plastic Waste and Recycling: Environmental Impact, Societal Issues, Prevention, and Solutions", Academic Press Inc. 2020.

Useful Links	
1	https://www.youtube.com/watch?v=_r5rHyMHKEg&list=PL3MO67NH2XxJngITU5LDb2md2TX4Gqex-
2	https://www.youtube.com/watch?v=sF7NhoIp1C8&list=PL3MO67NH2XxJngITU5LDb2md2TX4Gqex-&index=11
3	https://www.youtube.com/watch?v=VjKRPOUMu-8&list=PLbRMhDVUMngcUlCNSaynDVY7T1XFaMFFy&index=5

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1						3	3							
CO2	1					3	3						1	
CO3	2					3	3						1	

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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Course Information

Programme	B. Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Semester V
Course Code	6CV313
Course Name	Professional Elective 1: Air and Noise Pollution Control
Desired Requisites	Engineering Physics, Environmental Science

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs./week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 2			

Course Objectives

1	To provide knowledge on physics of atmosphere, meteorology and its relation to air pollution, different types of air pollution control equipment.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO1	***Recognize*** and ***summarize*** scientific and engineering principles for air pollution studies	Understand
CO2	***Apply*** appropriate dispersion models ***estimate*** air pollutant concentrations	Apply Evaluate
CO3	***Analyze*** situations leading to air pollution and ***design*** air pollution control strategies with due consideration to technical, environmental, health, safety and social considerations	Analyze Evaluae

Module	**Module Contents**	**Hrs**
I	**Air pollution: A retrospective** Air pollution: sources and types and effects on biosphere, National and international air emission standards; Air Quality Index (AQI)	3
II	**Meteorology** Physics of atmosphere, Solar radiation, Wind circulation, Lapse rate, Inversion, Stability conditions, Pasquil stability model, Maximum mixing depth, Wind rose, Plume behaviour, Global effects of air pollution: Green house effects, acid rain and ozone layer depletion, Heat island effect, Visibility, Photochemical reaction	5
III	**Dispersion of pollutants in the atmosphere** Eddy diffusion model, the Gaussian dispersion model, Point source, Line source, Maximum ground level concentration, Determination of stack height, Sampling time corrections, Effects of inversion trap	4
IV	**Control of Air Pollution** Control Equipment for Particulate Matter: Operation design and component detailing of Settling chamber, Cyclone, Wet collectors, Fabric filter, and Electrostatic precipitator	5
V	**Motor Vehicle Emissions** Automobile Source Emission of pollutants from automobiles, Photochemical smog, Reduction of emissions by different methods	4
VI	**Noise Pollution** Basics of acoustics and specification of sound; Sound power, Sound intensity and sound pressure levels; Plane, Point and line sources, Multiple sources; Outdoor and indoor noise propagation; Psycho-acoustics and noise criteria, Effects of noise on health, Annoyance rating schemes; Noise standards and limit values; Noise instrumentation and monitoring procedure. Noise indices.	5

Textbooks	
1	Wark and Warner, "Air Pollution", C.F., H.R. Publication, 1st Edition, 1978.
2	Nevers N., "Air Pollution Control Engineering" McGraw-Hill, New York, 2nd edition, 1995.
3	Martin Crawford, "Air Pollution and Control", Tata McGraw Hill Publication, 1st Edition, 1976.
References	
1	Richard W. Boubel and Bruce Turner, "Fundamentals of Air Pollution", Academic Press, New York, Third edition, 1994.
2	Stern A. C., "Air Pollution Vol. I and II", Allied Publishers Limited, 1st Edition, 1994.
3	Rao H.V.N. and Rao M. N., "Air Pollution", Tata McGraw Hill, 1st Edition, 1989.
4	Cunniff PE, "Environmental Noise Pollution", McGraw Hill, New York, 1987.

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2						3							
CO2		2					3							
CO3			2			3	3							

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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Course Information

Programme	B. Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	6CV314
Course Name	River Engineering
Desired Requisites:	Open Chanel Hydraulics and Water Resources Engineering

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	0 Hrs/week	30	20	50	100
		Credits: 2			

Course Objectives

1	To provide the student fundamentals of fluvial geomorphology
2	To expose to concept of analysis of river flow hydraulics, hydraulic geometry and stable alluvial channels and fluvial design for river bank protection
3	To prepare the students for higher studies and research in the field of river engineering.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO1	*Explain* the fundamentals of fluvial geomorphology.	Understand
CO2	*Apply* the knowledge of fundamental of analysis of river flow hydraulics, and hydraulic geometry for stable alluvial channels.	Apply, Analyse
CO3	*Design* of fluvial stable alluvial channels and river bank protection work.	Evaluate

Module	**Module Contents**	**Hours**
I	Fluvial Geomorphology: Fluvial system, variables for alluvial rivers, regime concept, river classifications, thresholds of river morphology, hydraulic geometry, meander platform, geomorphic analysis of river channel responses.	4
II	Foundation of Fluvial Process: Hydraulics of flow in river channel, physical properties of sediments, scour criteria and scour-related problems, alluvial bed forms and flow resistance, sediment movements in Rivers, flow in curved channels.	5
III	Regime Rivers and Responses: Analytical basis for hydraulic geometry, design of stable alluvial channel,	5
IV	Analytical river morphology, plan geometry and processes of river meanders	4
V	Modeling of river channel changes: Mathematical model for erodible channels	4
VI	Gradual breach morphology tidal responses of river and delta system, fluvial design of river bank protection	4

Textbooks

1	Howard C. H., "Fluvial Processes in River Engineering", John Wiley & Sons, 1988.
2	Kumar S, "River Engineering", Khanna Publishing House; 1st edition, 2020
3	Gupta K D, "River Engineering", Vayu Education Of India Edition, First Edition, 2014.

References

1	Kumar D.S., "Practical River And Canal Engineering", Read Books, 2011.
2	US Army Corps of Engineers "Engineering and Design: River Hydraulics (Engineer Manual 1110-2-1416)", Khanna Publishers, New Delhi, 8th Edition, 1993.

Useful Links	
1	
2	

CO-PO Mapping														
	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2												1	1
CO2		3											2	2
CO3			3										3	2
1: Low, 2: Medium, 3: High														

Assessment
The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 2 and 60% weightage on modules 3 to 4. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing).

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Course Information

Programme	B.Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	6CV315
Course Name	Professional Elective 1: Advanced Surveying
Desired Requisites:	Engineering Surveying

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	0	30	20	50	100
Practical	-				
Interaction	-	**Credits: 2**			

Course Objectives

1	To understand advanced surveying techniques and geospatial techniques.
2	To develop an ability to analyze land profiles in logical manner and will be able to apply well understood principles in planning and design of engineering structures on the Earth's surface.
3	To adopt suitable survey technique and select equipment based on the required level of accuracy and prevailing field conditions

Course Outcomes (CO)

CO1	**Study** modern surveying equipment effectively to improve quality of surveys.	Understand
CO2	**Analyze** and synthesize data from the aerial photographs and remote sensing images to prepare thematic maps.	Analyze
CO3	**Analyze and Solve** surveying problems by using remote sensing, GIS and GPS.	Analyze & Apply

Module	Module Contents	Hours
I	**Geodetic Surveying** Principles, Classification if triangulation systems, Selection of stations, Signals and towers, Baseline measurement and correction, Extension of base, base net, Satellite station, Reduction to center, Introduction to theory of errors and technical terms.	5
II	**Total Station Survey** Principle, Data observations, Software	5
III	**Aerial Photogrammetry** Aerial Photogrammetry, Basic concepts, Geometry of vertical photographs, Scale and Flying height, Relief displacement, Flight planning computations, Stereoscopy and Parallax, Photo mosaic, Elements of photo interpretation.	5
IV	**Remote Sensing** Concepts and foundations of remote sensing, Characteristics of Remote sensing satellites and sensors	5
V	**GIS** Overview of GIS, data input and output, data management.	3
VI	**GPS** Introduction to GPS, Geodesy, Working principle of GPS, Measurement and mapping techniques.	3

Text Books

1	Chandra A.M., Higher Surveying, New Age International Private Limited, 2015
2	Arora K. R. "Surveying", Vol. 1 & 2, Standard Book House, 16th edition, 2018.
3	Agrawal N.K., "Essentials of GPS" Spatial Network Pvt. Ltd., Hydrabad1997.

References

1	James Anderson and Edward Mikhail, Surveying: Theory and Practice, McGraw Hill Education; 7th edition, 2017
2	Lillesand T. M. and Kiefer. R.W., "Remote Sensing and Image Interpretation", 4th Edition, John Wiley and Sons, New York, 2002
3	R. E. Davis, F. Foote and J. Kelly, "Surveying; Theory and Practice", McGraw Hill Book Company, New York.
Useful Links	
1	

CO-PO Mapping

	Programme Outcomes (PO)												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	1											1		
CO2	1	1											1		
CO3	3	1													

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of a teacher's assessment. The mode of assessment can be field visits, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed, and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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Course Information

Programme	B.Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	6CV316
Course Name	Professional Elective 1: Structural Mechanics
Desired Requisites:	Solid Mechanics, Structural Analysis

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
Practical	-				
Interaction	-	**Credits: 2**			

Course Objectives

1	To explain the concept of matrix methods of structural analysis.
2	To inculcate applications of flexibility and stiffness methods to solve indeterminate structures.
3	To illustrate the concept and applications of finite element method in structural engineering.

