Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2025-26 onwards

Course Information

Programme	B. Tech. (Civil Engineering)
Class, Semester	Third-Year B. Tech., Sem V
Course Code	7CV301
Course Name	Soil Mechanics
Desired Requisites:	Geology, Fluid mechanics, Solid Mechanics

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

Course Objectives

This is the first course in the Geotechnical Engineering domain. It is designed to let students understand the mechanical behavior of soil/Earthen materials under stresses specifically when they interact with Civil Engineering structures. It is also intended to cover the requisite contents of important competitive examinations and entrance examinations for higher studies.

Course Outcomes (CO)

CO	Description	Blooms Taxonomy	
		Descriptor	Level
CO1	Explain soil properties, laboratory determination, soil classification, and behavior of soils affecting Civil Engineering structures.	Understanding	II
CO2	Determine effective stresses in soil under static and seepage conditions.	Applying	III
CO3	Estimate the soil settlement and time required under a given load	Evaluating	V
CO4	Determine soil strength & deformation parameters from soil tests	Applying	III

Module	Module Contents	Hours
I	**Introduction:** Description of soil, review of engineering geology, clay mineralogy, Scope of Geotechnical Engineering, Three-phase system and phase relationships, Determination of various Index Properties of Soil in the laboratory	6
II	**Soil Classification:** Grain size and hydrometer analysis, Plasticity Characteristics of Soil and their determination, Unified and IS soil classification system	5
III	**Permeability and Seepage:** Soil-water Statics, Principle of effective stress, One-dimensional flow, Darcy's law, laboratory methods for determination of coefficient of permeability. Seepage through soils - two-dimensional flow, flow nets, uplift pressure, piping, criteria for filter design; quicksand condition, liquefaction, mud-pumping	8
IV	**Compaction of Soils:** Definition and importance of compaction, Comparison between compaction and consolidation, Effect of compaction on soil properties, Theory of compaction, Laboratory determination of optimum moisture content and maximum dry density, Compaction in the field: specifications and quality control.	5
V	**Compressibility of Soils:** Initial, primary & secondary consolidation, spring analogy, Terzaghi's theory of consolidation, Procedure and Interpretation of consolidation test results, 2:1 approximate method and Bouusinesq's theory to determine vertical stress distribution, New marks chart, Contact pressures, Estimation of time rate and short-term/long-term magnitude of settlement of soils	9

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.	8

Text Books	
1	Gopal Ranjan and A.S.R. Rao (2016), "*Basic and Applied Soil Mechanics*", New Age International Publishers
2	Murthy, V. N. S. (2018), "*Textbook of Soil Mechanics and Foundation Engineering Geotechnical Engineering Series*", CBS publishing
3	B. M. Das, "*Principles of Geotechnical Engineering*", Cengage Learning
4	Gulhati, S. K. and Datta, M., "*Geotechnical Engineering*", Tata McGraw-Hill

References	
1	Robert D. Holtz, William D. Kovacs, Thomas C. Sheahan (2015), *"An Introduction to Geotechnical Engineering",* Pearson
2	Couduto, Donald P. (2017), "*Geotechnical Engineering – Principles and Practices*", Prentice-Hall
3	Muni Budhu(2011),"*Soil Mechanics and Foundations*", John Wiley & Sons

Useful Links	
1	https://www.youtube.com/watch?v=Lng0hVDvsu0&list=PLOzRYVm0a65dtbpo_DP7acjsLYdmWT99r
2	https://www.youtube.com/watch?v=V1m3cB-Aqy8&list=PL940DD62E8781E147
3	https://ocw.mit.edu/courses/1-322-soil-behavior-spring-2005/pages/lecture-notes/

CO-PO Mapping

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

The strength of mapping: - 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 25-30% weightage on modules 1 to 3 and 70-75% 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)

Prepared by Dr. A. K. Kokane	DAC/BoS Secretary Dr D. S. Chavan	Head/BoS Chairman Dr. A. K. Mali

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2025-26 onwards

Course Information

Programme	B. Tech. (Civil Engineering)
Class, Semester	Third-Year B. Tech.
Course Code	7CV302
Course Name	Water Supply and Treatment Technology
Desired Requisites:	Basic hydraulics and Engineering Chemistry

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 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)

CO	Description	Blooms Taxonomy	
		Descriptor	Level
CO1	**Explain** water quality, water supply system and treatment technologies.	Understand	II
CO2	**Apply** the concepts of water conveyance and treatment.	Apply	III
CO3	**Analyze** the problems pertinent to water quality, water supply system and treatment technologies.	Analyze	IV
CO4	**Design** water treatment units, and pipeline system.	Design	VI

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 L**

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 L**
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 clarifier, Clari-flocculator	**8 L**
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 Water plant residual management	**6 L**
V	**Treatment for TDS removal** Adsorption: Introduction, Basics of Carbon adsorption Ion Exchange: Theory, Design of softener Membrane filtration: Types, Basic concepts, Applications Defluoridation, Nanotechnology in water treatment Point of use purifiers	**6 L**

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 24x7 supply Leakage: Causes, Detection and Control Water quality in distribution: Causes of deterioration, Source trace, Water age, Nodal constituent concentration Automation in Water supply system	**8 L**

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.

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

CO-PO Mapping														
	Programme Outcomes (PO)												**PSPO**	
COs	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
CO4			3	1			2			1		1	3	3
The strength of mapping: - 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 25-30% weightage on modules 1 to 3 and 70-75% 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)

Prepared by	DAC/BoS Secretary	Head/BoS Chairman

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2025-26 onwards

Course Information

Programme	B. Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	7CV303
Course Name	Concrete Technology
Desired Requisites:	-

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 conceptual knowledge of cement, cement concrete, aggregates and admixtures.
2	To make students conversant with fresh and hardened properties and durability issues of concrete.
3	To provide and develop skills to prepare and design concrete mixes.

