A.Y. 2023-24 (Even Semester)

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 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	1		3						2	3	
CO2		3		1		3	3						3	3	
CO3			3	1			3						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.

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	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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AY 2023-24

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).

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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	

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:

15. Characteristics of sewage
    i. Bio-chemical oxygen demand (BOD)
    ii. Chemical oxygen demand
    iii. Total kjeldahl nitrogen
16. Estimation of BOD rate constant
17. Determination of mixed liquor suspended solids, mixed liquor volatile suspended solids
18. Determination of sludge volume index and sludge density index
19. Sludge characterization
    i. Moisture content
    ii. Total, fixed and volatile solids
20. Effect of sewage disposal on stream
21. Design of sewerage system for a housing colony/Part of city
22. 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	1			2			1	1		1			2	2
CO2				2			1	1		1				
CO3			3	2	2	1	1	1		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.				

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	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 ii. References	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_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	3			1		1	2	2		1	2	2
CO2			3		2	1		1	2	2	2	1	1	2
CO3					2	1		1	2	2		1	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 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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AY 2023-24

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									1	1		1		2
CO2		3			2				1	1		1		2
CO3		3	3						1	1		1	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.				

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	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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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 watershed development programme	5

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)

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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)

CO1	Explain elements of regional plan(RP) and development plan(DP)	Apply
CO2	Comprehend different aspects a town planning scheme	Understanding
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 zone 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).

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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	3	
CO2		3											3	3	
CO3		3											3	3	

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

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 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:

23. Density of Cement
24. Particle Size Analysis (Laser Diffraction)
25. Specific Surface area of cement (Blaine)
26. Setting time of concrete
27. Strength Activity Test
28. Modified Chappelle Test
29. Marsh Cone Test
30. Mini Slump Test
31. Freeze drying test on Cement Paste
32. 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	

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