Course Outcomes (CO) with Bloom's Taxonomy Level

CO1	**Apply** the concepts of matrix methods of structural analysis.	Applying
CO2	**Analyse** indeterminate structures by using structure oriented and element approach.	Analysing
CO3	**Calculate** the nodal displacements and member forces by using finite element method.	Evaluating

Module	**Module Contents**	**Hours**
I	**Flexibility Method- Beams & Frames** Flexibility coefficient matrix, Compatibility conditions, Development of flexibility matrix equations, Analysis of indeterminate beams and rigid jointed frames by using flexibility method.	5
II	**Flexibility Method- Trusses** Analysis of indeterminate trusses by using flexibility method, Stresses due to lack of fit or error in length, Temperature stresses.	4
III	**Stiffness Method- Structure Approach** Stiffness coefficient matrix, Relation between flexibility and stiffness coefficient matrix, Development of stiffness matrix equilibrium equations, Analysis of continuous beams and frames.	5
IV	**Stiffness Method–Element Approach: Beams & Frames** Formulation for element stiffness matrix for beam element and plane frame element, Local and global coordinates, Transformation of matrices, Analysis of continuous beams and frames by using direct stiffness method.	5
V	**Stiffness Method–Element Approach: Trusses** Direct stiffness method- Element approach, Development of element stiffness matrix and nodal load vector for truss element, Analysis of trusses.	5
VI	**Finite Element Method** Introduction finite element method, Basic concept, General procedure of finite element analysis, Discretization, nodes, element incidences, displacement model, shape function, selection of order of polynomials, Principle of minimum potential energy, variational principle, Development of element stiffness matrix and nodal load vector for bar element, Applications to bars with constant and variable cross sections subjected to axial forces.	5

Text Books

1	Gere, J. M. & Weaver, W., "Matrix Analysis of Framed Structures", CBS Publishers and Distributor, 2nd Edition, 2004.
2	Godbole, P. N., "Introduction to Finite Element Methods", I K International Publishing House Pvt. Ltd., 1st Edition, 2013.
3	Reddy, C. S., "Basic Structural Analysis", McGraw Hill Education, 3rd edition, 2017.

References	
1	Cook, Robert D., Malkus, David S., Plesha, Michael E., and Witt, Robert J., "Concepts and Applications of Finite Element Analysis", 2003.
2	McGuire, William, Gallaghar, Richard H. and Ziemian, Ronald D., "Matrix Structural Analysis", John Wiley, 2nd Edition, 2000.
3	Meghare A. S. and Deshmukh S. K., "Matrix Methods of Structural Analysis" Charotar Publishing House, 2nd Edition, 2016.

Useful Links	
1	https://nptel.ac.in
2	https://nptel.ac.in/content/syllabus_pdf/105105180.pdf
3	https://onlinecourses.nptel.ac.in/noc20_me91/preview
4	HoD Applied Mechanics - YouTube

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3													3
CO2		3												2
CO3			2		2									1

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of a teacher's assessment.
The mode of assessment can be field visits, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed, and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing

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Course Information

Programme	B. Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	6CV317
Course Name	Professional Elective 1: Advanced Concrete Technology
Desired Requisites:	Concrete Technology

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**ISE**	**MSE**	**ESE**	**Total**
Tutorial	-	20	30	50	100
Practical	-				
Interaction	-	**Credits: 2**			

Course Objectives

1	To give exposure to in depth knowledge and concepts of the manufacturing of cement and hydration of cement.
2	To provide conceptual knowhow of admixtures used in concrete to improve properties of concrete and develop skills to design concrete mixtures.
3	To make students conversant with durability issues of concrete and special types of concrete.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO1	Perceive and Apply the knowledge cement, concrete and admixtures to fulfil the requirement of construction industries.	Understand & Apply
CO2	Demonstrate and analyse durability of issues of concrete and apply knowledge special concretes.	Understand & Analyze
CO3	Design a concrete mixes according to construction industries requirements.	Design

Module	**Module Contents**	**Hours**
I	**Cement** Clinkering reactions, Hydration Reactions & Chemistry of Cement paste, Setting of Cements, Heat of Hydration, Microstructure of hydrated cement paste.	5
II	**Admixtures in Concrete - I** Specification, Functions, Classification and Working principles. Chemical Admixtures: Plasticizers, Super-plasticizer, Accelerators, Retarders, Air entraining agents, Speciality Admixture, Compatibility of Admixtures	4
III	**Admixtures in Concrete - II** Specification, Functions, and Classification. Mineral Admixtures: Fly ash, Silica Fume, Slag, Rice husk ash, Metakaolin Pozzolanic Reactivity of Mineral admixtures	4
IV	**Concrete Mix Design** Factors to be considered, Concrete mix design of High Strength Concrete and SCC by IS: 10262 (2019) method, Concept of Particle Packing density, Statistical quality control	5
V	**Special Concretes:** Fibre reinforced concrete, Ultra-high strength concrete and Pervious Concrete. Fresh Properties of Self Compacting Concrete	3
VI	**Durability of Concrete** Permeability and Pore Structure, Ionic Diffusion, Chemical Attack (Sulphate, Chloride, acid, leaching, Carbonation), Physical Attack (freeze-thaw), Corrosion of reinforcement, Alkali-Aggregate Reaction	5

Text Books

1	Mehta P. K. and Paulo J. M. M, "Concrete – Microstructure, Properties and Material", McGraw Hill Professional 3rd Edition, 2009.
2	Neville A. M. and Brooks J. J., "Concrete Technology", Pearson Education Limited, 1987

3	Shetty M. S., "Concrete Technology", S. Chand & Company Ltd. New Delhi, 7th Edition, 2013.
References	
1	Neville A. M., "Properties of Concrete", Prentice Hall, 5th edition, 2012
2	Newman J., Choo B.S., Advanced Concrete Technology-Constituent Materials, Elsevier Ltd. 1st edition, 2003
3	Taylor H.F.W., Cement chemistry, Thomas Telford, 2nd edition, 1997
Useful Links	
1	https://www.digimat.in/nptel/courses/video/105102012/L01.html
2	https://www.digimat.in/nptel/courses/video/105104030/L01.html
3	https://www.digimat.in/nptel/courses/video/105106176/L01.html

CO-PO Mapping

	Programme Outcomes (PO)												PSPO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1			2				2					1	2	
CO2			2				1						2	
CO3			3		2							2	3	

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of a teacher's assessment. The mode of assessment can be field visits, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE + ISE + ESE) are needed, and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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Course Information

Programme	B. Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	6CV318
Course Name	Professional Elective 1: Airport Engineering
Desired Requisites:	Transportation Engineering

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
Practical	-				
Interaction	-	**Credits: 2**			

Course Objectives

1	To give exposure to airport construction and maintenance aspects of airport and make familiar with components of airport.
2	Impart the techniques of planning and designing of the airport components like runways,taxiways, terminal building, hangars etc. along with the drainage and traffic controls methods.
3	To make conversant with various construction methods of airport.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO1	Demonstrate the knowledge required for planning and designing of various components of airports.	Understand
CO2	Explain and Apply design considerations of the various components of airports.	Understand & Apply
CO3	Compare and apply various techniques used in the construction of airports and Analyze professional practices for solving problems in the field of airport engineering.	Understand & Analyze

Module	**Module Contents**	**Hours**
I	**Module 1: Introduction to Airport Engineering** Introduction, History, Terminology, characteristics, airport classification, and organizations concerned with Airport Engineering, components of aircraft, Role of civil engineering in airport planning and design.	5
II	**Module 2: Planning** Factors influencing site selection for airports, Land use planning and zoning regulations, Runway orientation and site-specific considerations, Safety considerations and clearance requirements, airport obstructions, layouts, zoning laws.	5
III	**Module 3 : Geometric Design of Runways, Taxiways** Designing: Runways, Runway classification, Runways-orientation, basic runway length, geometric design.Taxiways- layouts, geometric design.	4
IV	**Module 4 : Terminal Buildings of Airport** **Terminal Buildings:** Site selection, facilities, aprons, gate positions. Hangars: Function, types, requirements.	4
V	**Module 5: Air Traffic Control System** Air Traffic Control: VFR, IFR, visual aids, lighting and marking. Heliports: Characteristics, site selection, planning, size, obstructions, orientation, marking and lighting.	4
VI	**Module 6: Airport Drainage and Environmental Considerations** Surface water management at airports, Drainage: Necessity, types. Environmental	4

	impacts of airports and mitigation measures.	

Text Books	
1	Robert M. Horonjeff, Francis X. McKelvey, William J. Sproule, and Seth Young "Planning and Design of Airports".
2	Khanna S. K. & Arora M. G., "Airport Planning and Design", Nem Chand and Brothers, 6th Edition, 2012.
3	Surinder Singh "Airport Engineering: Planning, Design, and Operations".5th Edition, 2015.

References	
1	Richard de Neufville, Amedeo Odoni, " Airport System: Planning, Design and Management",Mc Graw Hill Education
2	Horonjeff R., McKelvey F., Sproule W., Young S., "Planning and Design of Airports", McGraw Hill Professional, 5th Edition, 2010.