Course Outcomes (CO)

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

CO	**Description**	**Blooms Taxonomy**	
		Descriptor	Level
CO1	Perceive the knowledge of cement, aggregate, admixtures and concrete to fulfil the requirements of the construction industry.	Understand	II
CO2	Articulate the process of manufacturing concrete, and demonstrate properties of fresh concrete.	Apply	III
CO3	Apply the knowledge of the properties of hardened concrete and the durability issues of concrete.	Apply	III
CO4	Design concrete mixes according to IS 10262: 2019 codal provisions.	Design	VI

Module	**Module Contents**	**Hrs**
I	**Ingredients of Concrete** **Cement:** Manufacturing of Portland cement, Chemical composition, Hydration of cement, Classification and types of cement, Tests on cement. **Aggregate:** Classification, Mechanical and Physical Properties, Grading of Aggregates, Tests on aggregate, Artificial and recycled aggregate. **Water -** Mixing Water and Curing Water	7
II	**Concrete Manufacturing Process** Mixing, Transportation, Placing, compaction and finishing. **Admixtures:** Introduction to Mineral and Chemical Admixtures **Ready Mix Plant:** Layout, Components and Functions, etc.	7
III	**Properties of Fresh Concrete** Workability: Factors affecting workability, measurement of workability, Cohesion and segregation, bleeding, and Setting of concrete. **Curing** - Methods of curing	6
IV	**Concrete Mix Design** Factors to be considered, Concrete mix design for compressive strength by IS: 10262 (2019) method, Statistical quality control.	7
V	**Properties of Hardened Concrete** Strength of concrete, factors affecting strength, Micro-cracking and stress-strain relation, Elasticity, tensile and flexural strength, Creep, and Shrinkage. Non-destructive testing of concrete.	8

	Durability: Fundamental Concepts, Degradation Process, Attacks, and Durability issues.	
VI	**Special Concretes**: High-Performance Concrete, Self-Compacting Concrete, Dry Lean Concrete, Pavement Quality Concrete, Pre-stressed Concrete, Low Carbon footprint concrete	4

Textbooks	
1	Shetty M. S., Concrete Technology, S. Chand & Company Ltd. New Delhi.
2	Neville A. M. and Brooks J. J., Concrete Technology, Pearson Education Limited.
3	Gambhir, M. L., Concrete Technology, Tata McGraw-Hill Publishers.

References	
1	Neville A. M., "Properties of Concrete", Prentice Hall.
2	Mehta P. K. and Paulo J. M. M, "Concrete – Microstructure, Properties and Material", McGraw-Hill Professional.
3	Newman J., Choo B.S., Advanced Concrete Technology-Constituent Materials, Elsevier Ltd.

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
4	https://www.digimat.in/nptel/courses/video/105102012/L01.html

CO-PO Mapping

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

The strength of mapping: 1: Low, 2: Medium, 3: High

Assessment

1. The assessment is based on MSE, ISE and ESE.
2. MSE shall be typically on modules 1 to 3.
3. ISE shall be taken throughout the semester in the form of a teacher's assessment.
4. The mode of assessment can be field visits, assignments, Presentations, Complex Problems, etc. and is expected to map at least one higher-order PO.
5. ESE shall be on all modules with around 25-30% weightage on modules 1 to 3 and 70-75% weightage on modules 4 to 6.
6. Min. 40% marks in (MSE+ISE+ESE) are needed, and Min. 40% marks in ESE (ESE shall be a separate head of passing) are needed to pass a theory course.

Prepared by	DAC/BoS Secretary	Head/BoS Chairman

Walchand College of Engineering, Sangli

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AY 2025-26 onwards

Course Information

Programme	B. Tech. (Civil Engineering)
Class, Semester	Third-Year B. Tech. Sem. VI
Course Code	7CV304
Course Name	Design of Reinforced Concrete Structures
Desired Requisites:	Strength of Materials, Structural Analysis, Concrete Technology

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 introduce students to fundamental concepts of Limit state design of reinforced concrete structures using IS 456:200.
2	To equip students with the skill of determining the strength of RCC members for different criteria of the Limit state.
3	To provide knowledge and skills to students required for the design of basic RCC members using the IS 456:2000.

Course Outcomes (CO)

CO	**Description**	**Blooms Taxonomy**	
		Descriptor	**Level**
At the end of the course, the students will be able to,			
CO1	**Summarize** design philosophies, material behaviour, and IS 456:2000 provisions on durability and load combinations.	Understand	II
CO2	Apply relevant clauses of IS 456:2000 for designing reinforced concrete structural elements.	Apply	III
CO3	Design RC slabs, staircases, and columns under axial and combined loads as per IS code.	Analyze	IV
CO4	Design isolated and combined RC footings as per limit state method and relevant codal provisions.	Create	VI

Module	**Module Contents**	**Hrs**
I	**Fundamentals of Structural Design and Design Philosophies:** RCC Design Overview: Importance, applications, and structural behavior. Design Methods: Working Stress, Ultimate Load, and Limit State Methods – concepts and comparison. Design Steps: Load types, combinations, structural system selection, analysis, and design procedure. Material Properties: Key properties and stress-strain behavior of concrete and steel. IS 456:2000 Introduction: Code guidelines, safety factors, and design approach.	3
II	**Design of RC Beams: Part 1** Singly and Doubly Reinforced Beams: Stress block analysis, neutral axis depth, section types (balanced, under-reinforced, over-reinforced), moment of resistance, design procedure, effective length Flanged Beams (T and L Sections): Types, effective flange width, stress block analysis, moment of resistance, design steps	9

III	**Design of RC Beams: Part 2, Shear, Bond, and Torsion:** Shear: Shear stress distribution in isotropic and RC beams, truss analogy, critical shear sections, IS code design provisions for shear Bond: Bond stress, development length, standard hooks and anchorage details Torsion: Equivalent shear and moment in RC members, design of beams for torsion as per IS code	7
IV	**Design of RC Slabs and Staircases:** Types and behavior of slabs, Codal provisions for slabs, Design of one-way slabs: single span, continuous, and cantilever, Design of two-way slabs using IS code method, Design of dog-legged staircases.	7
V	**Design of RC Columns:** Types of columns: short & long, axially loaded & with bending, Effective length of columns, IS 456 codal provisions, Load carrying capacity of axially loaded short and long columns, Design of columns under combined axial load and uniaxial bending, P-M interaction diagram.	7
VI	**Design of RC Footing:** Design of isolated footings: Square and Rectangular footing, Eccentric footing Design of combined footings: Rectangular & Trapezoidal Combined Footing	6

Text Books

1	Punmia, B. C., Jain A. K., Limit state design of reinforced concrete, Laxmi Publication.
2	Shah, V. and Karve, S., Limit state theory and design of reinforced concrete, Structures Publications.
3	Varghese, P. C., Limit state design of reinforced concrete structures, Prentice Hall.

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..
3	Ramamruthm, S., Design of reinforced concrete structures (conforming to IS 456), Dhanpat Rai Publishing.

Useful Links

1	https://onlinecourses.nptel.ac.in/noc23_ce79/preview
2	https://youtu.be/v325KpFJxnQ?si=3pPi5mWBh0DN2sVs

CO-PO Mapping

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

The strength of mapping: - 1: Low, 2: Medium, 3: High

Assessment

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

MSE shall typically be 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 25-30% weightage on modules 1 to 3 and 70-75% 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)

Prepared by	DAC/BoS Secretary	Head/BoS Chairman

Walchand College of Engineering, Sangli

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AY 2025-26 onwards

Course Information

Programme	B. Tech. (Civil Engineering)
Class, Semester	Third-Year B. Tech.
Course Code	7CV351
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**
Tutorial	-	30	30	40	100
Practical	2 hrs/week				
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.
3	To expose the students to real-life water quality issues.

Course Outcomes (CO)

CO	Description	Blooms Taxonomy	
		Descriptor	Level
CO1	***Apply*** the analysis techniques to determine the physical, chemical and bacteriological water quality parameters.	Apply	III
CO2	***Design*** experiment/s to address real-life cases pertinent to water quality.	Design	VI
CO3	***Analyze*** the results to assess the quality of water for potability.	Analyze	IV
CO4	***Interpret*** the observations/results to draw conclusions.	Analyze	IV

List of Experiments / Lab Activities

List of Experiments:

10. Physical and chemical water quality parameters:

1. Electrical conductivity and Total Dissolved Solids
2. Turbidity and Total Suspended Solids
3. Calcium
4. Sulphate
5. Residual chlorine
6. Fluoride

7. Biological water quality parameter

1. Most Probable Number (MPN)

2. Application of water quality analysis

1. Optimal coagulant dose by jar test
2. Chlorine demand for surface/groundwater
3. Efficiency of water purifier (reverse osmosis/resin) for hardness removal.
4. Assessment of river/bore well water pollution through chloride content.
5. Efficiency of cascade aerator for dissolved oxygen enhancement.

6. Advanced instrumentation (Demonstration)

a. UV-visible spectrophotometer
b. Atomic absorption spectrophotometer
c. Gas chromatograph
d. TOC analyzer
e. CHNS analyzer

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	
CO4			1	3			2	1		2			2	

The strength of mapping: 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 the starting week of a semester. The actual schedule shall be as per the academic calendar. Lab activities/Lab performance shall include performing experiments, mini-projects, 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.				

Prepared by	DAC/BoS Secretary	Head/BoS Chairman

Walchand College of Engineering, Sangli

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AY 2025-26

Course Information

Programme	B. Tech. (Civil Engineering)
Class, Semester	Third-Year B. Tech. Sem V
Course Code	7CV352
Course Name	Soil Mechanics Laboratory
Desired Requisites:	Solid Mechanics and Fluid Mechanics Lab

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

Course Objectives

This course is intended to complement parallel theory course so that students can relate soil behavior theoretical concepts with practical validations. The laboratory exercises develop the skills to find Index properties and engineering properties of soil. Students would learn to characterize and classify soils based upon observations and analysis of results.

Course Outcomes (CO)

CO	Description	Blooms Taxonomy	
		Descriptor	Level
CO1	Determine index properties of soil	Evaluating	V
CO2	Determine Engineering properties of soils and interpret the behaviour of soils based upon experimental data.	Evaluating	V
CO3	Demonstrate use of MS-Excel for data analysis and interpretation	Applying	III
CO4	Classify soil sample	Applying	III

List of Experiments / Lab Activities

List of Experiments:

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

Text Books

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

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, 1978, 1st edition.
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											
CO2			3											
CO3					2									
CO4	3													
The strength of mapping: 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 the starting week of a semester. The actual schedule shall be as per the academic calendar. Lab activities/Lab performance shall include performing experiments, mini-projects, 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.				

Prepared by Dr. A. K. Kokane	DAC/BoS Secretary Dr. D. S. Chavan	Head/BoS Chairman Dr A. K. Mali

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2025-26 onwards

Course Information

Programme	B. Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	7CV353
Course Name	Concrete Technology Lab
Desired Requisites:	-

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 make students familiar with basic test methods for evaluating properties of cement, aggregate and concrete.
2	To develop the ability to interpret and analyse test results for assessing the quality of material according to codal provisions.
3	To provide skills to determine fresh and hardened properties of concrete and assess concrete by non-destructive techniques.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	Description	Blooms Taxonomy	
		Descriptor	Level
CO1	Comprehend and apply test methods to assess the properties of cement, aggregate and concrete.	Apply	III
CO2	Analyse the test results of cement and aggregate to decide the suitability for construction as per the IS Code provisions.	Evaluate	V
CO3	Assess the quality of concrete based on the test results of the concrete.	Evaluate	V
CO4	Inspect the concrete quality by non-destructive test methods.	Analyse	IV

List of Experiments / Lab Activities

List of Experiments:

19. Consistency of cement
20. Initial and Final Setting Time of Cement
21. Strength of Cement
22. Soundness of Cement
23. Gradation of Coarse aggregate
24. Workability of concrete - Slump Cone and slump retention test, Compaction factor test
25. Compressive and Split tensile strength of concrete
26. Flexural Strength of Concrete
27. Rebound Hammer Test
28. Ultrasonic Pulse velocity test

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 (1999). "Methods of physical tests for hydraulic cement" Bureau of Indian Standards (BIS), New Delhi, India.
2	IS 516 (1959). "Methods of tests for strength of concrete" Bureau of Indian Standards (BIS), New Delhi, India.
3	IS 13311 (1992). "Method of Non-destructive testing of concrete" Bureau of Indian Standards (BIS), New Delhi, India.
Useful Links	
1	https://www.digimat.in/nptel/courses/video/105106176/L01.html
2	

CO-PO Mapping														
	Programme Outcomes (PO)												**PSO**	
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1			2					1				1	
CO2	1			2					1				1	
CO3	1			2					1				1	
CO4	1			2	3				1				1	
The strength of mapping: 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 the starting week of a semester. The actual schedule shall be as per the academic calendar. Lab activities/Lab performance shall include performing experiments, mini-projects, 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.				