CO-PO Mapping

	Programme Outcomes (PO)												PSPO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1			2										2	
CO2			2										2	
CO3			3	2									2	

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of a teacher's assessment. The mode of assessment can be field visits, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed, and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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Course Information

Programme	B. Tech. (Other than Civil Engg.)
Class, Semester	Third Year, Semester II
Course Code	6OE301
Course Name	Building Planning and Construction
Desired Requisites:	Nil

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial		30	20	50	100
		Credits: 3			

Course Objectives

1	To impart Necessary knowledge and concepts in Building Planning and functional design.
2	To impart Necessary knowledge and concepts in the utilization of building materials, their properties and their applications in construction of building.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO1	Grasp the principles of planning, building bye laws to apply in the planning of residential/public buildings in relation to functional planning.	Understand
CO2	Classify the various components and their relationships in buildings and identify the materials and building services to be adopted for different buildings.	Apply

Module	Module Contents	Hours
I	**Site, Building and Building Drawings** Categories of buildings, Types of Residential buildings, Site selection, Factors influencing selection of site, guidelines for planning and drawing of buildings, Positions of various building components, types of drawings and relevant scales.	6
II	**Principles of Building Planning and Building Bye laws** Principles of planning: Aspects, prospect, Privacy, Furniture, Roominess, Grouping, Circulation, Sanitation, Lighting, Ventilation, Flexibility, Elegance, Sanitation, Economy. Bye laws: Minimum plot size, building frontage, open spaces, standard dimensions in buildings, Provision for light & ventilation, FSI, Height of Building.	7
III	**Planning concepts in Buildings** Requirements in different types of buildings, Integrated approach to planning in various aspects like aesthetics, landscape, interior, etc. Guidelines for planning & drawing residential and public buildings.	6
IV	**Components of building** Sub structure, Foundations, Bearing Capacity of Soils, Types of Shallow and Deep foundations, Conditions for their applications, masonry, Bonds, Doors, Windows, Staircases, Roofs and Floors, Flooring and their Applications	7
V	**Construction Materials** Types, Engineering properties and Uses of Bricks, Stones, Aggregate, Lime, Cement, Steel, Aluminium, PVC, Glass. Concrete: Ingredients, Preparation, Properties of concrete, Types of concrete and their applications	7

VI	**Building Services and Finishes** Plumbing services for water supply, plumbing services for drainage, symbols, Electrification, symbols of electrical fixtures, Types of Plastering and Pointing, Defects, Paints and Varnishes Types, Application, Methodology on various surfaces, Defects.	7

Textbooks	
1	R.K.Rajput S. 'Building Materials' S. Chand Publications.
2	Bindra and Arora, "Building Construction", Dhanpat Rai and Sons
3	Kumarswamy and Kameshwar Rao., "Building Planning and Design," Tata McGraw Hill Pvt. ltd, 1995.
4	Civil Engineering Drawing - V. B. Sikka, S. K. Kataria and Sons.
References	
1	Punmia, Jain, Jain, "Building Construction", Laxmi Publications ltd. 2005
2	Mantri Institute's 'The A to Z of Practical Building Construction and its Management' Mantri Institute of Devp. and Research. Pune, 1994.
3	Building drawing with Integrated approach – Shah, Kale & Patki, Tata Mc Graw Hill Pub.
4	National Building Code of India and SP- 7.
Useful Links	
1	https://www.youtube.com/watch?v=pYLKA4YQMyI&list=PL46yD-wnVQqxZ8f-_g1PZaFjJIxnJWyFE
2	https://www.youtube.com/watch?v=4kLXfCGB_RI&list=PL46yD-wnVQqxZ8f-_g1PZaFjJIxnJWyFE&index=5
3	https://www.youtube.com/watch?v=2tb1heySCx0
4	https://www.youtube.com/watch?v=Y0Y8zuETHOQ

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2													
CO2	2												1	

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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Course Information

Programme	B. Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	6OE302
Course Name	Open Elective 1: Disaster Management
Desired Requisites:	B. Tech. (Civil Engineering)

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
Practical	-				
Interaction	-	**Credits: 3**			

Course Objectives

1	To provide students with necessary knowledge in understanding Disasters, Man-made Hazards and Vulnerabilities.
2	To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
3	To develop rudimentary ability to respond to their surroundings with potential disaster response in areas.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO1	Explain disasters, man-made hazards and vulnerabilities.	Understand
CO2	Apply knowledge to develop effective communication skills for providing information, warnings, and raising public awareness about disaster risks.	Apply
CO3	Assess vulnerability and various methods of risk reduction measures.	Evaluate

Module	**Module Contents**	**Hours**
I	**Module 1: Introduction to Disaster Management** Definition, scope, and objectives of disaster management, Types of disasters (natural and man-made): – Earthquake, Landslide, Flood, Drought, Fire, and their characteristics, Historical perspectives on disasters and lessons learned.	6
II	**Module 2: Disaster Risk Assessment and Management** Understanding disaster risk and vulnerability, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Hazard identification, mapping, and assessment techniques, Risk analysis and risk reduction strategies, Land-use planning and zoning.	7
III	**Module 3: Disaster Response and Recovery** Incident command systems and emergency operations centers, Search and rescue operations, Medical response and triage, Temporary sheltering and logistics.	6
IV	**Module 4: Mitigation and Resilience** Structural and non-structural measures for disaster mitigation, Community-based disaster risk reduction, Climate change adaptation strategies, Post-disaster reconstruction and recovery planning.	7
V	**Module 5: Technology and Innovation in Disaster Management** Geospatial technologies and remote sensing applications. Information management systems and decision support tools. Use of drones, mobile applications, and social media in emergencies.	7

VI	**Module 6: Case Studies and Field Works** Land Slide, Earthquake, Drought, Storm, Flood, Forest fire, Space Based Inputs for Disaster Mitigation, Management and field works related to disaster management.	6

Textbooks	
1	Singhal J.P. Disaster Management, Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423
2	Bhattacharya Tushar, Disaster Science and Management, McGraw Hill India Education Pvt. Ltd., 2012. ISBN-10: 1259007367, ISBN-13: 978-1259007361]
3	Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011
References	
1	Govt. of India: Disaster Management Act, Government of India, New Delhi, 2005.
2	Karlene Roberts and Donald D. H. Chávez "Disaster Risk Management: Systems Analysis and Tools"
Useful Links	
1	

CO-PO Mapping														
	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1						2								
CO2						2								
CO3						2								

Assessment
The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of a teacher's assessment. The mode of assessment can be field visits, assignments etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed, and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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Course Information

Programme	B.Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	6CV321
Course Name	Waste Management and Pollution Control
Desired Requisites:	Water Supply and Treatment Technology, Environmental Science

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**ISE**	**MSE**	**ESE**	**Total**
Tutorial		20	30	50	100
Practical	-				
Interaction	-	**Credits: 3**			

Course Objectives

1	To introduce concepts of wastewater engineering, solid waste processing, air and noise pollution control.
2	To provide pertinent knowledge for the design and operation of waste management facilities.
3	To prepare students for higher studies and research in the field of waste management and pollution control.
4	To make students aware of recent advances in waste management.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, students will be able to,

CO1	**Explain** collection and characteristics of wastewater and solid waste; monitoring air quality and meteorological impact; treatment/processing/control technologies for prevention of pollution associated with wastewater, solid waste, air and noise.	Understand
CO2	**Analyze and Solve** the problems on wastewater and solid waste associated with generation, characteristics, collection and treatment/processing; air and noise pollution.	Analyse/ Apply
CO3	**Design** sewerage and wastewater treatment system.	Create

Module	**Module Contents**	**Hours**
I	**Wastewater and Collection** Wastewater: Sources, Flow rate and variations, Quantitative estimation, Characteristics Gravity sewer collection system: Nomenclature, Manhole, Inverted siphon, Pumping station Design of sanitary and storm sewer, Computer application SEWERCAD	**6**
II	**Introduction to Wastewater treatment** Wastewater treatment: Philosophy, Unit operations and unit processes Primary treatment: Screening, Grit removal, Settling Biological/Secondary treatment: Fundamentals of aerobic and anaerobic treatment, Classification	**5**
III	**Aerobic Wastewater treatment** Aerobic suspended growth: Conventional Activated Sludge Process (ASP) and modifications, Process design and operating parameters (ASP), Operational problems (ASP), Process design of oxidation ditch and Waste stabilization pond, Biological filtration	**9**

IV	**Decentralized treatment and Disposal** Decentralized treatment: Concept, Septic tank and soakage pit, Anaerobic baffled reactor (ABR), Anaerobic filter (AF), Constructed wetland (CW), Typical system Advances in wastewater treatment : Moving bed bioreactor (MBBR), Membrane bioreactor (MBR), Cyclic ASP Disposal of wastewater: Methods, Effluent standards Stream pollution: Self-purification (Stream rejuvenation), DO sag curve, Streeter Phelp's equation for point source, Stream classification	**8**
V	**Solid waste** Sludge: Characteristics, thickening, dewatering, digestion, disposal Solid Waste: Characteristics, Generation, Collection and transportation Engineered systems for solid waste processing: Mechanical, Thermal, Biological Sanitary land fill: Location, Components, Design	**6**
VI	**Air and Noise pollution** Air Pollution: Meteorological parameters, Ambient air quality monitoring, Air quality standards Air pollution control: Approaches and equipment for particulate and gaseous pollutants Noise pollution: Permissible limits of noise pollution, measurement of noise, Control of noise pollution.	**6**

Text Books	
1	Nathanson, J. A., "Basic Environmental Technology", PHI Learning private limited, 5th Edition, 2009.
2	Modi, P. N., "Wastewater Engineering" Standard Book House, 6th Edition, 2018.
3	Peavy H, S, Rowe D, R, and Tchobanoglous G, "Environmental Engineering", McGraw-Hill Book Company, Indian Edition, 2017.

References	
1	Hammer M, J and Hammer M, J, "Water and Wastewater Technology", PHI learning private limited, 7th Edition, 2018.
2	"Manual on Sewerage and Sewage Treatment", CPHEEO, Ministry of Housing and Urban Affairs Development, Govt., of India, New Delhi, 2013.
3	"Manual on Municipal Solid Waste Management", CPHEEO, Ministry of Housing and Urban Affairs Development, Govt., of India, New Delhi, 2016.
4	Hammer M, J and Hammer M, J, "Water and Wastewater Technology", PHI learning private limited, 7th Edition, 2018.