Prepared by	DAC/BoS Secretary	Head/BoS Chairman

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2025-26 onwards

Course Information	
Programme	B. Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	7CV321
Course Name	Highway and Railway 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 exposure to highway planning and designing of geometric elements of roads and rails.
2	To comprehend the geometric standards and various practices adopted for the construction of roads and railways.
3	To develop skills in construction, 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

CO	**Description**	**Blooms Taxonomy**	
		Descriptor	**Level**
CO1	Explain the principles of planning and designing of various geometric elements of highways and railways.	Understand	II
CO2	Apply knowledge for the selection of construction materials and select appropriate methods of construction and maintenance for roads and railways.	Apply	III
CO3	Analyse and adopt various techniques for the traffic management of highways and railways.	Analyse	IV
CO4	Assess the geometric standards of road pavements.	Evaluate	V

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, and 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, 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, coning of wheels and tilting of rails, Rails: Types, functions, wear, various defects and failures, joints, Sleepers, Fixtures and fastenings, Ballast. **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.
2	Khanna S. K., Justo C. E. G., Veeraragavan A, "Highway Engineering", Nem Chand & Sons.
3	Arora S. P. and Saxena S. C., "A Textbook of Railway Engineering", Dhanpat Rai Publications Pvt, Ltd.

References	
1	Kadiyalai, L. R., "Traffic Engineering and Transport Planning", Khanna Publishers.
2	Mundrey J. S., "Railway Track Engineering", Tata McGraw Hills Publications..
3	Wright, Paul H. and Dixon, "Highway Engineering", John Wiley & Sons.

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	2												1	
CO2	3												2	
CO3		2	3										2	
CO4	3		3										2	

The strength of mapping 1: Low, 2: Medium, 3: High

Assessment

1. The assessment is based on MSE, ISE and ESE.
2. MSE shall typically be on modules 1 to 3.
3. ISE shall be taken throughout the semester in the form of a teacher's assessment.
4. The mode of assessment can be field visits, assignments, Presentations, Complex Problems, etc. and is expected to map at least one higher-order PO.
5. ESE shall be on all modules with around 25-30% weightage on modules 1 to 3 and 70-75% weightage on modules 4 to 6.
6. Min. 40% marks in (MSE+ISE+ESE) are needed, and Min. 40% marks in ESE (ESE shall be a separate head of passing) are needed to pass a theory course.

Prepared by	DAC/BoS Secretary	Head/BoS Chairman

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2025-26 onwards

Course Information

Programme	B. Tech. (Civil Engineering)
Class, Semester	Third-Year B. Tech., Sem VI
Course Code	7CV322
Course Name	Foundation Engineering
Desired Requisites:	Soil Mechanics, Soil Mechanics Lab

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	1 Hr/ week-	30	20	50	100
Practical	-	**Credits: 3**			

Course Objectives

This course aims at developing student's ability to apply principles of soil mechanics to analyse and design geotechnical structures. They would learn to decide soil investigation plan for a particular project. Students are expected to be introduced to the profession of foundation engineering and retaining wall designs.

Course Outcomes (CO)

CO	Description	Blooms Taxonomy	
		Descriptor	Level
CO1	Describe various subsurface exploration techniques and select a suitable technique to investigate for a given geotechnical structure.	Understanding	II
CO2	Explain mechanics concepts required to analyse a geotechnical system	Understanding	II
CO3	Analyse earth pressure distribution on retaining structures and stability of slopes	Analyzing	IV
CO4	Analyse and Design shallow and deep foundations from the geotechnical aspect.	Analyzing	IV

Module	Module Contents	Hours
I	**Introduction**: Role of civil engineer in the selection, design and construction of foundation of civil engineering structures, **Sub-surface investigations**: spacing/depth of boreholes, disturbed/undisturbed soil sampling, geophysical exploration, , preparation of borehole logs and final report Field Tests: plate load test, standard penetration and cone penetration tests	4
II	**Earth Pressure on Retaining Structures**: Three basic earth pressure conditions with reference to wall movement: Active, At rest, and Passive. Rankine's and Coulomb's Earth Pressure theory, Retaining walls - various types, size proportioning and stability analysis, Sheeting and bracing of foundation excavation.	5
III	**Foundations:** Types of foundations, mechanism of load transfer in shallow and deep foundations, Combined footing and raft foundation, proportioning of footings and rafts	3
IV	**Shallow Foundations Analysis**: Terzaghi's and Meyerhoff's bearing capacity theories, effect of various factors, design of a footing in cohesionless/cohesive soil based on settlement and bearing capacity criteria	5

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.	6
VI	**Slope Stability Analysis** Failure mechanisms, stability analysis of infinite and finite slopes, Bishop's simplified method **Introduction to Ground improvement** Necessity, Introduction to mechanical , Inclusion/Confinement, hydraulic, physical/chemical modification methods.	4
The tutorial period will involve numerical problem-solving sessions on topics related to the analysis and design of foundations, retaining walls and slope		

Text Books	
1	B.M.Das, "Principles of Foundation Engineering", Cengage Learning
2	Gopal Ranjan and A.S.R. Rao (2016),"Basic and Applied Soil Mechanics",New Age International Publishers
3	Murthy, V. N. S., "Geotechnical Engineering: Principles and practices of Soil Mechanics and Foundation Engineering ", Marcel Dekker Inc., New York
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.(2017), "Geotechnical Engineering – Principles and Practices", Prentice-Hall
Useful Links	
1	https://nptel.ac.in/courses/105/101/105101083/
2	https://www.youtube.com/watch?v=H6_J8LuTa-M&list=PLA4019BB0B0CF6518
3	https://ocw.mit.edu/courses/1-322-soil-behavior-spring-2005/pages/lecture-notes/

CO-PO Mapping

	Programme Outcomes (PO)												**PSPO**	
COs	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1				2									1	1
CO2	2												1	1
CO3		3											2	3
CO4			3										2	3
The strength of mapping: - 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 25-30% weightage on modules 1 to 3 and 70-75% 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)

Prepared by Dr. A. K. Kokane	DAC/BoS Secretary Dr D. S. Chavan	Head/BoS Chairman Dr. A. K. Mali

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2025-26 onwards

Course Information

Programme	B. Tech. (Civil Engineering)
Class, Semester	Third-Year B. Tech.
Course Code	7CV323
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	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	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)

CO	Description	Blooms Taxonomy	
		Descriptor	Level
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	II
CO2	**Apply** the waste management concepts	Apply	III
CO3	**Analyze** the problems on wastewater and solid waste associated with generation, characteristics, collection and treatment/processing; air and noise pollution.	Analyze	IV
CO4	**Design** sewerage and wastewater treatment system.	Design	VI

Module	**Module Contents**	**Hours**

I	**Wastewater and Collection** Wastewater: Sources, Flow rate and variations, Quantitative estimation, Characteristics Gravity sewer collection system: Nomenclature, Manhole, Pumping station Introduction to pneumatic (vacuum drainage) sewer system Design of sanitary and storm sewer, Computer application SEWERCAD	**6 L**
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 L**
III	**Aerobic Wastewater treatment** Aerobic suspended growth: Conventional Activated Sludge Process (ASP), Sequential batch reactor (SBR), Process design and operating parameters (ASP and SBR), Operational problems (ASP), Concepts of oxidation ditch and Waste stabilization pond Biological filtration	**10 L**
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) Concept of package sewage treatment plant Disposal of wastewater: Methods, Effluent standards Stream pollution: Self-purification (Stream rejuvenation), DO sag curve, Streeter Phelp's equation for point source, Stream classification	**7 L**
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, Bio-mining	**6 L**

VI	**Air and Noise pollution** Air Pollution: Meteorological parameters, Ambient air quality monitoring, Indoor air pollution, 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 L**

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

CO-PO Mapping														
	Programme Outcomes (PO)												**PSPO**	
COs	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
CO4			3	1			2			1		1	3	3
The strength of mapping: - 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 25-30% weightage on modules 1 to 3 and 70-75% 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)

Prepared by	DAC/BoS Secretary	Head/BoS Chairman

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2025-26 onwards

Course Information

Programme	B. Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	7CV371
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 give exposure to various tests adopted to characterise the road construction materials and management of traffic.
2	To explain the parameters governing the selection of the best pavement construction material.
3	To develop the ability to assess various properties of highway materials and various practices adopted for construction.
4	To demonstrate the method of designing bituminous mixes for flexible pavement.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	Description	Blooms Taxonomy	
		Descriptor	Level
CO1	Apply practices to examine the properties of road construction materials for their use in road construction and to manage road traffic.	Apply	III
CO2	Interpret the test results of materials and compare the values with the Indian standard codal provision to decide the suitability of the road construction material.	Analyse	IV
CO3	Apply knowledge of traffic studies to analyse the data for traffic management.	Analyse	IV
CO4	Comprehend the concept of bituminous mix design for flexible pavements.	Understand	II

List of Experiments / Lab Activities

List of Experiments:

10. Specific Gravity of Bitumen
11. Penetration Test on Bitumen
12. Softening Point of Bitumen
13. Viscosity of Bitumen
14. Flash and Fire Point of Bitumen
15. Ductility of Bitumen
16. Bituminous Extraction Test
17. Spot Speed Study
18. Intersection Traffic Volume Study
19. Impact and Abrasion Test of Aggregate
20. Demonstration of the Marshall Stability Test

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

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

The strength of mapping, 1: Low, 2: Medium, 3: High

Assessment

There are three components of the 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.				

Prepared by	DAC/BoS Secretary	Head/BoS Chairman

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2025-26 onwards

Course Information

Programme	B. Tech. (Civil Engineering)
Class, Semester	Third-Year B. Tech. Civil, Sem. VI
Course Code	7CV372
Course Name	Problem Based Laboratory I
Desired Requisites	Knowledge of the courses covered from Sem. I to Sem. V

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 inculcate problem-solving skill in students.
2	To encourage students to use various experiments/softwares to provide solution to real life problems.
3	To orient the students to deal with real-life problems.

Course Outcomes (CO)

CO	Description	Blooms Taxonomy	
		Descriptor	Level
CO1	**Identify** societal/engineering problems.	Remember	I
CO2	**Collect** the data required for field-based/analytical problem identified for the study.	Create	VI
CO3	**Design/decide** the methodology for experimental/analytical work.	Evaluate	V
CO4	**Study** the problem and provide technically sound, economical and feasible solution.	Analyze	IV

List of Experiments / Lab Activities

List of Experiments:

Students are expected to select any **societal problem associated with Civil Engineering** and provide a solution to it. The use of modern tools/experiments/analytical approach/software application is desired in addressing the problem. Process given below shall be followed:

1. **Identification of problem (**field based/analytical**)**
2. **Data collection**
    1. **For field-based problems:**
        - Site visits
        - Observations
        - Sample collection
        - Interaction
    2. **For analytical problems:**
        - Selection of tool/software
        - Use of tool/software

3. **Methodology**
    1. Design/finalize the experiment
    2. Finalize and document the procedure/process of experimentation
4. **Actual work**
    1. Experimental work
    2. Simulation/modelling/design/analysis
5. **Remedial measures/solution**
    1. Alternatives methods/measures to solve the problem
    2. Discussion on an alternative scenario
6. **Conclusion**

Software	
1	Water Infrastructure Division, US EPA, EPANET User Manual.
2	Autodesk, An Introduction to AutoCAD for beginners.
3	Bentley Systems.
4	Q-GIS.
5	ArcGIS.
6	GeoStudio 2D.
7	GEO5.
References	
1	Shih R., AutoCAD Tutorial.
2	Walski T., 'Advanced Water Distribution Modeling', Haestad Press.
3	'Stormwater Conveyance Modeling and Design', Haestad Press.
4	https://www.geoslope.support/kb/article/10-geostudio-reference-manuals/
Useful Links	
1	https://www.youtube.com/channel/UCbFIgNot42PRCi-05X8aF_A
2	https://www.seequent.com/products-solutions/geostudio/

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			**2**	**3**					**1**					
CO3			**2**	**3**		**1**			**1**					
CO4			**3**		**3**	**1**	**1**		**1**				**2**	
The strength of mapping: 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 the starting week of a semester. The actual schedule shall be as per the academic calendar. Lab activities/Lab performance shall include performing experiments, mini-projects, 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.				