Useful Links	
1	https://nptel.ac.in/course.html

CO-PO Mapping

	Programme Outcomes (PO)												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
CO1	3			1			2			1		1	3	3	
CO2		3		1			2			1		1	3	3	
CO3			3	1			2			1		1	3	3	

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High

Assessment

ISE: Assignment on real-life problem pertaining to modules 1 to 3 and evaluated by test/quiz/presentation/oral; Field visit to water treatment plants and evaluated by test/quiz/presentation/oral.

MSE: Assessment is based on 50% of course content (Normally first three modules)

ESE: Assessment is based on 100% course content with 60-70% weightage for course content (normally last three modules) covered after MSE.

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Course Information

Programme	B.Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	6CV322
Course Name	Quantity Survey and Valuation
Desired Requisites:	Building Materials and Construction, Building Planning and Design

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**ISE**	**MSE**	**ESE**	**Total**
Tutorial	-	20	30	50	100
Practical	-				
Interaction	-	**Credits: 3**			

Course Objectives

1	To provide students with necessary knowledge and skills in specification writing, estimating, costing, methods of execution of works.
2	To make students aware of prevailing professional practices.
3	To provide a sound understanding of concepts and principles of valuation of immovable properties.

Course Outcomes (CO)

At the end of the course, students will be able to,

CO1	**Explain** elements of estimating and valuation of immovable properties.	Understand
CO2	**Construct** specifications and quantity sheets for various items of traditional as well as unconventional civil works.	Create
CO3	**Analyze** rates and **estimate** costs of different civil works; and identify an appropriate method for execution of a civil work.	Apply & Analyse
CO4	**Appraise** the different methods for valuation and **value** the different immovable properties.	Analyse & Evaluate

Module	**Module Contents**	**Hours**
I	**Elements of Estimating and Costing** Meaning, Purpose, Types of Estimates, Various terminologies in Estimating and Costing Concept of item of work, Units and modes of measurement, Introduction to IS 1200.	4
II	**Specifications and Quantity Sheets** Necessity and Types of specifications, Essential requirements of specifications, Contents of detailed specifications, Specifications for various items of works, PWD method, Measurement and Abstract Sheets, Long Wall and Short Wall Method, Bar Bending Schedule (BBS), Quantity sheets for buildings.	10
III	**Rate Analysis** Definition, Purpose, Importance, Factors affecting rate, Procedure of Rate Analysis, Categories of Labours, Rate analysis of typical items of work: PCC, RCC (Footing, Column, Beam, Lintel, Slab), Brick Masonry, Plastering, Flooring.	6
IV	**Elements of Valuations** Purposes of valuation, factors affecting valuations, Concept of value, price and cost, various types of values and essential characteristics of market value, Freehold and leasehold properties, Different types of leases. Different types of rents, Depreciation, different methods, sinking fund, obsolescence, land as a real estate.	6
V	**Computational parameters and Physical Method of valuation** Years Purchase, Single rate and dual rate, reversion value of land, net yield, capitalized value, Valuation tables. Valuation of properties including land and building, Valuation of large plots of land, Belting method of valuation	6

VI	**Rental, Profits and Development Method of Valuation** Gross rent, outgoings, net rent, capitalized value and Deferred value of land, Rental method of valuation Gross profit, outgoings, net profit, Profit based method of valuation Types of developments, Plotting scheme, hypothetical building scheme, Cost of development, Development method of valuation	8

	Text Books
1	Dutta, B. N., "Estimating & Costing in Civil Engineering," UBS Publishers, 28th Revised Edition, 2016.
2	Chakraborti M., "Estimating, Costing, Specification & Valuation In Civil Engineering", Dhanapat Rai Sons, 20th Edition, 2010.
3	Patil B. S., "Civil Engineering Contracts & Estimates", Orient Longman Ltd., 4th Edition, 2015.
4	Rangwala " Estimating, Costing and Valuation ", Charotar Publishing House, 17th Edition: 2020

	References
1	Indian Standard 1200 (Part I to XXX) BIS, New Delhi
2	Standard Specification Vol. I & II", PWD Maharashtra.
3	State Schedule of Rate, PWD Maharashtra for the recent year.
4	Khan Z. A., "Engineering Economy", New Delhi: Dorling Kindersley, 1st Edition, 2012

	Useful Links
1	https://www.youtube.com/watch?v=ofkpm4lhJcg
2	https://www.youtube.com/watch?v=IcmigyqQcEw&list=PLQyaYNzUhXMYbV752AWdvYN_NtCsnYOs8
3	https://www.youtube.com/watch?v=ZYJhky9pqpA
4	https://www.youtube.com/watch?v=3BAj3CABySo

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3												1	2
CO2			2										1	
CO3		2											1	
CO4	3													2

Where, 1: Low, 2:Medium, 3:High

Assessment

- The assessment is based on MSE, ISE, and ESE.
- MSE shall be typically on modules 1 to 3.
- ISE shall be taken throughout the semester in the form of a teacher's assessment. Mode of assessment can be field visits, assignments, etc., and is expected to map at least one higher-order PO.
- ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
- For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing).

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Course Information

Programme	B.Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	6CV323
Course Name	Foundation Engineering
Desired Requisites:	Soil Mechanics, Soil Mechanics Laboratory

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**ISE**	**MSE**	**ESE**	**Total**
Tutorial	-	20	30	50	100
Practical	-				
Interaction	-	**Credits: 3**			

Course Objectives

This course aims at developing student's ability to apply principles of soil mechanics to analysis of geotechnical structures. Students are expected to get introduced with the profession of foundation and retaining wall designs

Course Outcomes (CO)

At the end of the course, students will be able to,

CO1	Describe various subsurface exploration techniques and select a suitable technique to investigate for a given geotechnical structure.	Understand
CO2	Analyse earth pressure distribution on retaining structures and stability of slopes	Analyse
CO3	Analyse and Design shallow and deep foundations from the geotechnical aspect.	Analyse, Evaluate

Module	Module Contents	Hours
I	**Introduction** :Role of civil engineer in the selection, design and construction of foundation of civil engineering structures, brief review of soil mechanics principles used in foundation engineering. **Sub-surface investigations** :Drilling bore holes, sampling, plate load test, standard penetration and cone penetration tests	6
II	**Earth Pressure on Retaining structures**: Rankine's and Coulomb's Earth Pressure theory, Analysis of different types of soil retaining structures	7
III	**Foundations:** Types of foundations, mechanism of load transfer in shallow and deep foundations. Introduction to Ground Improvement techniques.	6
IV	**Shallow Foundations Analysis**: Terzaghi's and Meyerhoff's bearing capacity theories, effect of various factors, Combined footing and raft foundation, Settlement analysis of footings, Stress distribution in soils : Boussinesq's theory, pressure bulbs, Contact pressure; Use of field test data in design of shallow foundations, proportioning of footings and rafts, Sheeting and bracing of foundation excavation.	7
V	**Deep Foundations Analysis:** Types and methods of construction , Axial load capacity of piles in sands and clays, dynamic and static formulae, pile load test, pile under lateral loading, pile group efficiency, negative skin friction. Well foundations: Methods of construction, tilt and shift, remedial measures, Bearing capacity, settlement and lateral stability of well foundation.	7
VI	**Slope Stability Analysis** Failure mechanisms, stability analysis of infinite and finite slopes, Bishop_s simplified method	6

Text Books

1	Das B.M., "Principles of Foundation Engineering", Cengage Learning, 7th Edition

2	Ranjan G. and Rao A.S.R. "Basic and Applied Soil Mechanics", New Age International Publishers, 3rd Edition, 2016
3	Murthy, V. N. S., "Geotechnical Engineering: Principles and practices of Soil Mechanics and Foundation Engineering ", Marcel Dekker Inc., New York 2003
References	
1	IS 1888 : 1982," Method of load test on soils (Second Revision)", IS 1892 : 1979" Code of practice for subsurface investigation for foundations (First Revision)"
2	IS 1080 : 1985," Code of practice for design and construction of shallow foundations in soils (Other Than Raft, Ring And Shell) (Second Revision)", IS 2911," Design and construction of pile foundations"
3	Couduto, Donald P. "Geotechnical Engineering – Principles and Practices", Prentice-Hall.,2nd Edition, 2017,
Useful Links	
1	https://nptel.ac.in/courses/105/101/105101083/
2	https://www.youtube.com/watch?v=H6_J8LuTa-M&list=PLA4019BB0B0CF6518

CO-PO Mapping

	Programme Outcomes (PO)												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1			3									2	2	
CO2		3											3	3	
CO3			3										3	3	

Assessment

- The assessment is based on MSE, ISE, and ESE.
- MSE shall be typically on modules 1 to 3.
- ISE shall be taken throughout the semester in the form of a teacher's assessment. Mode of assessment can be field visits, assignments, etc., and is expected to map at least one higher-order PO.
- ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.

For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing).