Prepared by Dr. D. S. Chavan	DAC/BoS Secretary	Head/BoS Chairman

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2025-26

Course Information

Programme	B. Tech. (Civil Engineering)
Class, Semester	Third-Year B. Tech.
Course Code	7VSCV371
Course Name	Computer-Aided Structural Design
Desired Requisites:	Design of Reinforced Concrete Structures, Structural Analysis,

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 demonstrate the design of residential building and combined footing.
2	To apply holistic approach of planning, analysis and design of RCC building.
3	To impart training of various analysis, design and drawing professional software for civil engineering structures using relevant IS codes

Course Outcomes (CO)

CO	Description	Blooms Taxonomy	
		Descriptor	Level
CO1	Apply fundamental RC design principles to develop practical structural solutions for real-world projects.	Apply	III
CO2	Demonstrate a thorough understanding of relevant design codes and standards, ensuring compliance in all design aspects.	Create	VI
CO3	Design various RC structural elements, such as beams, slabs, columns, and foundations, ensuring structural integrity and safety.	Apply	III
CO4	Prepare detailed structural drawings that clearly communicate design intent, including reinforcement detailing and connection details using software tools.	Analyze	IV

List of Experiments / Lab Activities

The lab work shall consist of detailed design &drawing of the following R. C. structures

Part 1. Residential G+1 storey building

1. Forming groups of 4-5 students in each batch and choose a specific Residential RC structure (G+1) with isolated footing to design.
2. Prepare detailed drawing of structure using AutoCAD.
3. Design structural element of RC structure. (Footing, Column, Beam, slab etc.)
4. Prepare detailed bar bending schedule for all structural elements.
5. Prepare detailed report of project.

Part 2. Residential G+1 Storey Building Design Using STAAD.Pro

1. Form groups of 4–5 students in each batch and select a specific Residential RC structure (G+1) with isolated footing for structural design.
2. Create a 3D structural model of the building using **STAAD.Pro**, defining appropriate materials, supports, and load cases.
3. Analyze and design RC structural elements such as **footings, columns, beams, and slabs** using STAAD.Pro as per relevant design codes.
4. Generate and compile a **detailed bar bending schedule** for all structural elements based on the analysis and design output.
5. Prepare a comprehensive **project report** including modeling steps, design results, bar bending schedule, and conclusions.

Text Books	
1	N. C. Sinha & S. K. Roy, "Fundamentals of Reinforced Concrete" S. Chand Publishing,
2	B. C. Punmia, Jain and Jain, "Comprehensive Design of R.C. Structures",
3	Dr. V. L. Shah and Dr. S.R. Karve, "Limit State Theory and Design".
References	
1	P. C. Varghese "Limit State Design of Reinforced Concrete", Prentice Hall of India, New Delhi, 1st Edition,1999.
2	STAAD.Pro V8i for Structural Analysis and Design – T.S. Sarma
3	AutoCAD 2024 for Engineers and Designers – Sham Tickoo
Useful Links	
1	https://www.csiamerica.com/
2	https://www.bentley.com/
3	https://www.autodesk.com/

CO-PO Mapping														
	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1		3			2				2	1			1	
CO2			3						2	1			1	
CO3			2		3				2	1			1	
CO4			2		3				2	2				
The strength of mapping: 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 the starting week of a semester. The actual schedule shall be as per the academic calendar. Lab activities/Lab performance shall include performing experiments, mini-projects, 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.				

Prepared by	DAC/BoS Secretary	Head/BoS Chairman

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2025-26

Course Information

Programme	B. Tech. (Civil Engineering)
Class, Semester	Third-Year B. Tech.
Course Code	
Course Name	Professional Elective 2: Remote Sensing and GIS
Desired Requisites:	Basics of Surveying

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)

After completion of the course students will able to

CO	Description	Blooms Taxonomy	
		Descriptor	Level
CO1	Identify and describe the fundamentals of Remote Sensing and Geographic Information Technologies.	Understanding	II
CO2	Demonstrate, and interpret spatial data to extract maximum information.	Analysing	IV
CO3	Implement Geospatial Applications in Various Domains.	Applying	III
CO4	Classify the remotely sensed data.	Evaluating	IV

Module	**Module Contents**	**Hours**
I	**Principles 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, Review on photogrammetry, Advantages of Remote sensing, Data formats and pre-processing techniques, errors in remote sensing data, Radiometric and geometric corrections	4
III	**Visual Image Interpretation** Types of Pictorial Data Products, Image interpretation strategy, Process of Image Interpretation, Interpretation of Aerial Photo, Three dimensional interpretation Method, Basic elements of Image Interpretation	4
IV	**Fundamentals Geographical Information System** Definition and principles of GIS, Components of a GIS (hardware, software, data, methods), Spatial data models (vector and raster), GIS Queries, Coordinate systems and map projections, GIS Architecture, Theoretical Models of GIS, GIS Categories	5
V	**Spatial Data Modelling** Stages of GIS Data Modelling, Graphic Representation of Spatial Data, Raster GIS Models, Vector GIS Models	4

VII	**Introduction of Global Positioning System** Satellite constellation, GPS signals and data, Geo-Positioning-Basic Concepts. Control Segment Discussion on NAVSTAR, GLONASS, GALLILEO, COMPASS, Coordinate Systems, Special Referencing system, Map Scale, Scale factors, Indian geodetic System, GNSS.	5
VIII	**Creation of Information System and its application** Land use and land cover mapping, Environmental monitoring and assessment, Urban planning and management, Natural resource management and conservation, Archaeology investigation, Agriculture management.	4

Text Books	
1	Reddy M. A., "Remote Sensing & Geographical Information System", BS Publications, Hyderabad.
2	Lillesand T. M. & Kiefer R., "Remote Sensing and Image Interpretation" , John Villey.
3	French, Gregory T. Understanding the GPS: An Introduction to the Global Positioning System: what it is and how it Works. United States: GeoResearch."

References	
1	Jensen J. R. "Remote Sensing & Digital Image Processing", Department of Geography University of South Carolina Columbia.
2	Panda B C, "Principles of Remote Sensing", Viva Books Private Limited.
3	Colvocoresses, Alden P.. Remote Sensing Platforms. United States, U.S. Geological Survey.

Useful Links	
1	https://www.youtube.com/watch?v=vJAQHA5XQWI&list=PL3MO67NH2XxLAFn3jc7gOhXLD9YFx-oew
2	https://www.youtube.com/watch?v=1zwg-siuvuc&list=PLp76zJxzEriMstHWJssWiczio7rtIAU6r

CO-PO Mapping

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

The strength of mapping: - 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 25-30% weightage on modules 1 to 3 and 70-75% 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)

Prepared by	DAC/BoS Secretary	Head/BoS Chairman

Walchand College of Engineering, Sangli

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A.Y. 2025-26 Onwards

Course Information	
Programme	B. Tech. Civil Engineering
Class, Semester	Third Year, Semester II
Course Code	
Course Name	Plastic and Electronic Waste Management
Desired Requisites:	

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

Course Objectives

1	To provide students with a comprehensive understanding of sources, types, and 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 methods and challenges associated with their collection, recycling, and disposal.

Course Outcomes (CO)

CO	Description	Blooms Taxonomy	
		Descriptor	Level
CO1	Explain the sources, types, and generation patterns of plastic and e-waste environmental and health impacts of plastic and e-waste, and	Understand	II

	the need for sustainable management practices.		
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	II
CO3	Identify generation patterns of plastic and e-waste, methods, challenges and opportunities in their collection, recycling, and disposal.	Analyse	IV

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 of plastic by chemical and dissolution method, use of nanotechnology and AI in plastic waste management, use of plastic in roads, bricks and furniture	4
III	**E-Waste Generation and Sources** Sources of e-waste: consumer electronics, IT equipment, appliances, 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, E-waste disposal methods: landfilling, incineration, and their environmental impacts.	5
V	**Extended Producer Responsibility (EPR) and Policy Framework** 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.	5

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	Dr. Ramesha Chandrappa and Dr. Diganta B. Das "Solid Waste Management: Principles and Practice" , Springer, Publications.	
2	George Tchobanoglous Hilary Theisen Samual Vigil, “Integrated Solid Waste Management,” McGraw Hill publications, Indian edition.	
3	Murali Srinivasan Natamai Subramanian, “Plastics Waste Management: Processing and Disposal”, Wiley publications.	
References		
1	Kamila Pope, “Global Waste Management: Models for Tackling the International Waste Crisis”, Kogan Page publishing.	
2	Eric Williams, Klaus Hieronymi, Ramzy Kahhat, “E-waste Management From Waste to Resource”, Tayler and Francis.	
3	Trevor Letcher (Editor), “Plastic Waste and Recycling: Environmental Impact, Societal Issues, Prevention, and Solutions”, Academic Press Inc.	
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	
COs	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1						3	3							
CO2						3	3						1	
CO3						3	3						1	
The strength of mapping :- 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)

Prepared by DAC/BoS Secretary Head/BoS Chairman

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2025-26 Onwards

Course Information

Programme	B. Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Semester VI
Course Code	
Course Name	Professional Elective 1: Fundamentals of Air and Noise Pollution
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 describe sources and effects of air and noise pollution
2	To explain different techniques to control air and noise pollution
3	To demonstrate application of regulatory standards for air and noise pollution control

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO1	***Identify*** sources and ***Describe*** effects of air and noise pollution on human health, animals, and environment	Remember
CO2	***Explain*** the meteorological factors such as atmospheric composition, stability, and wind patterns associated with air pollution	Understand
CO3	***Demonstrate*** use of instrumentation to monitor level of air and noise pollutants in ambient atmosphere and compare measured values with respective regulatory standards	Apply

Module	Module Contents	Hrs
I	**Air Pollution: Introduction** Air pollution: Classification and sources of air pollutants; Effects of various air pollutants on man, animals, vegetation, and materials; Ambient air quality standards, and concept of Air Quality Index (AQI).	4
II	**Meteorology** Composition and structure of the atmosphere; Meteorological factors influencing air pollution; Atmospheric stability, Lapse rate, and Inversion; construction of Wind rose diagram, Plume behavior patterns	4
III	**Air Pollution Control Techniques** Operating principles for the control of Gaseous Pollutants: Absorption, Adsorption, Chemical Scrubbing, and Incineration; Control of Particulate Matter: Settling Chamber, Cyclone, Wet Collectors, Fabric filter, and Electrostatic precipitator.	5
IV	**Motor Vehicle Emissions** Automobile emissions; Emission standards and introduction to vehicular emission inventory, Various prevention and control measures, Status of vehicular air pollution in India.	4
V	**Noise Pollution** Introduction to Noise Pollution: Definition and sources of noise pollution; Measurement of noise, sound pressure level (SPL); Health and environmental effects of noise; Noise Pollution Control Techniques.	4
VI	**Air and Noise Pollution Monitoring, Legislation, and Case Studies** Air and Noise Pollution Monitoring Techniques and instrumentation; Air and Noise Pollution Legislation: National and international standards for air and noise pollution control; A Case study for air and noise pollution control in industry and public utility.	5

Textbooks	
1	S. K. Garg “Environmental Engineering” (Vol. II: Air and Noise Pollution), Khanna Publishers
2	R. K. Khitoliya “Environmental Engineering” Dhanpat Rai Publishing Company
3	P. Venugopala Rao “A Textbook of Environmental Engineering” Prentice Hall India
4	S. K. Agarwal “Noise Pollution: Theory and Control"
References	
1	Rao H.V.N. and Rao M. N., "Air Pollution", Tata McGraw Hill.
2	Cunniff PE, “Environmental Noise Pollution”, McGraw Hill, New York.
3	Central Pollution Control Board (CPCB) Publications Website: https://cpcb.nic.in
Useful Links	
1	https://onlinecourses.nptel.ac.in/noc23_ce14/preview
2	https://www.youtube.com/watch?v=ToO0WOnFdq4

CO-PO Mapping														
	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2				2	2							
CO2		3			3	2								
CO3	3	2				3	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 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, student should obtain Min. 40% marks in (MSE+ISE+ESE) with individual passing i.e. Min. 40% marks in ESE as a separate head of passing

Prepared by	DAC/BoS Secretary	Head/BoS Chairman

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2025-26 onwards

Course Information	
Programme	B. Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	
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 understand concept of analysis of river flow hydraulics, hydraulic geometry and to design 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.	Understanding
CO2	*Apply* the knowledge of fundamental of analysis of river flow hydraulics, hydraulic geometry and design stable alluvial channels.	Applying, Analysing
CO3	*Design* of fluvial stable alluvial channels and river bank protection.	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	Chang H. Howard, "Fluvial Processes in River Engineering", John Wiley & Sons1988.
2	Santosh Kumar, "River Engineering", Khanna Publishing House; 1st edition (30 September 2020)
3	K D Gupta, "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	
3	
4	

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 2025-26 onwards

Course Information

Programme	B. Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech. Civil, Sem. VI
Course Code	
Course Name	Program Elective-I: 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)