Walchand College of Engineering, Sangli

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AY 2023-24

Course Information

Programme	B. Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech, Sem VI
Course Code	6CV324
Course Name	Design of Reinforced Concrete Structures
Desired Requisites:	Solid Mechanics, Concrete Technology, Structural Analysis

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	--	30	20	50	100
		Credits: 3			

Course Objectives

1	To introduce the fundamental concepts of limit state method for the design of reinforced concrete components.
2	To impart knowledge for strength determination of different kinds of RC components using IS code.
3	To provide knowledge for design of the various structural members in the building system as per IS code.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO1	Apply the concept of limit state for design of reinforced concrete components.	Apply
CO2	Calculate the strength of reinforced concrete members.	Evaluate
CO3	Design various components of reinforced concrete structures.	Create

Module	**Module Contents**	**Hours**
I	**Introduction** Design Philosophies- Working Stress Method, Ultimate Load Method, Limit State Method, Limit state of collapse, Characteristic strength, Characteristic load, Partial safety factors, Stress-strain curves for concrete and steel, Limit state of serviceability, Provisions in IS code.	3
II	**Design of Reinforced Concrete Beams** a) Singly reinforced rectangular beam, Balanced section, Under- reinforced section and over-reinforced section, Moment of resistance, Design of Singly rectangular, T and L sections. b) Moment of resistance for doubly reinforced rectangular, T and L beams. c) Design of doubly reinforced rectangular, T and L beams.	8
III	**Shear, Bond, and Torsion** a) Shear: Truss analogy, Design of beam for shear according to IS code. b) Bond: Bond and development length, Bond stress, Standard hooks, Anchorages. c) Torsion: Design of beam subjected to torsion according to IS code.	7
IV	**One Way and Two-Way Slab** a) Design of single span, continuous and cantilever one way slab. b) Design of two-way slab by IS code method. c) Design of dog legged staircase	7
V	**Columns** Load carrying capacity of axially loaded column, short and long columns, Rectangular and circular columns, Design according to IS, Column subjected to combined axial load and uniaxial bending, P-M interaction diagram.	7
VI	**Design of Footing** Design of square/rectangular isolated footing, Design of raft foundation.	7

Textbooks	
1	Punmia, B. C., Jain A. K., Limit state design of reinforced concrete, Laxmi Publication, 4th Edition, 2016.
2	Shah, V. and Karve, S., Limit state theory and design of reinforced concrete, Structures Publications, 8th Edition, 2017.
3	Varghese, P. C., Limit state design of reinforced concrete structures, Prentice Hall, 4th Edition, 2010.
References	
1	IS 456:2000 (Reaffirmed in 2021) – Code of practice for plain and reinforced concrete, BIS and SP 34-1987 – Handbook on concrete reinforcement and detailing.
2	Pillai, S. V. and Menon. D, "Reinforced concrete design", Tata McGraw Hill Book Co., 5th Edition, 2006.
3	Ramamruthm, S., Design of reinforced concrete structures (confirming to IS 456), Dhanpat Rai Publishing, 18th Edition, 2011.
Useful Links	
1	https://onlinecourses.nptel.ac.in/noc23_ce79/preview
2	
3	
4	

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3												1	1
CO2		3											2	2
CO3			3										3	3

1: Low, 2: Medium, 3: High

Assessment

The assessment is based on MSE, ISE, and ESE.

MSE shall be typically on modules 1 to 3.

ISE shall be taken throughout the semester in the form of a teacher's assessment. Mode of assessment can be questions on the basis of field visits, quiz, assignments, etc., and is expected to map at least one higher-order PO.

ESE shall be on all modules with around 30 - 40% weightage on modules 1 to 3 and 60 -70 % weightage on modules 4 to 6.

For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing).

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AY 2023-24

Course Information

Programme	B. Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Semester VI
Course Code	6CV371
Course Name	Sewerage and sewage treatment laboratory
Desired Requisites:	Engineering Chemistry Laboratory, Water Quality Analysis Laboratory and Sewage Treatment Technology

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	-	**LA1**	**LA2**	**Lab ESE**	**Total**
Tutorial	-	30	30	40	100
Practical	2 h/week				
Interaction	-	**Credits: 1**			

Course Objectives

1	To provide the students hands-on practice for sewage characterization.
2	To develop the skills required for applying knowledge to design sewage collection and treatment system.

Course Outcomes (CO)

At the end of the course, students will be able to,

CO1	**Apply** the analysis techniques to determine organic content of sewage and assess the quality of mixed liquor.	Apply
CO2	**Analyze** and **interpret** the results of settleability and effect of sewage disposal on stream.	Apply & Analyse
CO3	**Design** sewerage and sewage treatment system for real-life condition.	Create

List of Experiments / Lab Activities

List of Experiments:

1. Characteristics of sewage
    i. Bio-chemical oxygen demand (BOD)
    ii. Chemical oxygen demand
    iii. Total kjeldahl nitrogen
2. Estimation of BOD rate constant
3. Determination of mixed liquor suspended solids, mixed liquor volatile suspended solids
4. Determination of sludge volume index and sludge density index
5. Sludge characterization
    i. Moisture content
    ii. Total, fixed and volatile solids
6. Effect of sewage disposal on stream
7. Design of sewerage system for a housing colony/Part of city
8. Decentralized treatment system for a household/Apartment/housing colony

Text Books

1	Metcalf and Eddy, "Wastewater Engineering Treatment and Reuse", Tata McGraw Hill Publication, 5th Edition, 2014.

2	Sawyer. C. N. And McCarty. P. L., "Chemistry for Environmental Engineers", Tata McGraw-Hill Publishing Company Limited, 5th Edition, 2003.
References	
1	IS 3025 (Relevant parts), Bureau of Indian Standards.
2	Standard Methods for the Examination of Water and Wastewater, APHA, 23rd Revised Edition, 2017.
Useful Links	
1	https://ee1-nitk.vlabs.ac.in/exp/determination-of-biological-oxygen/

CO-PO Mapping														
	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1				2			1						2	
CO2				2			2						2	
CO3			1	3			2	1		2			2	

Assessment

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.

Assessment	Based on	Conducted by	Typical Schedule (for 26-week Sem)	Marks
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab activities, attendance, journal	Lab Course Faculty	During Week 15 to Week 18 Marks Submission at the end of Week 18	40

Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments.

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Course Information

Programme	B. Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech. Sem. VI
Course Code	6CV341
Course Name	Mini-Project-2 Estimating and Costing in Civil Engineering
Desired Requisites:	Quantity Survey and Valuation

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	-	**LA1**	**LA2**	**ESE**	**Total**
Tutorial	-	30	30	40	100
Practical	2 Hrs./week				
Interaction	-	**Credits: 1**			

Course Objectives

1	To develop the skills required for formulating specifications and carrying out rate analysis.
2	To provide students hands-on practice for estimating cost of civil works.
3	To impart training to use computer for estimating and costing.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, students will be able to,

CO1	***Formulate*** specifications and determine quantities of different items of work.	Analyze, Create
CO2	***Estimate*** costs of the different civil works by ***Demonstrating*** application of computer for estimating and costing.	Apply Analyze
CO3	***Value*** the different immovable properties.	Evaluate

Module	**Module Contents**	**Hours**
	The mini-project to be completed for the course shall comprise of two parts as specified below	
	Part 1. Estimate of Residential Building Preparation of a report incorporating i. General description of the work, Drawings, data and assumptions ii. Detailed Estimate of Two story residential building iii. Detailed Specifications: Minimum 3 traditional items of work and Minimum 1 nontraditional items of work pertaining to the estimate in ii iv. Preparation of Bar Bending Schedule (BBS) for a part of the above work v. References	10
	Part 2. Rate analysis of Residential Building Preparation of a report incorporating i. Rate analysis for the items covered in iii in Part 1. ii. Tender notice for the above work iii. Listing all conditions of contract for the above work and detailed drafting of any three conditions of contract for the above work iv. References	10
	Part 3. Valuation of Existing Residential Building Preparation of a report incorporating i. Valuation of residential building by any two suitable methods of valuation	6

Text Books	
1	Dutta, B. N., "Estimating & Costing in Civil Engineering," UBS Publishers, 28th Revised Edition, 2016.
2	Chakraborti M., "Estimating, Costing, Specification & Valuation In Civil Engineering", Dhanapat Rai Sons, 20th Edition, 2010.
3	Patil B. S., "Civil Engineering Contracts & Estimates", Orient Longman Ltd., 4th Edition, 2015.
4	Rangwala " Estimating, Costing and Valuation ", Charotar Publishing House, 17th Edition: 2020

References	
1	I.S. code 1200 (Part I to XXX) B.I.S., Delhi
2	"Standard Specification Vol. I & II", PWD Maharashtra.
3	"State Schedule of Rate", PWD Maharashtra for the recent year.
4	Khan Z. A., "Engineering Economy", New Delhi: Dorling Kindersley, 1st Edition, 2012

Useful Links	
1	https://www.youtube.com/watch?v=ofkpm4lhJcg
2	https://www.youtube.com/watch?v=IcmigyqQcEw&list=PLQyaYNzUhXMYbV752AWdvYN_NsnYOs8
3	https://www.youtube.com/watch?v=ZYJhky9pqpA
4	https://www.youtube.com/watch?v=3BAj3CABySo

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3													
CO2	3													
CO3	3				3									

Assessment

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.

Assessment	Based on	Conducted by	Typical Schedule (for 13-week Sem)	Marks
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab activities, attendance, journal	Lab Course Faculty	During Week 13 to Week 18 Marks Submission at the end of Week 13	40

Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 13-week semester. The actual schedule shall be as per academic calendar.