CO	Description	Blooms Taxonomy	
		Descriptor	Level
CO1	Restate the analysis equations in the form of matrix equations.	Understanding	2
CO2	Analyse indeterminate trusses, beams and frames applying flexibility method.	Analysing	4
CO3	Analyse indeterminate trusses, beams and frames applying stiffness method.	Analysing	4
CO4	Calculate the nodal displacements and member forces using finite element method.	Evaluating	5

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 using flexibility method.	5
II	**Flexibility Method - Trusses** Analysis of indeterminate trusses 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 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 using direct stiffness method.	4

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.	4
VI	**Finite Element Method** Introduction to finite element method, Basic concept, General procedure of finite element analysis, Discretization, nodes, element connectivity, displacement model, shape function, selection of order of polynomials, Development of element stiffness matrix and nodal load vector for bar element, Application to bar with constant cross section subjected to axial forces.	4

Text Books	
1	Gere, J. M. & Weaver, W., Matrix Analysis of Framed Structures, CBS Publishers and Distributor.
2	Godbole, P. N., Introduction to Finite Element Methods, I K International Publishing House Pvt. Ltd..
3	Reddy, C. S., Basic Structural Analysis, McGraw Hill Education.

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

Useful Links	
1	https://archive.nptel.ac.in/courses/105/105/105105180/
2	https://onlinecourses.nptel.ac.in/noc20_me91/preview

CO-PO Mapping														
	Programme Outcomes (PO)												PSO	
COs	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	**2**													**2**
CO2	**3**													**2**
CO3	**3**													**2**
CO4	**3**													**2**
The strength of mapping: - 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 25-30% weightage on modules 1 to 3 and 70-75% 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).

Prepared by Dr. D. S. Chavan	DAC/BoS Secretary	Head/BoS Chairman

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2025-26

Course Information

Programme	B. Tech. (Civil Engineering)
Class, Semester	Third-Year B. Tech.
Course Code	
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 the airport construction and maintenance aspects of the airport and make them familiar with the components of the airport.
2	Impart the techniques of planning and designing the airport components like runways, taxiways, terminal building, hangars, etc., along with the drainage and traffic control methods.
3	To make conversant with various construction methods of airports.

Course Outcomes (CO)

CO	Description At the end of the course, students will be able to	Blooms Taxonomy	
		Descriptor	Level
CO1	Explain the fundamental concepts, history, classifications, and terminology related to airport engineering.	Understand / Apply	II & III
CO2	Explain and apply design considerations of the various components of airports.	Apply	III
CO3	Illustrate air traffic control systems, lighting, and marking requirements for runways, taxiways, and heliports.	Understand	II
CO4	Analyze airport drainage systems and propose mitigation measures for environmental impacts caused by airport operations.	Analyze / Apply	III & IV

Module	Module Contents	Hours
I	**Introduction to Airport Engineering** Introduction, History, Terminology, characteristics, airport classification, and organizations concerned with Airport Engineering, ACM & PCM ,components of aircraft, Role of civil engineering in airport planning and design.	5
II	**Airport 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, and zoning laws.	5
III	**Airport Geometric Design of Runways, Taxiways** Designing: Runways, Runway classification, runway orientation, basic runway length, geometric design.Taxiways- layouts, geometric design, Waterways	4
IV	**Airport Terminal Buildings** **Terminal Buildings:** Site selection, facilities, aprons, gate positions. Hangars: Function, types, requirements.	4

V	**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	**Airport Drainage and Environmental Considerations** Surface water management at airports, Drainage: Necessity, types, Environmental impacts of airports and mitigation measures.	4

Text Books	
1	G. Venkatappa Rao., "Airport Engineering", Tata McGraw-Hill
2	Khanna S. K. & Arora M. G., "Airport Planning and Design", Nem Chand and Brothers
3	Richard de Neufville, Amedeo Odoni, " Airport System: Planning, Design and Management", McGraw-Hill Education.

References	
1	Rangwala S.C. " Principals of Airport Engineering" Universities Press
2	Horonjeff R., McKelvey F., Sproule W., Young S., "Planning and Design of Airports",

Useful Links	
1	https://www.youtube.com/watch?v=bn2_NZkYQAo&list=PLvG1qort4KxZwu0l4mS2gW06-lrQW6M56

CO-PO Mapping

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

The strength of mapping: - 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 25-30% weightage on modules 1 to 3 and 70-75% 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)

Prepared by	DAC/BoS Secretary	Head/BoS Chairman

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2025-26 onwards

Course Information	
Programme	B. Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	
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 of cement chemistry and the hydration of cement.
2	To provide conceptual know-how of admixtures used in concrete to improve the 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,

CO	**Description**	**Blooms Taxonomy**	
		Descriptor	**Level**
CO1	Apply the knowledge of cement chemistry and the hydration of cement.	Apply	III
CO2	Compare the properties of admixtures to decide their suitability depending on the construction industry requirements.	Analyze	III
CO3	Analyse the durability of issues of concrete and apply knowledge of special concretes.	Analyze	III
CO4	Design a special concrete mix according to the IS 10262: 2019 provisions.	Design	V

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	**Chemical Admixtures** Specification, Functions, Classification and Working Principles. Chemical Admixtures: Plasticisers, Super-plasticiser, Accelerators, Retarders, Air entraining agents, Speciality Admixture, Compatibility of Admixtures	4
III	**Mineral Admixtures** 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	5

V	**Durability of Concrete** Permeability and Pore Structure, Ionic Diffusion, Chemical Attack (Sulphate, Chloride, Acid, Carbonation), Physical Attack (freeze-thaw), Corrosion of reinforcement, Alkali-Aggregate Reaction	5
VI	**Special Concretes** Fibre reinforced concrete, Ultra-high strength concrete, Pervious Concrete, Recycled Aggregate Concrete.	3

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

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

The strength of mapping: 1: Low, 2: Medium, 3: High

Assessment

10. The assessment is based on MSE, ISE and ESE.
11. MSE shall typically be on modules 1 to 3.
12. ISE shall be taken throughout the semester in the form of a teacher's assessment.
13. The mode of assessment can be field visits, assignments, Presentations, Complex Problems, etc. and is expected to map at least one higher-order PO.
14. ESE shall be on all modules, with around 25-30% weightage on modules 1 to 3 and 70-75% weightage on modules 4 to 6.
15. Min. 40% marks in (MSE+ISE+ESE) are needed, and Min. 40% marks in ESE (ESE shall be a separate head of passing) are needed to pass a theory course.

Prepared by	DAC/BoS Secretary	Head/BoS Chairman