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Course Information

Programme	B. Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	6CV342
Course Name	Mini-Project-3: Steel Structures Design and Drawings
Desired Requisites:	Engineering Mechanics, Solid mechanics, Design of steel structures

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	-	**LA1**	**LA2**	**Lab ESE**	**Total**
Tutorial	-	30	30	40	100
Practical	2 hrs/week				
Interaction	-	**Credits: 1**			

Course Objectives

1	To impart the knowledge of analysis and design of various steel members and their connections.
2	To demonstrate the design of practical steel structures such as industrial sheds, steel buildings etc.
3	To provide the knowledge of detailing of steel structural drawings.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO1	Estimate various types of loads such as Dl, LL, WL, etc. acting on steel structures.	Apply
CO2	Calculate design forces in members of steel structures for various combinations of loads using modern tools.	Evaluate
CO3	Design various types of practical steel structures and develop detailed structural drawings.	Create

List of Experiments / Lab Activities

List of Experiments: **Part 1. Industrial shed** a. Roof truss, purlin, and connections. b. Gantry girder. c. Columns and column bases	6
Part 2. Building Frames a. Secondary and main beams. b. Column and column bases. c. Beam- to- beam connection. d. Column- beam connection.	9
Part 3. Foot Bridge a. Influence lines. b. Cross beam. c. Main truss. d. Raker. e. Joint details. f. Support details. OR **Welded Plate Girder** a. Stiffeners b. Curtailment of Flange plates	9
Part 4. Analysis results of the first problem of industrial shed shall be compared with the results by any standard software package.	4

Text Books

1	Duggal S. K., "Limit state design of steel structures", Tata McGraw-Hill Publications, New Delhi, 2nd Edition, 2014.
2	Shiyekar, M. R., "Limit state design in structural steel", PHI learning Pvt. Ltd Publications 2nd Edition 2013.
3	Subramanian N., "Design of steel structures", Oxford University Press, 2010.

References	
1	Dayaratnam, P., "Design of steel structures", S. Chand Publication, New Delhi, 2008.
2	Gaylord, Edwin and Gaylord, Charles, "Design of steel structures", Tata McGraw Hill Publishing Company Ltd., New Delhi, 3rd Edition, 2010.
3	IS 800-2007 "Code of Practice for General Construction in steel", and IS 875-1987 part 1 to 5; "Code of Practice for Design Loads (other than earthquake) for building structures", Bureau of Indian Standards, New Delhi.
4	SP: 6(1) - 1998, Hand Book for Structural Steel Sections.

Useful Links	
1	

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1														2
CO2		3			2									2
CO3		3	3										3	3

Where, 1:Low, 2:Medium, 3:High

Assessment

There are three components of lab assessment, LA1, LA2, and Lab ESE
IMP: Lab ESE is a separate head of passing. Lab ESE is treated as End Semester Exam and is based on all experiments/lab activities.

Assessment	Based on	Conducted by	Typical Schedule	Marks
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab Performance and documentation	Lab Course faculty	During Week 13 to Week 18 Marks Submission at the end of Week 18	40

Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments.

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Course Information

Programme	B. Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech. Sem. VI
Course Code	6CV331
Course Name	Professional Elective 2: Industrial and Biomedical Waste Management
Desired Requisites:	

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs./week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 2			

Course Objectives

1	To provide conceptual and field knowledge for the analysis and evaluation of processes of industrial and biomedical waste management.
2	To enhance the technical competency to conduct research and address the problems of industry/society related to industrial and biomedical waste management.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO1	**Explain** and **apply** concepts of industrial and biomedical waste management	Understand Apply
CO2	**Analyze** the effluent treatment systems used in industrial and biomedical effluent treatment	Analyz
CO3	**Evaluate** the effluent treatment waste processing alternatives used for industrial and biomedical waste management	Evaluate

Module	**Module Contents**	**Hours**
I	**Waste Management** Classification of wastes, Characterization of wastes, Principle of waste management, Segregation at source, Collection, Transfer and transport, Processing and disposal	3
II	**Waste Minimization Techniques** Concept of waste minimization and Techniques of volume and strength reduction. Equalization: Process, Flow and quality, Location, Volume requirement and Design considerations. Reuse and recycling concepts, Process description, Objectives and Methods of Neutralization and Proportioning.	3
III	**Agro Based Industries** Manufacturing processes, Water usage, Sources, Quantities and characteristics of effluents (process stream and combined), Pollution effects, Waste Reduction/ Reclamation/Byproduct recovery, Utilization, Alternative methods of treatment and disposal for Agro-based industries: Sugar, Distillery, Dairy and Textile Industry	7
IV	**Chemical Industries** Manufacturing processes, Water usage, Sources, Quantities and characteristics of effluents (process stream and combined), Pollution effects, Waste Reduction /Reclamation/Byproduct recovery, Utilization, Alternative methods of treatment and disposal for Chemical industries: Petroleum and refineries, Fertilizer and Tannery Industry	5
V	**Introduction to Biomedical Waste** Concept, Sources, Types, Principles of managing chemical disinfectants, Waste from dental clinics, Laboratories, Blood banks, Patient care areas, radioactive waste, Expired pharmaceuticals.	3

VI	**Handling of Biomedical Waste and Impact on Environment** Handling of waste from dental clinics, Laboratories, Blood banks, Patient care areas, radioactive waste, Expired pharmaceuticals. Impact on environment of chemical in biomedical waste (viz. mercury, lead, cadmium, chromium), Disinfectants, Gaseous pollutants Impact of biomedical waste on food and livestock, Water and aquifer, Marine ecosystem.	5

	Textbooks
1	Peavy H. S., Rowe D. R. and Tchobanoglous G., "Environmental Engineering", McGraw-Hill Book Company, 2017.
2	Metcalf and Eddy "Wastewater Engineering Treatment and Reuse", Tata McGraw Hill Publication, 2017.
3	Reynolds T. D. and Richards P. A., "Unit Operations and Processes in Environmental Engineering", 2nd Edition, PWS Publishing Company, 1995.
4	Radhakrishan R., "Biomedical Waste Management", Sumit Enterprises, 2007
	References
1	Droste, Ronald L "Theory and Practice of Water and Wastewater Treatment", Wiley student Edition 2009.
2	Crites Ron and Tchobanoglous George, "Small and Decentralized Wastewater Management Systems", McGraw-Hill Book Company, 1998.
3	Quasim, S. R., "Wastewater treatment plants planning, design and operation", CRC Press, 2nd Edition, 2010.
4	"Guidelines for Management of Healthcare Waste as per Biomedical Waste Management Rules, 2016", CPCB and MoEF, 2016.
	Useful Links
1	https://www.youtube.com/watch?v=fHRxhuMQQnE&list=PLbRMhDVUMngdeOSgQOe399aBKqdxkxNCp
2	https://pubs.rsc.org/en/content/chapterhtml/2021/bk9781839162794-00001?isbn=978-1-83916-279-4&sercode=bk

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1						3							
CO2	1						3							
CO3	1						3							

Assessment

The assessment is based on MSE, ISE and ESE.

MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of a teacher's assessment. The mode of assessment can be field visits, assignments etc. and is expected to map at least one higher order PO.

ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.

For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed, and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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AY 2023-24

Course Information

Programme	B. Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	6CV332
Course Name	Professional Elective 2: Advances in Urban Water Distribution System
Desired Requisites:	Water Treatment Technology, Hydraulics

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**ISE**	**MSE**	**ESE**	**Total**
Tutorial	-	20	30	50	100
Practical	-				
Interaction	-	**Credits: 2**			

Course Objectives

1	To introduce concepts on advances in water distribution network design and 24 × 7 (continuous) water supply systems.
2	To provide pertinent knowledge for the design and operation of Water Distribution System, and pricing of water.
3	To highlight the scope of automation in water supply system.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO1	Explain the concepts on 24×7 water supply, water quality, calibration, water losses, pricing of water and automation in in water distribution system (WDS).	Understand
CO2	Solve the problems on water quality in WDS, water losses, and pricing of water.	Apply
CO3	Design Water Distribution System.	Create

Module	**Module Contents**	**Hours**
I	**Advances in Water Distribution Network Design** Advances in Water Distribution Network Design, 24×7 (Continuous) Water Supply Systems, Design Guidelines of 24×7 Water Supply Systems, Framework for Conversion of Intermittent System into 24×7 Systems, District Metered Area (DMA) for Zoning in Water Distribution Networks, Software for Water Distribution Networks Design and Analysis	**5**
II	**Water Quality in WDS** Water quality in distribution system, Causes of variation, transport of constituents in pipe, chemical reactions, water quality simulations for source trace and water age, Water quality in 24×7 Water Supply Systems	**4**
III	**Calibration of WDS** WDS testing: Fundamentals, Pressure and flow measurement. Calibration: Overview of hydraulic and water quality calibration approaches. Application of computer models: WDS analysis and design, Identifying and solving common WDS problems, Extension of WDS, Rehabilitation, Calibration.	**4**
IV	**Water losses in WDS** Reasons and sources, Categories, Factors influencing, Water audit for loss estimation, Water balance, Water loss performance indicators, Water loss detection, Systems of water leak detection (conventional and advanced), Leak management approaches, Water loss control measures,	**5**
V	**Automation in Water Supply and Smart Water Supply Systems** Introduction to Smart Water Supply Systems, Features of Smart Water Supply Systems, Objective of Smart Water Supply, Elements of Water Supply Systems, Technology Solutions for Smart Water Systems, Smart Metering and Sensing Devices, IoT and Automation in Water Supply, Supervisory Control and Data Acquisition (SCADA) Systems, Examples of Automation and Smart Water Supply Systems	**4**

VI	**Water Economics and Pricing** Valuing Water (Economic Value of Water), Economics of Water Supply Projects, Components of Full Cost and Value of Water, Price Based Demand and Willingness to Pay, Price Elasticity of Water Demand, Procedures for Economic Analysis of Water Supply Projects, Capital and Operational Cost of Water Supply Systems, Pricing Water, Water Pricing Models	**4**

Tutorial: N/A

Text Books	
1	Walski, Chase and Savic, "Water Distribution Modeling", Haestad Press, First edition, 2007.

References	
1	"Manual on Water Supply and Treatment", CPHEEO, Ministry of Housing and Urban Affairs Development, Govt., of India, New Delhi, 1999.
2	Hammer M, J and Hammer M, J, "Water and Wastewater Technology", PHI learning private limited, 7th Edition, 2018.

Useful Links	
1	https://onlinecourses.nptel.ac.in/noc22_ce07

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
CO1	3												2	3	
CO2		3			2								3	3	
CO3			3		2								3	3	

Where, 1:Low, 2:Medium, 3:High

Assessment

ISE: Assignment on real-life problem pertaining to modules 1 to 3 and evaluated by test/quiz/presentation/oral; Field visit to water treatment plants and evaluated by test/quiz/presentation/oral.
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with 60-70% weightage for course content (normally last three modules) covered after MSE.

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Course Information

Programme	B.Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	6CV333
Course Name	Professional Elective 2: Watershed Management
Desired Requisites:	Open Chanel Hydraulics and water resources Engineering

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial		30	20	50	100
		Credits: 2			

Course Objectives

1	To provide the technical know-how of analyzing the degradation of soil and water resources and implementation of the measures for soil and water conservation.
2	To provide a comprehensive treatise on the engineering practices of watershed management for realizing the higher benefits of watershed management.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO1	*Explain* planning, management and water conservation pertaining to watershed.	Understand
CO2	*Apply* water conservation practice to the development of watershed.	Apply,
CO3	*Analyse and develop* a watershed for appropriate soil and water conservation	Evaluate

Module	**Module Contents**	**Hours**
I	Introduction of Watershed: Definition, concept, Objectives, Land capability classification, priority watersheds, land resource regions in India	4
II	Watershed Planning: Planning principles, collection of data ,present land use, Preparation of watershed development plan ,Estimation of costs and benefits, Financial plan , selection of implementation agency , Monitoring and evaluation system	5
III	Watershed Management: Participatory watershed Management, run off management, Factors affecting runoff, Temporary & Permanent gully control measures	4
IV	Water conservation practices in irrigated lands, Soil and moisture conservation practices in dry lands	4
V	Water Conservation Practices: In-situ & Ex-situ moisture conservation principle and practices, Afforestation principle, Micro catchment water harvesting	4
VI	Ground water recharge, percolation ponds, Water harvesting, Farm Pond, Supplemental irrigation, Evaporation suppression, Seepage reduction and	5

	watershed development programme	
Textbooks		
1	Suresh, R., "Soil and Water Conservation Engineering, Standard Publishers & Distributors,", New Delhi, 2005.	
2	Ghanashyam Das, "Hydrology and Soil Conservation Engineering", Prentice Hall of India Private Limited, New Delhi, 2000.	
References		
1	Gurmel Singh et al.., "Manual of soil and water conservation practices", Read Books, 2011. Oxford & IBH publishing Co. New Delhi.2004	
2	Suresh, R. "Land and water management principles", Standard Publishers & Distributors, New Delhi, 2008.	
3	Tripathi R.P. and H.P.Singh "Soil erosion and conservation," Willey Eastern Ltd., New Delhi, 2002.	
Useful Links		
1		
2		

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2												1	1
CO2		3											2	2
CO3			3										3	2

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 2 and 60% weightage on modules 3 to 4.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2022-23

Course Information

Programme	B.Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	6CV334
Course Name	Professional Elective 2: Town and Country Planning
Desired Requisites:	Building Planning and Design

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**ISE**	**MSE**	**ESE**	**Total**
Tutorial	-	20	30	60	100
Practical	-				
Interaction	-	**Credits: 2**			

Course Objectives

This course is designed to be offered as elective to interested students who wish to consider town and country planning as their probable career option, It focuses on relevant practices in preparation of RP, DP, TPS etc. It also includes relevant legislations knowledge required for a modern town planner.

Course Outcomes (CO)

After completion of course the students will be able to

CO1	**Explain** elements of regional plan(RP) and development plan(DP)	**Apply**
CO2	**Comprehend** different aspects a town planning scheme	**Understand**
CO3	**Describe** important provisions of different town planning legislations	**Apply**

Module	Module Contents	Hours
I	**Introduction** Objective of town planning, principles, stages in town development, brief history, growth of towns and theories of developments (ribbon, sector zone, concentric, multiple zones etc.), Institutional arrangements in Maharashtra (CIDCO, MMRDA, MHADA, SRA, TPVD etc.)	4
II	**Regional Plan (R.P)** Need of contents of Regional Plan, Regional Delimitation, Surveys necessary for Regional Plan, Analysis and Projections, Necessary Steps for starting and ending the process of Regional Planning, Relation with the state Plan and surroundings	4
III	**Development Plan (D.P)** Surveys, types, duration etc., Analysis and Projections, Demographic Projections, Goals and objectives, Public Participation, Implementation and Financial Aspects., Delineation, Relation with R.P., Content of DP and Planning norms, Modifications, purchase notice, Legal and Administrative process to start D.P.	5
IV	**Town Planning Scheme** Concept of T.P.S, Legal Provision, Relation with D.P., Original Plot, final Plot, Semi-final Plot, Incremental Contribution (Betterment charge), Rational for charging Incremental Contribution, Function of Arbitrator, Advance Possession, Amenities, Partially beneficial, Cost of Scheme.	5
V	**Acts and Rules** Municipal Act, MR and TP Act 1966, LA Act. 1894, and LARA 2013 SEZ, DCR	4
VI	**Special Townships** Special Township Policy, Land requirement, procedures for locational clearance, salient feature, Responsibilities of developer, Hill station Policy few case studies	4

Text Books	
1	Hiraskar G. K.,"*Fundamentals Of Town Planning*", Dhanpat Rai Publication (p) Ltd., New Delhi,17th Edition, 2012
2	Rangawala S.C., "*Town Planning*", Charotar Publications, Pune ,27th edition, 2014
3	Hiranmay Biswas, "*Principles Of Town Planning And Architecture*", VAYU Education of India, 2012
References	
1	MRTP Act 1966, Land Acquisition Act, UDPFI guidelines, ministry of urban affairs and employment, Govt. & India.
2	Michael Todaro, "*Economic development in Third world",* Orient Longman Publication
3	Koperdekar and Diwan, " *Planning legislation* "
Useful Links	
1	https://nptel.ac.in/courses/124107158

CO-PO Mapping

	Programme Outcomes (PO)												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
CO1	1		1										1		
CO2			2				2						2		
CO3			2			2							2		

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

Assessment

- The assessment is based on MSE, ISE, and ESE.
- MSE shall be typically on modules 1 to 3.
- ISE shall be taken throughout the semester in the form of a teacher's assessment. Mode of assessment can be field visits, assignments, etc., and is expected to map at least one higher-order PO.
- ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing).

Walchand College of Engineering, Sangli

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AY 2023-24

Course Information

Programme	B.Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	6CV335
Course Name	Professional Elective 2: Design of Masonry Structures
Desired Requisites:	Building Materials and Construction, Strength of Materials

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
Practical	-				
Interaction	-	**Credits: 2**			

Course Objectives

1	Introduce the rational theoretical basis for prediction of structural masonry.
2	Understand and apply the structural design of axial and laterally loaded masonry walls.
3	Educate and carry out applied research on structural masonry based on modern and proven structural theories.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO1	Perceive the properties of various building units/mortar and within the available alternatives make qualitative judgment with appropriate choices for structural masonry.	Evaluate
CO2	Analyze design and estimate the strength of masonry under vertical and lateral loading conditions.	Analyse, Create
CO3	Apply the concepts of reinforced and contained masonry and impart ductility and earthquake resistance to masonry buildings.	Apply

Module	**Module Contents**	**Hours**
I	**Introduction on Masonry Materials** History of Masonry, Masonry units, materials and types, Characteristics of bricks in India, stones, Hourdi block, concrete blocks, stabilized mud blocks, FAL G blocks, Factors affecting properties of masonry units, Classification and properties of Mortars, Testing procedures as per IS codes, Energy considerations.	5
II	**Behaviour of Masonry under Compression** Factors influencing masonry compressive strength, Effects of bed materials, unit height, hollow block units, type of bond, wall types, direction of loading, workmanship factors, workmanship and construction details, Deformation properties of masonry under compression, compression failure theories.	5
III	**Masonry in tension, shear and biaxial stress** Interfacial bond strength, tensile bond strength, flexural bond strength, strength of masonry in shear, Failure modes, Masonry under biaxial stress, Shear modulus of masonry.	5
IV	**Design Analysis of unreinforced Masonry** Structural adequacy of masonry walls, types of walls, Design considerations, Lateral support and stability, Stiffening walls, Effective height, length and thickness considerations, Structural design as per codal provisions, Computations of permissible stresses, Application of reduction factors, Assessment of eccentricity.	5
V	**Practical Applications and Case studies** Codes of practice, Planning, detailing and construction techniques, Joints with slabs, Joints with roof structure, Reinforcement, Expansion joints, Tolerances, Case studies.	4

VI	**Reinforced masonry for seismic resistance** Seismicity and buildings, Design philosophy, Performance and vulnerability of masonry structures, Typical failure at Bhuj and Latur earthquakes, Structural configuration, BIS codal provisions, Concept of confined masonry, Minimum wall density, Construction Guidelines, New Research trends in contained Masonry.	4

Text Books	
1	Structural Masonry, K. S. Jagadish, I. K. International Publishing House, New Delhi, 2015.
2	Brick and Brick Reinforced Structures, P. Dayaratnam, Oxford and IBH publishing House,
References	
1	Structural Masonry, A. W. Hendry, Macmillan Press Ltd, 1998, London.
2	Structural Design of Masonry, Andrew Orton, Longman, 1992 second edition
3	Structural Masonry, Sven Sahlin, Prentice Hall, 1971.
4	Alternative Building Materials and Technologies, K. S. Jagadish, B. V. Venkatrama Reddy, K. S. Nanjunda Rao, New Age International.
5	Structural Masonry designer's Manual, Curtin, Shaw and Beck, BSP Professional Books, Second edition 6. IS 1905, Indian standard code of practice for structural use of unreinforced masonry, BIS, New Delhi.

CO-PO Mapping

	Programme Outcomes (PO)												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1		3													
CO2			3												
CO3				2											

Where, 1:Low, 2:Medium, 3:High

Assessment

The assessment is based on MSE, ISE and ESE.

MSE shall be typically on modules 1 to 3.

ISE shall be taken throughout the semester in the form of a teacher's assessment. The mode of assessment can be field visits, assignments etc. and is expected to map at least one higher order PO.

ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.

For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed, and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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AY 2023-24

Course Information

Programme	B.Tech. Civil engineering
Class, Semester	Third Year B. Tech., Sem. VI
Course Code	6CV336
Course Name	Professional Elective 2: Advanced Structural Analysis
Desired Requisites:	Solid Mechanics, Structural analysis, Structural Mechanics

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
Practical	-				
Interaction	-	**Credits: 2**			

Course Objectives

1	To impart the knowledge of advanced methods of structural analysis.
2	To provide knowledge for analyzing special types of structures.
3	To apply advanced structural analysis techniques to various civil engineering structures.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO1	**Apply** advanced methods for analysis of structures.	Apply
CO2	**Calculate** forces and displacements for special structures.	Evaluate
CO3	**Evaluate** external and internal forces in frames and beams using relevant software.	Evaluate

Module	Module Contents	Hours
I	**Influence line Diagrams for Indeterminate Structures** Muller Breslau principle, qualitative and quantitative Influence line diagrams for reactions, Shear force and bending moment's for propped cantilever, fixed beam and continuous beams. Practical applications of influence lines.	5
II	**Approximate Methods** Portal and Cantilever methods for analysis of building frames subjected to lateral loads. Axial force, Shear force and Bending moment diagrams.	4
III	**Beams on Elastic Foundations** Assumptions, Types of beams on elastic Foundation, Analysis of beams on elastic foundation subjected to various loads and boundary conditions, deflection curve, pressure distribution; shear force and bending moment diagrams.	5
IV	**Beams Curved in Plan** Analysis of statically determinate and indeterminate structures curved in plan subjected to loads normal to plane of beam using strain energy method. Bending moments and twisting moment diagrams.	5
V	**Secondary Stresses** Causes of secondary stresses, change in angles, deflection angles and analysis of secondary stresses in plane frames, Analysis of pin jointed space frames by tension coefficient method.	5
VI	**Fixed Arches** Types of arches, Elastic Center Method, Analysis of parabolic and circular / semi-circular fixed arches. Normal Thrust, Radial Shear and Bending Moment at any section of an arch.	4

Text Books

1	Vazirani. V.N. & Ratwani M. M., "Advanced Theory of Structures", Khanna Publishers, 2008
2	Reddy C. S., "Basic Structural Analysis", Tata McGraw hill, 7th Edition, 1981.
3	Junnarkar S. B., "Mechanics of Structures Vol. I", Chartor House publications. 31st Edition, 2014.

4	Krishna Raju N., "Advanced Mechanics of Solids and Structures", McGraw-Hill Education, 2018
References	
1	Mcquire and Gallghar. R. H. "Matrix Structural Analysis", John Wiley, 2nd Edition, 2000
2	Beaufit F.W et al. "Computer Methods of Structural Analysis", Prentice Hall, illustrated,1970
3	John L. and Meek, "Matrix Structural Analysis", McGraw Hill Book Company, illustrated,1971
4	Pandit G. and Gupta S., "Structural Analysis - A Matrix Approach2008",McGraw Hill Education; 1st edition
Useful Links	
1	https://nptel.ac.in/courses/105/105/105105108/
2	https://nptel.ac.in/courses/105/101/105101086/
3	http://engineeringvideolectures.com/course/281?pn=0#videolist
4	https://nptel.ac.in/courses/105/105/105105109/

CO-PO Mapping

	Programme Outcomes (PO)												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
CO1	3													3	
CO2		3												2	
CO3			2		2									1	

Where, 1:Low, 2:Medium, 3:High

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of a teacher's assessment.
The mode of assessment can be field visits, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed, and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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AY 2023-24

Course Information

Programme	B. Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	6CV337
Course Name	Professional Elective 2: Bridge Engineering
Desired Requisites:	Transportation Engineering

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
Practical	-				
Interaction	-	**Credits: 2**			

Course Objectives

1	To give exposure to bridge hydrology, construction and maintenance aspects of bridges and make familiar with substructure and superstructure of bridges.
2	Impart the techniques of planning and designing of the bridge.
3	To make conversant with various construction methods of bridges

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO1	Explain various components of bridges	Understand
CO2	Apply the planning and design concepts for the construction of bridge.	Apply
CO3	Identify and select appropriate substructure and superstructure for different types of bridge.	Analyze

Module	Module Contents	Hours
I	**Introduction of Bridge engineering:** Classification of bridges, selection of site, Bridge Hydrology: Determination of design discharge, linear water way,economical span, location of piers and abutments, afflux, scour depth, design problems on above topics.	5
II	**Bridge loading:** Standard Specification for Bridges: Indian Road Congress Bridge Code. Width of carriage-way and clearances, IRC loads, Railway bridge loading, forces acting on super structure. Design considerations, aesthetics of bridge design.	5
III	**Bridge foundation:** Bridge foundations, Types and their suitability, Bridge piers, Abutments,Wing walls, Approaches. Construction of various types of bridges, launching, erection, bearings. Maintenance and rehabilitation of bridges	4
IV	**Bridge Superstructure** Bridge decks – Structural forms and behavior, Choices of superstructure types	4
V	**Bridge Substructure** Substructure - Pier; Abutment, Wing walls, Importance of Soil Structure Interaction - Types of foundations, Open foundation, Pile foundation, well foundation, simply supported bridge, Continuous Bridge	4

VI	**Bridge Bearings and Expansion Joints** Bearings and Expansion Joints - Different types of bridge bearings and expansion joints - Parapets and Railings for Highway Bridges	4

Text Books	
1	Bindra S. P., "Principles and Practice of Bridge Engineering", Dhanpat Rai Publications, 8th Edition, 2012.
2	Johnson Victor D., "Essentials of Bridge Engineering", Oxford and IBH Publishing Co., New Delhi, 2009.
3	Victor D. J., "Elements of Bridge Engineering", Oxford and IBH, 5th Edition, 2001
References	
1	Alagia J. S., Rangwala S. C., "Elements of Bridge Engineering", Charotar Publishing House, 8th Edition, 1983
2	Ponnuswamy , S. " Bridge Engineering" McGraw-Hill Education , New Delhi , 2008

CO-PO Mapping

	Programme Outcomes (PO)												PSPO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3												2	2
CO2		2											2	2
CO3			2										2	2

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of a teacher's assessment. The mode of assessment can be field visits, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed, and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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AY 2023-24

Course Information

Programme	B.Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	6CV372
Course Name	Elective Lab 1: Advanced Concrete Technology Lab
Desired Requisites:	Concrete Technology

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	-	**LA1**	**LA2**	**Lab ESE**	**Total**
Tutorial	-	30	30	40	100
Practical	2 hrs/week				
Interaction	-	**Credits: 1**			

Course Objectives

1	To give the exposure to advance characterisation and testing techniques for cement concrete.
2	To develop ability to analyse the properties of cement concrete materials to decide its suitability.

Course Outcomes (CO)

At the end of the course, students will be able to,

CO1	**Apply** practices to examine the properties of cement concrete materials	**Apply**
CO2	**Interpret** the test results of materials and **judge** the suitability in the cement concrete.	**Interpret**
CO3	**Decide** dosage of plasticiser for concrete and **Analyse** the concrete durability.	**Analyse**

List of Experiments / Lab Activities

List of Experiments:

1. Density of Cement
2. Particle Size Analysis (Laser Diffraction)
3. Specific Surface area of cement (Blaine)
4. Setting time of concrete
5. Strength Activity Test
6. Modified Chappelle Test
7. Marsh Cone Test
8. Mini Slump Test
9. Freeze drying test on Cement Paste
10. Thermal Analysis of Cement Paste

Text Books

1	Mehta P. K. and Paulo J. M. M, "Concrete – Microstructure, Properties and Material", McGraw Hill Professional 3rd Edition, 2009.
2	Neville A. M. and Brooks J. J., "Concrete Technology", Pearson Education Limited, 1987
3	Shetty M. S., "Concrete Technology", S. Chand & Company Ltd. New Delhi, 7th Edition, 2013.

References

1	IS 4031 Part-2 (1999). "Methods of physical tests for hydraulic cement- part 2-Determination of fineness by blaine air permeability method." Bureau of Indian Standards (BIS), New Delhi, India.

2	IS 16354. (2015). "Metakaolin for Use in Cement, Cement Mortar and Concrete Specification." *Bureau of Indian Standards (BIS)*, New Delhi, India.
3	ASTM C311. (2019). "Standard Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use." *ASTM International*, West Conshohocken, PA, United States.

Useful Links	
1	https://www.digimat.in/nptel/courses/video/105106176/L01.html
2	
3	
4	

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1				3	2							1	1	1
CO2				3		1	1					1	2	1
CO3				3	3								2	

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

Assessment

There are three components of lab assessment, LA1, LA2, and Lab ESE
IMP: Lab ESE is a separate head of passing. Lab ESE is treated as End Semester Exam and is based on all experiments/lab activities.

Assessment	Based on	Conducted by	Typical Schedule	Marks
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab Performance and documentation	Lab Course faculty	During Week 13 to Week 18 Marks Submission at the end of Week 18	40

Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments.