B12K

Walchand College of Engineering, Sangli
(Government Aided Autonomous Institute)

AY 2023-24

Course Information

Programme	B.Tech. (Civil Engineering)
Class, Semester	Final Year B. Tech. Sem. VII
Course Code	5CV401
Course Name	Estimating and Costing
Desired Requisites:	Building Materials and Construction, Building Planning and Design

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 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 acquaint the students with estimation software.

Course Outcomes (CO) with Bloom's Taxonomy Level

CO1	***Explain*** elements of estimating as well as contracting.	Understanding
CO2	***Construct*** specifications and quantity sheets for various items of traditional as well as unconventional civil works.	Creating
CO3	***Analyze*** rates and ***estimate*** costs of different civil works; and identify an appropriate method for execution of a civil work.	Applying Analyzing

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`** Necessity and significance, Types of specifications, Essential requirements of specifications, Contents of detailed specifications, Specifications for various items of works, Typical specifications for traditional items of civil work, Pros and cons of standard specifications, Typical deviations w.r.t. standard specifications.	4
III	**Quantity Sheets** PWD method, MES method, Measurement and Abstract Sheets, Long Wall and Short Wall Method, Bar Bending Schedule (BBS), Quantity sheets for buildings and other civil works.	4
IV	**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.	4

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V	**Approximate Estimates** Definition, Purpose, Methods, Approximate Estimates of civil works namely Building, Bridges, Roads, Water supply and drainage schemes, Irrigation works etc.	5
VI	**Detailed Estimates** Definition, Purpose, Procedure, Methods, Provisions, Detailed Estimates of Buildings, Bridges, Roads, Water supply and drainage schemes, Irrigation works etc.	5

	Text Books
1	Dutta, B. N., "Estimating & Costing in Civil Engineering," UBS Publishers, 28th Revised Edition, 2016.
2	Birdi G.S., "Text book of Estimating & Costing", Dhanapat Rai Sons, 7th Edition, 2015.
3	Patil B. S., "Civil Engineering Contracts & Estimates", Orient Longman Ltd., 4th Edition, 2015.

	References
1	**I.S. code 1200 (Part I to XXX) B.I.S., Delhi**
2	"Standard Specification Vol. I & II", PWD Maharashtra.
3	"D.S.R.", PWD Maharashtra for the recent year.

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

CO-PO Mapping

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

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of 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	Final Year B. Tech., Sem VII
Course Code	5CV402
Course Name	Reinforced and Prestressed Concrete Design
Desired Requisites:	Design of Concrete structures I

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

Course Objectives

1	To provide knowledge of design of reinforced concrete structures.
2	To impart knowledge of concept of prestressed concrete members.
3	To provide knowledge of design of prestressed concrete structures.

Course Outcomes (CO)

CO1	**Distinguish** concept of reinforced and prestressed concrete.
CO2	**Evaluate** various RCC and prestressed concrete sections.
CO3	**Design** of RCC and prestressed concrete sections.

Module	Module Contents	Hours
I	Water tank - Design of circular and rectangular water tank resting on ground using approximate and IS Code method.	4
II	Foundation - Design of combined footing (Slab type, slab beam type) and raft foundation.	5
III	Retaining wall - Design of cantilever & counterfort retaining wall.	4
IV	Introduction to prestressed concrete, material used, systems and methods of Prestressing, basic concepts, Analysis by stress concept, strength concept, load balancing concept, Pre-& Post tensioned members, end anchorages Losses in Prestress, merits & demerits of prestressed concrete	5
V	Analysis of rectangular and Symmetrical I section, thrust line, cable profiles. Design of rectangular and Symmetrical I section, kern distances & efficiency of section.	5
VI	Shear & diagonal tension, End block stresses, Design of end block by I.S. code method.	3

Textbooks

1	A. K. Jain "Reinforced Concrete Design (Limit State)" Nem Chand and brother's publishers, 1st Edition, 2012.
2	N. C. Sinha & S. K. Roy, "Fundamentals of Reinforced Concrete" S. Chand Publishing, 4th Edition, 2013.
3	N. Krishna Raju "Prestressed Concrete", Tata McGraw Hill Education, 4th Edition, 2006.
4	

References

1	P.C. Varghese "Limit State Design of Reinforced Concrete", Prentice Hall of India, New Delhi, 2nd Edition, 2011.
2	T.Y. Lin "Prestressed Concrete", John Wiley & sons Inc. New York, 3rd Edition, 1981.
3	IS Codes
4	

Useful Links	
1	https://nptel.ac.in/courses/105108069
2	https://nptel.ac.in/courses/105106117
3	
4	

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	**2**		**3**	**3**											
CO3	**3**		**2**	**2**											

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

Assessment

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

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AY 2023-24

Course Information

Programme	B.Tech. (Civil Engineering)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	5CV404
Course Name	Construction Project Management
Desired Requisites:	Building Planning Design, Estimating and Costing

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

Course Objectives

1	Provide students with a comprehensive understanding of construction project management principles, methodologies, and techniques.
2	Deliver theoretical knowledge and practical insights into project planning, scheduling, cost management, quality control, and risk management in construction projects.
3	Equip students with the skills necessary to effectively plan, execute, and control construction projects, considering factors such as time, cost, quality, and stakeholder expectations.
4	Promote collaboration, communication, and teamwork skills among students through group activities, case studies, and project-based learning approaches.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO1	Recall and comprehend the fundamental principles and concepts of construction project management.	Analyse
CO2	Apply project management tools and techniques to plan, schedule, and control construction projects.	Apply
CO3	Critically evaluate and assess the performance of construction projects using project management metrics.	Evaluate

Module	Module Contents	Hrs
I	**Introduction to Construction Project Management** Overview of construction project management Construction project: unique features, types, phases, and role in economic development Ethical conduct for civil engineers: importance, professional codes of ethics, and ethical decision-making, Project life cycle and stakeholders, Roles and responsibilities of a construction project manager, construction project management processes	6
II	**Project Planning and Scope Management** Importance of Construction Project Planning, Defining Project Objectives and Scope Work Breakdown Structure (WBS), Activity Sequencing and Dependency Relationships Estimating Activity Durations, Construction Project Scheduling Techniques-Introduction to project scheduling techniques Critical Path Method (CPM) and its applications in construction projects Developing project schedules using network diagrams Identifying critical activities and calculating float/slack Incorporating PERT analysis into project schedules	8
III	**Construction Materials Management and Cost Management:** Introduction to Construction Materials Management, Material Procurement and Supplier Selection Inventory Management and Control Principles of inventory management in construction projects Inventory control techniques (e.g., just-in-time, ABC analysis) Material handling and storage practices, Testing and inspection methods for construction materials, Quality assurance practices and standards, introduction to ERP systems and their role in materials management, Importance of cost codes for effective cost tracking and control, Time-Cost Trade-Off in Construction Projects, Principles	8

	and techniques of cost planning in construction projects, Value engineering and value analysis techniques	
IV	**Project Monitoring and Control** Introduction to Project Monitoring and Control, Performance Measurement and Tracking, Earned Value Management (EVM), Management Information Systems (MIS) in Project Monitoring and Control, Communication and Reporting.	6
V	**Construction Quality and Safety management** Introduction to Construction Quality Management, Quality Planning and Assurance Introduction to Total Quality Management (TQM) principles and concepts, Application of TQM in construction projects, Quality improvement methodologies in TQM (e.g., PDCA cycle, Six Sigma), Safety Management in Construction, Importance of safety management in construction projects, Key principles and concepts of safety management, Legal and regulatory requirements for construction safety	6
VI	**Project Risk Management** Risk identification, assessment, and prioritization, Risk response planning and implementation, Risk monitoring and control. Contingency planning and mitigation strategies	4

Textbooks	
1	Kumar Neeraj Zha, "Construction Project Management", Pearson India Education, 1st edition,2011
2	Chitkara K K, "Construction Project Management: Planning, Scheduling and Controlling‖, Tata McGraw - Hill Education, 2nd edition, 2010
3	Seetharaman S., "Construction Project Management: Planning, Scheduling, and Control", Tata McGraw - Hill Education,1st edition, 2014
References	
1	Jha, Sinha, and Sinha "Construction Project Management: Theory and Practice'' Himalaya Publishing House, 2nd Edition 2019
2	P K Joy, Handbook of Construction Management, Macmillan India Limited,2nd edition (2000)
3	Barrie D.S. & Paulson B C, "Professional Construction Management", McGraw Hill
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			3		1						1	1	1	
CO2			3										2	2
CO3							3				2		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 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 2022-23

Course Information

Programme	B.Tech. (Civil Engineering)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	5CV451
Course Name	Construction Project Management Lab
Desired Requisites:	Building Planning Design, Estimating and Costing

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 develop amongst students the necessary analytical & managerial skills to systematically analyze the scope of work on construction sites and evaluate the relation between time and money during the planning phase of construction projects to achieve better productivity.
2	To understand the practical complexities involved during the planning and execution of various phases/activities of construction projects and learn the various tools and techniques to manage the resources namely time, money, material, equipment & labour, thereby facilitating to become productive managers.

Course Outcomes (CO)

CO1	Comprehend scope of selected construction project and develop WBS
CO2	Schedule selected project using precedence network technique based contemporary scheduling software.
CO3	Demonstrate conceptual level Quality management and safety management Programme for the same projec

List of Experiments / Lab Activities

List of Experiments:

Small student groups formed will need to undertake following stages in this course; -

1. Identify a small construction project and collect its documents defining scope (BOQ, drawings etc.)
2. Prepare the Work breakdown structure(WBS) to evolve at least 100 distinct activities (appropriate software may be used)
3. Schedule the project using contemporary software taking into consideration following:-
   - Activity list generated from WBS
   - Construction methodology decision for each activity
   - Important Resource allocations
   - Precedence relations (Both technical and resource constrained)
   - Time duration allotment (based upon resources, work content)
   - Working calendar
4. Demonstrate quality management plan and safety management plan for the same project at preliminary level.

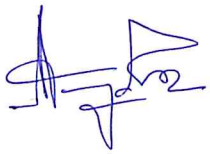
	Text Books
1	Kumar Neeraj Zha, —Construction Project Management‖, Pearson India Education, 1st edition,(2011)
2	Saleh Mubarak, — Construction Project Scheduling and Control‖, Wiley, 2nd edition (2010)
3	S. Seetharaman, —Construction Engineering & Management‖, Umesh Publications Delhi, 4 th edition,(2008)
	References
1	Chitkara K K, —Construction Project Management : Planning, Scheduling and Controlling‖, Tata McGraw - Hill Education, 2nd edition, 2010
2	Sonia Atchison, Brian Kennemer,‖ Using Microsoft Project 2010‖, Pearson, 2011
3	Paul E Harris ,—Planning and Control Using Primavera® P6 Version 7: For All Industries‖, Eastwood Harris Pty Limited, 2013
	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	
CO2			1	3									2	1
CO3			2		1								2	1

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

Assessment				
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 6 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab Performance and documentation	Lab Course faculty	During Week 12 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	Final Year B. Tech. Sem. VII
Course Code	5CV447
Course Name	Mini-Project-4 Estimating and Costing
Desired Requisites:	Estimating and Costing

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 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

CO1	***Formulate*** specifications and ***analyze*** rates for different items of work	Analyzing Creating
CO2	***Estimate*** costs of the different civil works	Analyzing
CO3	***Demonstrate*** application of computer for estimating and costing	Applying

Module	**Module Contents**	**Hours**
	The mini-project to be completed for the course shall comprise of two parts as specified below	
	Part 1. Estimate for 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 for a part of the above work v. Rate analysis for the items covered in iii vi. Tender notice for the above work vii. Listing all conditions of contract for the above work and detailed drafting of any three conditions of contract for the above work viii. References	20

Part 2. Estimate for any One Civil Work other than building (such as Road, Canal, C.D. Works, Structural Steel Work, Water Supply or Treatment Work, S.T.P., E.T.P. etc.) Preparation of a report incorporating i. General description of the work, Drawings, data and assumptions ii. Detailed Estimate of the work iii. Detailed Specifications: Minimum 1 item of work pertaining to the estimate in other than those common in buildings. iv. Rate analysis for the items covered in xii v. References	6

	Text Books
1	*"Estimating & Costing in Civil Engineering"*, B.N. Dutta., UBS Publishers, 28th Revised Edition, 2020.
2	*"Text book of Estimating & Costing"*, Birdi G.S., & DhanapatRai Sons, Latest Edition.
3	*"Civil Engineering Contracts &Estimates"*, B. S. Patil, CRC Press, 7th Edition, 2019.

	References
1	*"Standard Specification Vol. I & II"*, PWD Maharashtra.
2	*"D.S.R."*, PWD Maharashtra.

	Useful Links
1	https://www.youtube.com/watch?v=ZYJhky9pqpA

CO-PO Mapping

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

Assessment

There are three components of lab assessment, LA1, LA2, and Lab ESE
IMP: Lab ESE is a separate head of passing. 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/Labperformance shall include performing experiments, mini-project, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments.

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AY 2022-23

Course Information

Programme	B.Tech. (Civil Engineering)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	5CV448
Course Name	Mini Project 5: Concrete Structures Design and Drawings
Desired Requisites:	Design of Concrete structures I

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 demonstrate the design of residential building and combined footing.
2	To demonstrate the design of water tank with staging and retaining wall.
3	To impart training of various analysis, design and drawing professional software for civil engineering structures using relevant IS codes.

Course Outcomes (CO)

CO1	**Analyse** real life civil engineering RCC structures.
CO2	**Appraise** various structural designs and drawings.
CO3	**Create** structural detailing and drawings.

Module Contents

The lab work shall consist of detailed design &drawing of the following R. C. structures by Limit State method unless specified.

1. Residential G+2 storey building
2. Any two from following

a) Circular water tank resting on ground with rigid base. (by working stress method)
b) Retaining wall (cantilever or counter fort type)
c) Combined footing/ raft foundation/ pile foundation.

Note:

- Computer analysis of any one frame for project No.1 shall be performed for Dead Load, Live Load & Earthquake Loads using relevant application software.
- Drawings prepared shall indicate ductility details as per the provision in IS: 13920.

Textbooks

1	N. C. Sinha & S. K. Roy, "Fundamentals of Reinforced Concrete" S. Chand Publishing, 4th Edition, 2013.
2	B. C. Punmia, Jain and Jain, "Comprehensive Design of R.C. Structures", Standard Book House, New Delhi, 8th Edition, 1998.
3	Dr. V. L. Shah and Dr. S.R. Karve, "Limit State Theory and Design", Pune Vidyarthi Griha Publication, 7th Edition, 2015.
4	

References

1	P. Dayaratnram, "Limit State Analysis and Design", Wheeler Publishing company, Delhi, 5th Edition, 1996.
2	Sinha, "RCC Analysis and Design Vol. I and II", S. Chand and Co. New Delhi,3rd Edition, 2014.
3	P. C. Varghese "Limit State Design of Reinforced Concrete", Prentice Hall of India, New Delhi, 1st Edition,1999.
4	

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	3
CO1		**3**						**3**							
CO2		**2**	**3**					**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

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	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	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.

(SBK)

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2022-23

Course Information

Programme	B.Tech. (Civil Engineering)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	5CV491
Course Name	Project-I
Desired Requisites:	

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	-	**LA1**	**LA2**	**Lab ESE**	**Total**
Tutorial	-	30	30	40	100
Practical	6 hrs/week				
Interaction	-	**Credits:3**			

Course Objectives

1	This course intends to make group of students to identify a specific problem for their next semester major project and design methodology to address the problem. It also focuses on skills such as teamwork, leadership, interaction skills, and presentation skills.
2	

Course Outcomes (CO)

CO1	Identify a specific problem for the current need of the society and collect information related to the same through detailed review of literature.
CO2	formulate problem statement and Design solution methodology
CO3	present work progress.

List of Experiments / Lab Activities

The student groups collectively are made to work on a specific topic approved by the head of the division under the guidance of a faculty member who is familiar in this area of interest. o They can select any topic which is relevant to the area of Civil Engineering. (may be theoretical or case studies) o At the end of the semester, a detailed report on the work done should be submitted which contains clear definition of the identified problem, detailed literature review related to the area of work and methodology for carrying out the work.

Text Books

1	based upon broader area selected for the project
2	
3	

References

1	R.C. Kothari, ‖Research Methodology‖, New Age Publications, 2nd Edition
2	Technical books based upon broader area selected for the project
3	

Useful Links

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

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

Assessment

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 6 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab Performance and documentation	Lab Course faculty	During Week 12 to Week 18 Marks Submission at the end of Week 18	40

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

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AY 2023-24

Course Information

Programme	B.Tech. (Civil Engineering)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	5CV455
Course Name	Techno-Socio Activity/Summer Internship
Desired Requisites:	-

Teaching Scheme		**Examination Scheme (Marks)**			
Practical	-	**LA1**	**LA2**	**Lab ESE**	**Total**
Interaction	1 Hrs/ Week	30	30	40	100
		Credits: 1			

Course Objectives

1	To expose students to the professional/industrial environment.
2	Develop skills like teamwork, and communication through field experience.
3	Enhance understanding of the socio-economic impact of engineering projects and technology on society.
4	Apply engineering knowledge and problem-solving skills to address real-world challenges.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO1	Explain professional culture/ethics and build proficiency in professional communication, working in teams, decision making and leadership.	Understand Apply
CO2	Apply the technical knowledge through participation in techno-socio assignments.	Apply
CO3	Demonstrate ethical quality and social responsibilities through the technical knowledge gained.	Evaluate

Lab Activities/Topics

List of Activities:

Internship: Every student is supposed to complete an internship of 45 days in the second and/or third-year summer and/or winter vacation in phases of 15 days or continuous 45 days, according to the guidelines of AICTE.

1. Internship
   a) Presentation on internship activity undergone/undergoing
   b) Submission of internship report
2. Involvement in techno-socio activity
   a) Presentation on involvement in techno-socio activity individually/through student clubs during FY B.Tech. to TY B.Tech.
   b) Submission of summary report on these activities.
3. Techno-socio activity (Team Activity)
   a) Organization of a technical activity/event for the benefit of society in a batch.
   b) Submission of report on the organized activity.
4. Submission of certificates/documents required for student port-folio (GATE/CAT/GRE, Participation in Curricular and Extra-Curricular Activities within and outside the campus).

Textbooks	
1	
2	
References	
1	
2	
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	3	3		1	1	
CO2	2	1	2	1		2	2		2	2	1		1	
CO3	2	1	1			2	1		2	2			1	
The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO, and preferably to only one PO.														

Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing. (min 40 %), LA1+LA2 should be min 40%				
Assessment	**Based on**	**Conducted by**	**Typical Schedule**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40
Week 1 indicates starting week of a semester. 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 and related activities if any.				

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2022-23

Course Information

Programme	B.Tech. Civil engineering
Class, Semester	Final Year B. Tech., Sem. VII
Course Code	5CV41[illegible]
Course Name	Elective: Advanced Structural Analysis
Desired Requisites:	Solid Mechanics, Structural analysis, Structural Mechanics

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

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)

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

Module	**Module Contents**	**Hours**
I	**a) Basics in structural analysis** Types of structures, various loads and methods of structural analysis, energy theorems and application of virtual work principle. Introduction to basic software's for structural analysis. **b) 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.	7
II	**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.	7
III	**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.	6
IV	**Approximate Methods** Portal and Cantilever methods for analysis of building frames subjected to lateral loads. Axial force, Shear force and Bending moment diagrams.	6
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.	7
VI	**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.	7

Text Books	
1	Vazirani. V.N. & Ratwani M.M., "Advanced Theory of Structures", Khanna Publishers, 2008
2	C. S. Reddy , "Basic Structural Analysis", Tata McGraw hill, 7th Edition, 1981.
3	S. B. Junnarkar, "Mechanics of Structures Vol. I", Chartor House pulications. 31st Edition, 2014.
4	Krishna Raju N., "Advanced Mechanics of Solids and Structures", McGraw-Hill Education, 08-Nov-2018 - Technology & Engineering

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)					
	1	**2**	**3**	**4**	**5**	**6**
CO1			2	2		3
CO2			2	2		3
CO3	1		2			2

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

Assessment

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 2022-23

Course Information

Programme	B. Tech. (Civil Engineering)
Class, Semester	Final Year B. Tech., Sem. VII
Course Code	5CV412
Course Name	Advanced Water and Wastewater Treatment
Desired Requisites:	Water Treatment Technology, Sewerage and Sewage Treatment

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

Course Objectives

1	To provide students the necessary knowledge and concepts of advancements/emerging techniques of treatment in physical, chemical and biological treatment processes.
2	To impart students with the skill of design and operation of water and wastewater treatment plants based on latest technology.
3	To provide students prerequisite knowledge necessary for higher studies and research in the field of water and wastewater treatment.
4	To encourage students for undertaking further studies in the field of environmental engineering.

Course Outcomes (CO)

CO1	***Explain*** and ***Apply*** the concepts of unit operations and processes for the removal of dissolved organics and inorganics.
CO2	***Analyze*** and ***evaluate*** the ion exchange, activated carbon, membrane filtration and wetland based treatment systems.
CO3	***Design*** ion exchange, activated carbon, membrane filtration and wetland systems.

Module	**Module Contents**	**Hours**
I	**Fundamentals** Need for Advanced water and wastewater Treatment, Reactors and Reaction Kinetics: Types of Reactions and Reaction, Kinetics Types of reactors and Principles of Reactor Design, Principles of aeration, Gas-liquid mass transfer, two film theory	6
II	**Removal of dissolved organics and inorganics** Adsorption processes, causes and types of adsorption, influencing factors, adsorption equilibria and development of adsorption isotherms, activated carbon adsorption kinetics, analysis and design of GAC and PAC contactors. Ion Exchange: Process, Ion exchange resins, exchange capacity, ion exchange chemistry and reactions, Applications for hardness and TDS removal, Design of ion exchange units	10
III	**Disinfection** Disinfection with ozone: chemistry, modeling, estimation of ozone dosage. UV disinfection: system components, modeling, Estimation of UV dose.	4
IV	**Membrane Processes** Membrane Filtration: Terminology, Process classification, Membrane configurations, Membrane operation for micro filtration, Ultra filtration and Reverse osmosis, Membrane fouling and its control, Application of Membranes. Electro dialysis: Theory, Area and power requirement, Disposal of concentrate waste streams.	6

V	**Biological Treatment Systems** Cyclic activated sludge process: System, Operation and Design Moving Bed Bioreactor (MBBR): System, Operation and Design Membrane Bioreactor: System, Operation and Design	7
VI	**Constructed wetland** Constructed Wetland (CW): Classification and application, Design and operation of horizontal flow subsurface, Vertical flow systems Emerging concepts in CW, Sludge treatment constructed wetland Design and operation of Water hyacinth system	7

Text Books	
1	Peavy H, S, Rowe D, R, and Tchobanoglous G, "Environmental Engineering", McGraw-Hill Book Company, International edition 1985.
2	Metcalf and Eddy "Wastewater Engineering Treatment and Reuse", Tata McGraw Hill Publication, 6th Reprint. 2003.
3	Hammer M, J and Hammer M, J, "Water and Wastewater Technology", PHI learning private limited, 6th Edition, 2008.
4	Davis, M, L, and Cornwell, D, A, "Introduction to Environmental Engineering", Tata McGraw Hill Publishing Company, Special Indian Edition, 2010.

References	
1	Droste, Ronald L *"Theory and Practice of Water and Wastewater Treatment"*, John Wiley & Sons Publication, 1st Edition, 1997.
2	Weber W, J, *"Physico-Chemical Processes of Water quality control"*, Wiley- Interscience, 1994.
3	Reynolds T, D, and Richards, P. A, *"Unit operations and processes in Environmental Engineering"*, PWS Publishing Company, 2nd Edition, 1996.
4	Sincero A, P and Sincero G, A, *"Environmental Engineering A Design approach"*, PHI learning private limited, 2004.

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3													
CO2		3												
CO3			3										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 2022-23

Course Information

Programme	B. Tech. (Civil Engineering)
Class, Semester	Final Year B. Tech., Semester VII
Course Code	5CV413
Course Name	Air Pollution and Control
Desired Requisites:	Environmental Engineering

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

Course Objectives

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

Course Outcomes (CO)

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

Module	Module Contents	Hours
I	**Air pollution: A retrospective** Air pollution: sources and types and effects on biosphere, National and international air emission standards; air pollution emission inventory; emission factor; air quality index; Strategy for effective control of air pollution in India, Introduction to air pollution control act, and international agreements for mitigating global air pollution effects.	7
II	**Meteorology** Physics of atmosphere, Solar radiation, Wind circulation, Lapse rate, Inversion, Stability conditions, Pasquil stability model, maximum mixing depth, Wind rose, Plume behaviour, Global effects of air pollution: Green house effects, acid rain and ozone layer depletion, Heat island effect, Visibility, Photochemical reaction	7
III	**Dispersion of pollutants in the atmosphere** Eddy diffusion model, the Gaussian dispersion model, point source, Line source, maximum ground level concentration, Determination of stack height, sampling time corrections, Effects of inversion trap Definition, distribution and source of different particulate matter, Terminal settling velocity, basics of hood and duct design for particulate collection	6
IV	**Control Equipment for Particulate Matter** Operation design and component detailing of Settling chamber, Cyclone, Wet collectors, Fabric filter, and Electrostatic precipitator	7
V	**General control of Gaseous pollutants** Principles of absorption, Adsorption, Basic design of absorption and adsorption units, Incineration and after burner, Control of SO_2, NOx	7

VI	**Motor Vehicle Emissions** Automobile Source Emission of pollutants from automobiles, Photochemical smog, Reduction of emissions by different methods, Alternative fuels and their utilizations.	6

Text Books	
1	Wark and Warner, "Air Pollution", C.F., H.R. Publication, 1st Edition, 1978.
2	Nevers N., "Air Pollution control Engineering" McGraw-Hill, New York, 2nd edition, 1995.
3	Martin Crawford, "Air Pollution and Control", Tata McGraw Hill Publication, 1st Edition, 1976.

References	
1	Richard W. Boubel and Bruce Turner, "Fundamentals of Air Pollution", Academic Press, New York, Third edition, 1994.
2	Stern A. C., "Air Pollution Vol. I and II", Allied Publishers Limited, 1st Edition, 1994.
3	Rao H.V.N. and Rao M. N., "Air Pollution", Tata McGraw Hill, 1st Edition, 1989.

Useful Links	
1	https://www.youtube.com/watch?v=4AuwG2G_ERU&list=PLF5457B8AE71516CE&index=1
2	https://www.youtube.com/watch?v=HHxHQb5zx2I&list=PLF5457B8AE71516CE&index=35

CO-PO Mapping

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

Assessment

The assessment is based on MSE, ISE and ESE.

MSE shall be typically on modules 1 to 3.

ISE shall be taken throughout the semester in the form of 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 2022-23

Course Information

Programme	B.Tech. (Civil Engineering)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	5CV416
Course Name	Maintenance and Rehabilitation of Structures
Desired Requisites:	

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	The Degree holder enables to inspect and identifies the damages of civil engineering structures.
2	To make conversant with the techniques for Retrofitting and strengthening of structures.
3	Prepare the estimate of maintenance, rehabilitation and strengthening of structure.
4	

Course Outcomes (CO)

CO1	Distinguish between different types of causes of damage and decide the appropriate technique of repair according to failure.
CO2	Identify causes of failure of masonry building & R.C.C. building its retrofitting.
CO3	Compute strength and age of building, maintenance of life lines and prepare estimates & tenders for structure damage due to hazards.

Module	Module Contents	Hours
I	**Introduction** Necessity, operation, maintenance & repairs of structures Classification of maintenance, Rehabilitation (restoration), strengthening, retrofitting. Methodical approach to repairs, inspection-annual, emergency, special, repairs-minor, special and renovation.	4
II	**Causes & detection of damages:** Causes of damages, damages due to earthquakes, fire hazards, flood, hazards, dilapidation, List of basic equipment for investigation. **Materials for repairs:** Epoxy resin, epoxy mortar, gypsum cement mortar, quick setting, cement mortar, Shot-creating Mechanical anchors.	7
III	**Masonry walls:** Damp walls, causes effects, remedies, eradication of efflorescence Cracks in walls, remedial & preventive measures bond between old & new brick work, reinforced brickwork. **Repairs to foundation**: Remedies, types & processes of settlement, foundation sinking Examination of existing foundation, strengthening of foundation. **Water proofing:** Leaking Basements & roofs	7

11.09.2023

IV	**Concept of repairs & strengthening of RCC structures:** Concept of repairs of RCC structures Physical examination of common defects, Structural repairs & strengthening repairs by new developments. **Damage due to fire:** Fire resistance, effects of temp. of RCC, Repairs to RCC structures damaged due to fire	7
V	**Advanced Damage detection techniques:** Advanced damage detection techniques, non-destructive testing. **Strengthening methods**: Cantilevers, beams, slabs, walls, columns, foundation **Evaluation of strength, economic & age of building:** Determination of approx. age of a building. Determination of strength of structural member of old building. Finding cost in use of a existing building.	7
VI	**Maintenance of life lines:** Maintenance of electric supply, water supply leaking pipe joints and sewerage systems, closed drains, sewers. Maintenance of roads, road berms, side drain maintenance of bridges, culverts causeways **Estimates and tendering:** Estimates of annual repairs, special repairs and maintenance work. Preparation of tender	7

Text Books	
1	P.K. Guha, "Maintenance and Repairs of Buildings", New Central book Agencies Publications, 5th Edition, 2015,
2	Nayak B. S., "Maintenance Engineering For Civil Engineers" Khanna Publication, 2nd Edition, 2011
3	Hutchin B. D., "Maintenance and Repairs of Buildings", Newnes Butterworth Publications, 6th edition, 1975

References	
1	Shrikhande and Agrwal, "Earthquake resistant Design of Structures", 1st edition, PHI Learning Pvt. Ltd., 2006
2	S. K. Duggal, "Earthquake Resistant Design of Structures" 3ed Edition, Oxford University Press, 2007

CO-PO Mapping

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

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

Assessment

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

11.09.2023

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2021-22

Course Information

Programme	B. Tech. (Civil Engineering)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	5CV415
Course Name	Professional Elective - 4: Bridge and Airport Engineering
Desired Requisites:	Highway Engineering

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

Course Objectives

1	To 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 airport components like runways, taxiways, terminal building, hangars etc. along with the drainage and traffic controls methods.
3	To make conversant with various construction methods of bridges and airport.

Course Outcomes (CO)

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

Module	**Module Contents**	**Hours**
I	**Bridge Engineering Part I** 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.	7
II	**Bridge Engineering Part II** 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.	7
III	**Bridge Engineering Part III** 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	7

iV	**Airport Engineering Part I:** Introduction, History, Terminology, components of aircraft, characteristics, airport classification, and organizations concerned with Airport Engineering. Planning: Surveys, site selection, airport obstructions, layouts, zoning laws.	6
V	**Airport Engineering Part II** Designing: Runways- orientation, basic runway length, geometric design. Taxiways- layouts, geometric design. Terminal Buildings: Site selection, facilities, aprons, gate positions.	7
VI	**Airport Engineering Part III** Hangars: Function, types, requirements. Drainage: Necessity, types. Air Traffic Control: VFR, IFR, visual aids, lighting and marking. Heliports: Characteristics, site selection, planning, size, obstructions, orientation, marking and lighting.	6

Text Books	
1	Bindra S. P., "Principles and Practice of Bridge Engineering", Dhanpat Rai Publications, 8th Edition, 2012.
2	Khanna S. K. & Arora M. G., "Airport Planning and Design", Nem Chand and Brothers, 6th Edition, 2012.
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	Horonjeff R., McKelvey F., Sproule W., Young S., "Planning and Design of Airports", McGraw Hill Professional, 5th Edition, 2010.

CO-PO Mapping

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

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

Assessment

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

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2023-24

Course Information

Programme	B.Tech. Civil Engineering
Class, Semester	Final Year B. Tech., Sem. VII
Course Code	5CV416
Course Name	Professional Elective 4: Analysis of Statically Indeterminate Structures
Desired Requisites:	Solid Mechanics, Structural analysis, Structural Mechanics

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

Course Objectives

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

Course Outcomes (CO) with Bloom's Taxonomy Level

CO1	***Apply*** different methods for analysis of structures.	Applying
CO2	***Calculate*** forces and displacements for special structures.	Evaluating
CO3	***Evaluate*** external and internal forces in frames and beams.	Evaluating

Module	**Module Contents**	**Hours**
I	**Fixed Arches** 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.	6
II	**Consistent Deformation Method** Analysis of statically indeterminate beam- Propped cantilever with numericals.	7
III	**Three Moment Equation** Analysis of continuous beams with and without settlements using Clapeyron's three moment equation.	7
IV	**Rotation Contribution Method** Analysis of continuous beams, including support settlement, Rotation contribution method with side sway, single bay single storey and single bay two storey frames. Bending moment and shear force diagrams. Elastic curve.	6
V	**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.	7

VI	**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.	7

Textbooks	
1	Vazirani. V.N. & Ratwani M.M., "Advanced Theory of Structures", Khanna Publishers, 2008
2	C. S. Reddy , "Basic Structural Analysis", Tata McGraw hill, 7th Edition, 1981.
3	M. Vijayanand Dr. K.U. Muthu, Dr. H. Narendra, Dr. Maganti Janardhana "Indeterminate Structural Analysis" Dream Tech Press (1 January 2019)
4	Krishna Raju N., "Advanced Mechanics of Solids and Structures", McGraw-HillEducation, 08-Nov-2018 - Technology & Engineering
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/105/105/105105166/
2	https://onlinecourses.nptel.ac.in/noc23_ce87/preview
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	2	2
CO1		3											3	
CO2		3											3	
CO3		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. 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 2022-23

Course Information

Programme	B.Tech. (Civil Engineering)
Class, Semester	Final Year B. Tech. Sem. VIII
Course Code	5CV425
Course Name	Engineering Economics and Valuation
Desired Requisites:	Building materials and construction, Building planning and design; Civil Engineering Drawing, Engineering mathematics

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 provide a sound understanding of concepts and principles of engineering economy essential for economic feasibility studies relating to design and implementation of engineering projects.
2	To develop proficiency with methods for valuation of immovable properties.
3	To acquaint the students with use of excel for equivalence comparisons as well as computations for valuation.

Course Outcomes (CO) with Bloom's Taxonomy Level

CO1	***Describe*** elements of engineering economics as well as valuation	Understanding
CO2	***Appraise*** the different alternatives for an engineering project.	Analyzing
CO3	***Value*** the different immovable properties.	Evaluate

Module	**Module Contents**	**Hours**
I	**Introduction to Engineering Economy** Time value of money, Cash flow diagrams, Interest rate, Inflation rate, Discrete and continuous compounding. Tangible-intangible costs and benefits, Concept of economic viability, Cost-benefit analysis, Payback period, Return on capital.	4
II	**Economic Appraisal of Projects** Interest formulae for discrete and continuous compounding, Nominal and Effective interest. Effect of inflation on interest rate, Present worth method, Concept of Equivalence comparison, Annual cost method, Selection of appropriate method for equivalence comparison. Discounting cash flow, Internal rate of return, Methods for determining IRR, IRR for economic viability. Comparison of project alternatives based on IRR.	4

III	**Elements of Valuations** Purposes of valuation, factors affecting valuations, Concept of value, price and cost, attributes of value, various types of values and essential characteristics of market value, Various methods of valuation. **Immovable Properties** Freehold and leasehold properties, Different types of leases. Different types of rents, Depreciation, different methods, sinking fund, obsolescence, land as a real estate.	4
IV	**Computational parameters for valuation** Years Purchase, Single rate and dual rate, reversion value of land, net yield, capitalized value, Valuation tables. **Physical method of valuation** Valuation of properties including land and building, Depreciated value of buildings, determining value of land Valuation of large plots of land, Belting method, Number and widths of belts, Rates for belts.	5
V	**Rental Method of Valuation** Gross rent, outgoings, net rent, capitalized value and Deferred value of land, Value of extra open area in the plot, total value of the property,. Rating valuation, Rate as the property tax, Fundamental principles of rating valuation, basis for rating valuation, various allowances while determining assessed value.	4
VI	**Valuation Based on Profits and Development Method** Premises to be valued by Valuation Based on Profits, Gross profit, outgoings, net profit, and capitalized value, Deferred value of land, Value of extra open area in the plot, and total value of the property. Types of developments, Plotting scheme, hypothetical building scheme, Cost of development, Stamp duty, Engineering and supervision charges, Incidental charges, and Developer's profit, Purposes of valuation for development, computation of buying or selling prices.	5

	Text Books
1	*"Engineering Economy"* Brajesh Kumar, Arshad Noor Siddiquee, Zahid A. Khan Publisher: Pearson India,1st Edition, 2012.
2	*"Civil Engineering Contracts &Estimates"*, B. S. Patil, Orient Langman Ltd., 1st Edition, 1981.
3	*"Professional Practices (Estimating & Valuation)"*, Roshan Namavati., LBD Publishers, 4th Edition, 1984.
	References
1	*"Valuation of Real Properties"* Rangwala, Charotar Publishing House, 10th Edition: 2015
2	*"Engineering Economy"*, Zahid A khan, New Delhi: Dorling Kindersley, 1st Edition, 2012
	Useful Links
1	https://www.youtube.com/watch?v=ZYJhky9pqpA
2	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													2
CO2	3													2
CO3	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 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 2022-23

Course Information

Programme	B.Tech. (Civil Engineering)
Class, Semester	Final Year B. Tech., Sem VIII
Course Code	5CV492
Course Name	Project-II
Desired Requisites:	

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	-	**LA1**	**LA2**	**Lab ESE**	**Total**
Tutorial	-	30	30	40	100
Practical	12 hrs/week				
Interaction	-	**Credits:6**			

Course Objectives

1	This course intends to make group of students to identify a specific problem for their next semester major project and design methodology to address the problem. It also focuses on skills such as teamwork, leadership, interaction skills, and presentation skills.
2	

Course Outcomes (CO)

CO1	Identify a specific problem for the current need of the society and collect information related to the same through detailed review of literature.
CO2	formulate problem statement and Design solution methodology
CO3	present work progress.

List of Experiments / Lab Activities

The student groups collectively are made to work on a specific topic approved by the head of the division under the guidance of a faculty member who is familiar in this area of interest. o They can select any topic which is relevant to the area of Civil Engineering. (may be theoretical or case studies) o At the end of the semester, a detailed report on the work done should be submitted which contains clear definition of the identified problem, detailed literature review related to the area of work and methodology for carrying out the work.

Text Books

1	based upon broader area selected for the project
2	
3	

References

1	R.C. Kothari, ‖Research Methodology‖, New Age Publications, 2nd Edition
2	Technical books based upon broader area selected for the project
3	

Useful Links

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

Assessment				
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 6 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab Performance and documentation	Lab Course faculty	During Week 12 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

(Government Aided Autonomous Institute)

AY 2022-23

Course Information

Programme	B.Tech. (Civil Engineering)
Class, Semester	Final Year, VIII
Course Code	5CV471
Course Name	Structural Health Monitoring 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**			

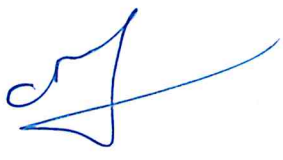
Course Objectives

1	Smart Materials Applications: To study the various smart materials and their applications in developing the Structural Health Monitoring systems.to understand the functional working of each smart material.
2	Structural Health monitoring principles: To study and develop the use of low-cost, long term monitoring systems to keep structures under constant surveillance, ensuring structural integrity. Moreover, the tools and skills the students will learn in this class can be implemented to develop sustainable maintenance and rehabilitation schemes and programs.
3	Structural Sustainability/ Resiliency: To incorporate the concepts of rapid inspections after disaster assessment of structures. The tools and skills incorporated within the curriculum of this class provide quantitative means to assess the structural integrity loss a system undergoes after natural disasters and other hazardous events.

Course Outcomes (CO)

CO	Description	Blooms Taxonomy
CO1	**Demonstrate** the knowledge required regarding SHM principles of various components of structures.	**Understanding**
CO2	**Apply** various techniques for SHM of structures.	**Understanding & Applying**
CO3	**Design and simulate various SHM** techniques for various structures.	**Design**

List of Experiments / Lab Activities



1. Determination and simulation of compressive strength of Concrete elements using NDT such as a) ultrasonic pulse velocity b) rebound hammer test c) validation with destructive test for compressive strength.
2. Determination and simulation of characteristics of ultrasonic guided waves using Piezo sensors in various materials a) Concrete b) metallic plate c) Composite plate d) HCSS plate
3. Damage detection of following materials and simulation a) Concrete b) metallic plate c) Composite plate d) HCSS plate
4. Determination of mode shapes for undamaged cantilever beams and simulation for following materials using accelerometers (piezo) a) metallic plate b) Composite plate c) HCSS plate
5 Determination of mode shapes for damaged cantilever beams and simulations for following materials using accelerometers (piezo) a) metallic plate b) Composite plate c) HCSS plate.
6 Determination of deflection and bending stresses of the simply supported concrete beam under static and dynamic loading and simulation using LVDT transducers and verification with theory.

Text Books	
1	Daniel Balageas, Claus - Peter FritzenamI Alfredo Guemes, Structural Health Monitoring, Published by ISTE Ltd., U.K. 2006.
2	Guide Book on Non-destructive Testing of Concrete Structures,Training course series No. 17, International Atomic Energy Agency,Vienna, 2002.
3	Smart Materials and Structures, Authors: Gandhi, M.V., Thompson, B.D. ISBN 978-0-412-37010-6
References	
1	Hand Book on Seismic Retrofitting of Buildings, Published by CPWD & Indian Building Congress in Association with IIT, Madras, Narosa Publishing House, 2008.
2	Hand book on "Repair and Rehabilitation of RCC Buildings", Published by Director General, CPWD, Govt. of India, 2002.
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										
CO2				2										
CO3				3										

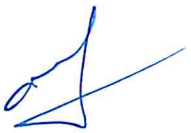
The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

Assessment

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

(Government Aided Autonomous Institute)

AY 2022-23

Course Information	
Programme	B.Tech. (Civil Engineering)
Class, Semester	Final Year B. Tech., Semester VIII
Course Code	5CV433
Course Name	Industrial Wastewater Treatment
Desired Requisites:	Sewerage and Sewage Treatment

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	Provide in-depth knowledge of manufacturing processes, wastewater generation and treatment.
2	To enhance the technical competency and apply the acquired knowledge for research and development, industry, and consultancy activities.
Course Outcomes (CO)	
CO1	***Explain*** and ***apply*** concepts of industrial wastewater treatment.
CO2	***Analyze*** and ***evaluate*** the physical and chemical treatment systems used in water and wastewater.
CO3	***Design*** physical and chemical treatment systems for water and wastewater.

Module	**Module Contents**	**Hours**
I	**Classification of Industries and Acts** Classification of Industries as per Central Pollution Control Board (CPCB), Provision of various acts pertaining to industrial wastes/effluents.	3
II	**Waste Minimization Techniques** Waste audit, Concept of waste minimization, Techniques of volume and strength reduction, Equalization: Process, Flow and quality, Location, Volume requirement, Design considerations, Reuse and recycling concepts, Process description, Objectives and Methods of Neutralization and Proportioning.	6
III	**Agro Based Industries** Manufacturing processes, Water usage, Sources, Quantities and characteristics of effluents(process stream and combined), Pollution effects, Waste Reduction /Reclamation/By-product recovery, Utilization, Alternative methods of treatment and disposal for Agro-based industries: Sugar, Distillery, Dairy, Pulp and paper mill and Textile.	12
IV	**Chemical and Engineering Industries** Manufacturing processes, Water usage, Sources, Quantities and characteristics of effluents (process stream and combined), Pollution effects, Waste Reduction /Reclamation/By-product recovery, Utilization, Alternative methods of treatment and disposal for i) Chemical industries: Pharmaceutical, Petroleum and refineries, Fertilizer and Tannery ii) Engineering industries: Steel, Electroplating, Foundries iii) Thermal power plants.	12
V	**Common Effluent Treatment Plant** Concept, Objectives, Methodology, Cost benefit analysis, Design, Operation and maintenance.	4
VI	**Detailed Project Report for Waste Treatment Facilities** Project report preparation for waste treatment and disposal system of industries, Prefeasibility, feasibility and detailed project reports, Project financial appraisal.	3

Text Books	
1	Rao M. N. and Datta, "Waste Water Treatment", Oxford & IBH Publication, 1st Edition, 1992.
2	Masters, G, M, "Introduction to Environmental Engineering and Science", Pearson Education, 2004.

References	
1	Nelson Nemerow, "Theories and Practices of Industrial Waste Treatment", Wiley Publication Company, 1st Edition, 1971.
2	"IS Standards for Treatment and Disposal of Various Industries".
3	Eckenfelder, W. W., "Industrial Water Pollution Control", McGraw-Hill, 2000.
4	Nemerow, N. L and Dasgupta, A., "Industrial and Hazardous Waste Treatment", Van Nostrand Reinhold (New York), 1991.

Useful Links	
1	https://www.youtube.com/watch?v=in3GSRuooRs
2	https://www.youtube.com/watch?v=JBSP6ayaIjU

CO-PO Mapping

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

Cdr. S.R. Murgavalli

BRK

Walchand College of Engineering, Sangli *(Government Aided Autonomous Institute)*					
AY 2022-23					
Course Information					
Programme	B.Tech. (Civil Engineering)				
Class, Semester	Final Year B. Tech. Sem. VIII				
Course Code	5CV434				
Course Name	Contract Management				
Desired Requisites:					
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 a sound understanding of concepts and principles of contract management of engineering projects.
2	To develop proficiency with methods for civil engineering contract and dispute resolution systems.
3	To acquaint the students to formulate different contract documents

Course Outcomes (CO) with Bloom's Taxonomy Level		
CO1	***Describe*** elements of Contract Management	Understanding
CO2	***Appraise*** the different alternatives types of contracts and dispute resolution methods for an engineering project.	Analysing
CO3	***Formulation*** of different contract documents	Design

Module	Module Contents	Hours
I	**Introduction to Contract Management** Importance of Contracts, Overview of Contract Management, Overview of Activities in Contract Management, Scope of Contract Management, Professional Ethics, Duties and Responsibilities of Parties, Detailed project report and understanding nature, specification, scope, timeline, cost and other salient points of projects for contact drafting.	6
II	**Indian Contract Act 1872** Objectives of the act, Definition of contact, Meanings of Proposal, Promise, Reciprocal Promise, Consideration, valid contract, free consent, Essential requirements of legally valid contract, Offer, Acceptance, Lawful Consideration, Intention, Capacity, and Legality of subject matter, Void and voidable contracts, Breach of Contract and its Consequences, Damages, Quantum Meruit, Mitigation the loss or damage	6
III	**Types Civil Engineering Contracts** Competitive bidding contracts, Negotiated contracts, Lump-sum contacts, Item rate contract, percentage rate contracts, cost plus types of contract, Trunkey contract, subcontract, annual maintenance contract, Supply and Installation Contracts, BOT, BOOT, BOLT, PPP, EPC, HAM, NCB, ICB etc. Pros and cons of each type.	7

BRK

IV	**Contract Formation** Tender, types of tender, Tender notice, Pretender conference, Contents of tender notice, E-tendering, Preparing a tender, tender documents, methods of tender submission, opening of tenders, scrutiny of tenders, contract award and letter, contract documents, contract agreement	8
V	**Conditions of Contract** Notice to proceed, Handing over the site to contractor, rights and duties of various parties, notices to be given, Fairness of Conditions of Contract, Subjects of conditions – Bid Security, Performance Security, Contract Duration and Price, Performance parameters; Payment terms, Delays, penalties and Liquidated damages; Force Majeure, Suspension and Termination, Changes and variations, subcontracting etc. Important contents of each condition, Typical conditions for each subject.	7
VI	**Dispute Resolution and Integrity in Contract** The "conventional" model of dispute resolution, Alternative Dispute Resolution methods (ADR), early neutral evaluation, negotiation, conciliation, mediation, and arbitration, Indian legislation for arbitration and conciliation, Integrity in Contract its significance and typical clauses.	6

Text Books	
1	"Contracts and their Management" B S Ramaswamy, Lexis Nexis, 5th Edition, 2016
2	"Civil Engineering Contracts &Estimates", B. S. Patil, Orient Langman Ltd., 3rd Edition, 2006.
3	"Law relating to Building and Engineering Contracts in India", Gajria, K. Butterworths India, 2000

References	
1	"Managing Engineering and Construction Contracts: Some Perspectives" Lakshman Prasad, LAP Lambert Academic Publishing, 2010
2	"Construction Contracts: Law and Management", J. R. Murdoch , Will Hughes, Routledge publications, 2015

Useful Links	
1	https://www.youtube.com/watch?v=O2AWwn-_zmg
2	https://www.youtube.com/watch?v=LvC4riB409E
3	https://www.youtube.com/watch?v=wJ8HZ7hqUs8&list=PL64587F5505355819

CO-PO Mapping

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

Assessment

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

AKM

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2022-23

Course Information

Programme	B. Tech. (Civil Engineering)
Class, Semester	Final Year B. Tech., Sem VIII
Course Code	5CV435
Course Name	Professional Elective - 5: Intelligent Transportation System
Desired Requisites:	Highway Engineering

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

Course Objectives

1	To make students conversant with the fundamentals of ITS.
2	Impart knowledge of transportation concepts in the field of ITS.
3	Introduce to the techniques of ITS to tackle the transportation needs.

Course Outcomes (CO)

CO1	Understand and apply the ITS data collection techniques.
CO2	Apply the various advanced traffic management systems.
CO3	Analyse and evaluate the current trends in the context of ITS

Module	Module Contents	Hours
I	Introduction to Intelligent Transportation Systems (ITS) – Definition of ITS and Identification of ITS Objectives, Historical Background, Benefits of ITS - ITS Data collection techniques – Detectors, Automatic Vehicle Location (AVL), Automatic Vehicle Identification (AVI), Geographic Information Systems (GIS), video data collection.	8
II	Telecommunications in ITS – Importance of telecommunications in the ITS system, Information Management, Traffic Management Centres (TMC). Vehicle – Road side communication – Vehicle Positioning System	7
III	ITS functional areas – Advanced Traffic Management Systems (ATMS), Advanced Traveler Information Systems (ATIS), Commercial Vehicle Operations (CVO), Advanced Vehicle Control Systems (AVCS), Advanced Public Transportation Systems (APTS), Advanced Rural Transportation Systems (ARTS).	7
IV	ITS User Needs and Services – Travel and Traffic management, Public Transportation Management, Electronic Payment, Commercial Vehicle Operations, Emergency Management, Advanced Vehicle safety systems, Information Management.	7
V	Automated Highway Systems - Vehicles in Platoons – Integration of Automated Highway Systems.	6
VI	ITS Programs in the World – Overview of ITS implementations in developed countries, ITS in developing countries.	5

Text Books

1	Chowdhary M A and Sadek A, Fundamentals of Intelligent Transportation systems planning, Artech House Inc., US, 2003.
2	Bob Williams, Intelligent transportation systems standards, Artech House, London, 2008.
3	Paolo Pagano, Intelligent Transportation Systems, CRC Press, 2016

References	
1	ITS Hand Book 2000: Recommendations by World Road Association (PIARC)
2	Sussman, J. M., Perspective on ITS, Artech House Publishers, 2005.

Useful Links	
1	https://www.civil.iitb.ac.in/~vmtom/nptel/591_ITS_1/web/web.html
2	https://www.youtube.com/watch?v=t6Gtkssq9Wk
3	https://www.youtube.com/watch?v=hz7ysz9aLaE
4	https://ocw.mit.edu/courses/civil-and-environmental-engineering/1-212j-an-introduction-to-intelligent-transportation-systems-spring-2005/lecture-notes/

CO-PO Mapping

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

KSG

Walchand College of Engineering, Sangli *(Government Aided Autonomous Institute)*					
AY 2022-23					
Course Information					
Programme	B. Tech. (Civil Engineering)				
Class, Semester	Final Year B. Tech., Sem. VIII				
Course Code	5CV436				
Course Name	Sustainable and Energy Efficient Building Technologies				
Desired Requisites:	Courses in Building Materials and Construction, Building Planning and Design				

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs./week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 3**			

Course Objectives	
1	To bring in a third parameter of energy into the performance of buildings.
2	To explore the alternative materials and technologies for various components that can minimize the energy consumption in buildings.
3	To study the different rating systems for assessment of Green Buildings

Course Outcomes (CO) with Bloom's Taxonomy Level		
CO1	Communicate in the language of energy in context to energy policy and express the relevance of environment and energy efficiency in context to construction industry.	Understand
CO2	Apply and assess the energy contribution of various materials and components in buildings.	Apply
CO3	Develop an ability to design sustainable and environmental friendly building systems leading to better efficiency in terms of energy, cost and performance.	Create

Module	**Module Contents**	**Hours**
I	**Buildings and Environment** Energy, planning & urban form, Global warming, causes, energy considerations, energy conservation and energy efficiency, energy systems and spatial structures, Classification of energy, primary and secondary energy, commercial and non-commercial energy, renewable and non re-newable energy, Global primary energy reserves and consumption, energy distribution, Units of Energy with examples, .	5
II	**Energy and Environmental issues in Building Materials** General facts, energy resources and their impacts on environment, energy in context to built environment, Sustainable buildings, sustainability and Objectives of Green buildings, planning aspects of	4

17/10/22

	sustainable buildings, energy consumption and efficiency in buildings, Design strategies, Material strategies, Parametric assessment, Env. Issues related to buildings materials.	
III	**Conventional Materials and Techniques in Buildings** Constraints in Choice of building systems, Pre & post construction performance, Properties of materials, Types of Physical, Mechanical, Chemical and Thermal characteristics, Introduction to structural and physical aspects of buildings, Conventional materials used in construction, Case studies of various building materials, Energy consumption in various building materials, Sustainability considerations.	6
IV	**Sustainable Materials and Techniques for Masonry** Felt requirements and real objectives of Green towns, Need and approach to sustainability, Green building materials, Design constraints, Appropriate materials and techniques in construction: Relevance of building blocks, mortars. Stabilized mud blocks, FAL-G blocks, Hollow concrete blocks, Calcium silicate bricks, Hourdi blocks, Energy comparison in building blocks., Relevance of Pozzolonic and combination mortars for masonry.	6
V	**Roofing concepts in Green Buildings** Structural inefficiencies in Conventional roofing systems, Concepts in roofing alternatives, Thatch roofs, Filler slab roofs, Filler materials, Composite beam-panel roofs / floors, hollow hourdi/concrete block roofs / floors, Ferrocement roofing systems, Masonry Domes and Vaults, Comparison of Energy consumption in roofing systems, Energy Embodied energy in buildings.	6
VI	**Energy systems in Building Maintenance** Elements of climate, Factors influencing climate, Climate and human comfort, Orientation of buildings, Comfort criteria, Heat exchange in buildings, Design for heat loss and heat gain in buildings, Concepts of Active and Passive Energy systems in Buildings, Use of modern gadgets leading to energy efficiency.	6

Text Books	
1	Sustainable Building Technologies, Edited by K.S. Jagadish, Published by BMTPC, I.K. International Publishing House Pvt. Ltd., New Delhi, 2019
2	Alternative Building materials and Technologies by K.S. Jagadish, B.V.Venkatarama Reddy, K. S. Nanjunda Rao., New Age International Publishers, 2nd edition 2017.
3	Manual of tropical Housing and Building- Climatic Design by Koenigsberger, Ingersoll, Mayhew, Szokolay. Universities Press (India) Private Limited, Reprint 2012

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References	
1	Building With Earth, John Norton, Intermediate Technology Pub., 1997.
2	Passive and Low Energy Building Design for Tropical Island Climates- by N. V. Baker, Published by Commonwealth Science Council, May 1987.
3	LIME and other alternative cements, Hill, Holmes and Mather, Intermediate Technology Pub. 1992.
Useful Links	
1	

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

Assessment
The assessment is based on 2 Tests (T1 & T2) of 20 marks each, and 1 end-semester examination (ESE) of 60 marks. Test 1 is typically based on the modules 1 & 2. Test 2 is based on modules 3 & 4 and ESE is based on all modules with 40-50% weightage on modules 1 to 4 and 50-60% weightage on modules 5 & 6.

Assessment Plan based on Bloom's Taxonomy Level				
Bloom's Taxonomy Level	**T1**	**T2**	**ESE**	**Total**
Remember				
Understand	10	10	20	**40**
Apply	10	5	20	**35**
Analyse		5	20	**25**
Evaluate				
Create				
Total	**20**	**20**	**60**	**100**

CBP/SNT

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2022-23

Course Information

Programme	B.Tech. (Civil Engineering)
Class, Semester	Final Year B. Tech., Sem VIII
Course Code	5CV437
Course Name	Computer Applications in Structural Engineering
Desired Requisites:	Analysis and Design of Concrete and Steel Structures

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 knowledge of numerical approach and significance of analysis by computers.
2	To provide necessary knowledge of numerical tools required for analyzing and solving problems in the field of engineering.
3	To provide pre-requisite knowledge to the students for analyzing and designing structures by computers.
4	To deliver know-how of typical software application techniques applicable to engineering problems.

Course Outcomes (CO) with Bloom's Taxonomy Level

CO1	Apply program development skill for Matrix operations, Numerical methods to analysis and design structures.	Applying
CO2	Analyze and develop sequential procedure and algorithm/program for analysis and design of civil engineering structures.	Analyzing
CO3	Design civil engineering structures using commercial software on computers and create design reports.	Creating

Module	Module Contents	Hours
I	**ALGORITHM DEVELOPMENT & PROGRAMMING LANGUAGES** Basics of computer hardware and Algorithm essentials: problem analysis and flowcharting, fundamentals of sequential programming: Variables,data types&functions +input-output+data handling+various development units, Introduction to programming in MS EXCEL®, MATLAB®or SCILAB.	6
II	**MATRIX METHODS AND PROGRAMMING** Matrix operations: product, inverse etc., Simultaneous linear equations, Programming/EXCEL techniques of above methods.	6
III	**NUMERICAL METHODS AND PROGRAMMING** Numerical Integration methods, Regression Analysis tools and curve fitting, Numerical Method in structural dynamics/earthquake engineering. Algorithm/Programming techniques of above methods.	6
IV	**COMPUTER AIDED STRUCTURAL ANALYSIS** Stiffness method: - Analysis of Trusses, Analysis of Continuous Beams by Finite Element method.	6

V	**COMPUTER AIDED STRUCTURAL DESIGN** Design of Steel Truss members by IS-800, Design of Beam sections in RCC, Design of One way/Two slab by IS-456.	6
VI	**COMMERCIAL SOFTWARE APPLICATIONS** Application in commercial software STAAD® **or** ETABS® Analysis of TRUSS, Essentials of RCC building Design.	6
	Module wise Measurable Students Learning Outcomes: 1. Apply fundamentals of Algorithm and programming. 2. Carry out matrix operations by programming. 3. Implement numerical methods by programming 4. Analyze 2D structural problems by Finite Element Method. 5. Design simple RCC and STEEL members by latest BIS-codes 6. Generate structural applications in Finite Element software.	

	Text Books
1	M.K.Jain, S.R.K.Iyengar & R.K.Jain " Numerical Methods for Scientific and Engineering Computation ", 4th ed. 2004
2	Pundit & Gupta "Structural Analysis", Tata MC Graw Hill Book company
3	Devdas Menon,S. Pillai , Reinforced Concrete Design - The MC Graw Hill company Third Ed–2009
4	N. Subramanian, "Design of Steel Structures", (Oxford Higher Education)-2008

	References
1	Steve Otto and James P. Denier,,An Introduction to Programming and Numerical Methods in, Springer International books, 1st Edition, 2007
2	Cotes, R.C., Couties, M.G., and Kong, F.K., Structural Analysis, 3rd Edition, 1990, ELBS
3	A.K.Chopra, "Structural Dynamics for Earthquake Engineering", 4th Edition, 2008,Pearson Pubilications

	Useful Links
1	https://wiki.csiamerica.com/display/sap2000/Home
2	https://www.sefindia.org/?q=node/20
3	https://www.spacegass.com/
4	

CO-PO Mapping

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

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)

AKK

Walchand College of Engineering, Sangli
(Government Aided Autonomous Institute)

AY 2022-23

Course Information

Programme	B.Tech. (Civil Engineering)
Class, Semester	Final Year B. Tech., Sem VIII
Course Code	5CV438
Course Name	Elective – 6 : Geosynthetics and Reinforced Soil Structures
Desired Requisites:	Soil mechanics, foundation Engineering, Soil Mechanics Lab

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

Course Objectives

Students are expected to explore avenues of modern geotechnical Engineering structures focusing upon reinforced earth structures. They are expected to apply their knowledge of geotechnical engineering courses for studying behaviour of reinforced earth structures

Course Outcomes (CO)

CO1	Realize the need and demand for the use of geosynthetic materials in the field of geotechnical construction works.
CO2	Design the Geosynthetics for the functions of separation, reinforcement, stabilization, filtration, drainage and moisture barriers.
CO3	Distinguish and describe various manufacturing methods of Geosynthetics and its quality control tests

Module	**Module Contents**	**Hours**
I	**Introduction :** Ground Improvement Techniques, Introduction to Geosynthetics – Basic description – Polymeric materials– Uses and Applications. Properties of Geotextiles – Geogrids – Geomembranes – Geocomposites.	8
II	**Geotextiles**: Design criteria for Separation – Reinforcement – Stabilization – Filtration – Drainage and Moisture barriers. Geogrids: Designing for Reinforcement – Stabilization – Designing Gabions – Construction methods.	6
III	**Use of Geosynthetics in Roads**: Geosynthetics in road ways- applications-role of subgrade conditions-desidn criteria-survivability-application in paved roads	6
IV	**Reinforced Earth Retaining Walls :** Components – External stability – Internal stability-Design of reinforced earth walls with strip, sheet and grid reinforcement.	8

AK-Karale

V	**Geomembranes:** Pond Liners – Covers for Reservoirs – Canal Liners – Landfill Liners– Caps and closures, moisture barriers. Geocomposites: An added advantage – Geocomposites in Separation –Reinforcement – Filtration – Geocomposites as Geowebs and Geocells.	8
VI	**Natural Geotextiles:** Natural fibres as geotextiles- factors governing the use- jute fibres-coir geotextiles-bamboo/timber-combination of geotextiles.	6

	Text Books
1	Shukla Sanjay Kumar(2016), "*An introduction to geosynthetic engineering*", CRC Press /Taylor & Freancis Group
2	Shukla Sanjay Kumar(2002), "*Geosynthetics and their applications engineering*", Thomas Telford
3	Peter G Nicholson (2015),*"Soil improvement and ground modification methods"*, Butterworth-Heinemann, , Elsevier Inc
	References
1	R. W. Sarsby (2006), "*Geosynthetics in Civil Engineering*", 1st Edition, Woodhead Publishing
2	Robert M Koerner (2005), *"Designing with Geosynthetics"*,5th Edition, Prentice Hall
3	Wu, Jonathan T. H (2019) ,*"Geosynthetic reinforced soil (GRS) walls"*, John Blackwell
	Useful Links
1	https://nptel.ac.in/courses/105106052 NPTEL course notes availableby Dr. K. Rajagopal, IIT Madras

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)

GMB / GRM

Walchand College of Engineering, Sangli *(Government Aided Autonomous Institute)*					
AY 2022-23					
Course Information					
Programme	B. Tech. (Civil Engineering)				
Class, Semester	Final Year B. Tech., Sem. VIII				
Course Code	5CV439				
Course Name	Environmental Management Systems				
Desired Requisites:	Environmental Engineering Course at Graduate Level				
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 knowledge of ecological aspects.
2	To provide knowledge of Environmental Ethics and Environmental Legislation.
3	To provide necessary knowledge of managerial tools required in the field of environmental management.

Course Outcomes (CO) with Bloom's Taxonomy Level		
CO1	***Explain*** ecological imbalance due to various types of pollution and perceive environmental ethics and legislation.	Understand
CO2	***Choose*** appropriate methodology for EIA and auditing and assess the impacts.	Apply
CO3	***Implement*** EMS and Environmental Management Plan for infrastructural facilities.	Apply

Module	**Module Contents**	**Hours**
I	**Ecological Aspects and types of Pollution** Ecological aspects: Salient features of major Eco Systems, Energy Transfer, Population Dynamics, Ecological imbalance, Preservation of Biodiversity. Land Pollution, Water Pollution due to sewage, industrial effluents and leachate, Pollution due to Nuclear Power Plants, Radioactive Waste, Thermal pollution, causes and control. Noise Pollution: Decibel Levels, Monitoring, Hazards, Control measures.	6
II	**Environmental Ethics and Legislation** Environmental Ethics: Ethics in society, Environmental consequences, Responsibility for environmental degradation, Ethical theories and codes of Ethics, Changing attitudes, Sustainable development.	6

	Environmental Legislation: Water (prevention and control of pollution) act 1974, The environmental act 1986, The Noise Pollution (Regulation and Control) Rules, 2000. Environmental economics.	
III	**Environmental Impact Assessment (EIA)** Definitions and Concept, Scope, Objectives, Types of impacts, Elements of EIA, Baseline studies. Methodologies of EIA, Prediction of impacts and its methodology, Uncertainties in EIA, Status of EIAs in India.	7
IV	**Environmental Auditing** Definitions and concepts, Scope and Objectives, Types of audit, Accounts audit, Environmental audit statement, Qualities of environment auditor. Environmental Impact Statement (EIS).	7
V	**ISO Standards** ISO and ISO 14000 Series: Introduction, Areas covered in the series of standards, Necessity of ISO certification. Environmental management system: Evolution, Need, Elements, Benefits, ISO 14001 requirements, Steps in ISO 14001 certification, ISO 14001 and sustainable development, Integration with other systems (ISO 9000, TQM, Six Sigma), Benefits of integration.	7
VI	**Environmental Management Plan** Definition, Importance, Development, Structuring, Monitoring, Cost aspects. Strategy for siting of Industries, Environmental Labeling, Life-Cycle Assessment.	6

Text Books	
1	Canter, L. W., Environmental Impact Assessment, McGraw-Hill, 2nd Edition, 1997.
2	Agarwal, N. P., Environmental Reporting and Auditing, Raj Pub., 1st Edition, 2002.
3	Judith, P. and Eduljee, G., Environmental Impact Assessment for Waste Treatment and Disposal Facilities, John Wiley & Sons, 1st Edition, 1994.

References	
1	"Environmental Auditing", Published by CPCB, Govt. of India Publication, New Delhi.
2	Mhaskar, A.K., Environmental Audit", Media Enviro Publications, 2002.
3	K. Whitelaw and Butterworth, ISO 14001: Environmental System Handbook, 1997.

Useful Links	
1	https://www.youtube.com/watch?v=wEqrMCdNjX4
2	https://www.youtube.com/watch?v=hfLGI73N_iA
3	https://www.youtube.com/watch?v=MpR6YiSiHrs

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

Assessment
The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of 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)

BhosaleGM
(M2 - GM Bhosale)

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2022-23

Course Information

Programme	B. Tech. (Civil Engineering)
Class, Semester	Final year, VIII
Course Code	5CV440
Course Name	Construction Equipment and Techniques
Desired Requisites:	

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	This course aims at making civil engineering students who need to understand the breadth and depth of construction field for possible engagement.
2	To introduce various construction equipment and techniques.
3	To provide knowledge about efficient utilization of the equipment and techniques.

Course Outcomes (CO)

CO	Description	Blooms Taxonomy
	At the end of the course, the students will be able to,	
CO1	Describe different construction equipment and plants.	**understanding**
CO2	Explain different construction techniques.	**understanding**
CO3	Choose suitable equipment, formwork and technique based on project requirements.	**Applying**

Module	Module Contents	Hours
I	**Construction Equipment** • **Introduction** –Conceptual planning of new project, site access and services, mechanical v/s manual construction • **Earth moving Equipment**- Bulldozers, Power shovel, Hoes, Hauling units, Simple numerical problems based on cycle time and production rates. • Drag line, Clamshell, Trenchers, Compactors-types and performance, operating efficiencies.	9
II	**Drilling & Blasting** Excavation in hard rock: Rippers, jack hammers, drills, compressors and pneumatic equipment, Blasting explosives, detonators, fuses.	7
III	**Formwork** • Material for formwork, introduction to design of formwork • Advanced formwork techniques	5
IV	**Plants for construction works** • RMC plant layout and applications • Asphalt mixing and batching plant (Hot mix plant), Sensor Paver for rigid roads • Aggregate crushing plants.	7

V	**Construction Techniques** • Diaphragm Walls: Purpose and Construction methods • Introduction to trenchless technology • Prefabricated construction: Planning for pre-casting, selection of equipment for fabrication, transport and erection, quality measures, safety measures during erection. • Steel Construction : Planning for field operations, selection of equipment and erection tools	7
VI	**Pile Construction** Pile driving equipment- Types, pile driving hammers, single acting and double acting, differential acting hammers, hydraulic and diesel hammers, vibratory drivers.	5

Text Books	
1	Kumar Neeraj Zha, "Construction Project Management", Pearson India Education, 2nd edition, 2015.
2	Robert Peurifoy, Clifford J. Schexnayder, Aviad Shapira, Robert Schmitt, "Construction planning, equipment, and methods", McGraw-Hill, 8th edition, 2010.
3	Sharma S.C. "Construction Equipment and Management", Khanna Publishers New Delhi, 1988.

References	
1	Kumar Neeraj Zha, "Formwork for construction" McGraw-Hill, 3rd reprint, 2019.

CO-PO Mapping

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

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

Assessment

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

AKM

Walchand College of Engineering, Sangli
(Government Aided Autonomous Institute)

AY 2022-23

Course Information

Programme	B. Tech. (Civil Engineering)
Class, Semester	Final Year B. Tech., Sem VIII
Course Code	5CV441
Course Name	Professional Elective - 6: Tunnel and Harbour Engineering
Desired Requisites:	-

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	60	100
Practical	-				
Interaction	-	**Credits: 3**			

Course Objectives

1	To give exposure to fundamentals of Tunnel and Harbour.
2	Impart the techniques of planning and designing of the Tunnel and Harbour.
3	To make conversant with various construction methods of Tunnel and Harbour.

Course Outcomes (CO)

CO1	**Comprehend** the fundamental knowledge of tunnels and docks and harbour engineering.
CO2	Explain, **analyze and design** the various aspects and elements of tunnel and, docks and harbours.
CO3	**Appraise and apply** various techniques used in the construction of tunnels, and docks and harbours.

Module	**Module Contents**	**Hours**
I	**Tunnel Engineering** General aspects, economic considerations, advantages, Selection of route, transfer of CL on surface, shapes and sizes, Tunnelling Methods: Types and purpose of tunnels; factors affecting choice of excavation technique; Methods – soft ground tunneling, hard rock tunneling, shallow tunneling, deep tunneling; Shallow tunnels – cut and cover, cover and cut, pipe jacking, jacked box excavation techniques, methods of muck disposal, supporting, problems encountered in tunneling and remedial measures.	8
II	Tunneling by Drilling and Blasting: Unit operations in conventional tunneling; Drilling – drilling principles, drilling equipment, drilling tools, drill selection, rock drillability factors; Blasting – explosives, initiators, blasting mechanics, blast hole nomenclature; types of cuts- fan, wedge and others; blast design, tunnel blast performance – powder factor, parameters influencing, models for prediction; mucking and transportation equipment selection. Modern Tunnelling methods Tunnel Lighting ,Ventilation of Tunnel, Methods of Ventilation, Dust control	8
III	**Harbour Engineering** Docks and Harbour Engineering Part I Sea and tides, hydrographic surveys, wind, waves and cyclones, siltation and erosion, investigations, model tests, ship features, traffic forecasting.	6
IV	Harbour layout, channel, basin and berths, breakwaters, wharves, jetties, dolphins and moorings. Locks, shore protection works, dry docks and slipways, aprons, transit shades and warehouses, cargo handling equipment,	6

V	Navigational Aids: Requirements of signals, fixed navigation structures, necessity of navigational aids, light houses, beacon lights, floating navigational aids, light ships, buoys, radar; Dredging and Coastal Protection: Classification, types of dredgers, choice of dredger, uses of dredged materials, coastal erosion and protection, sea wall, revetment, bulkhead, coastal zone and beach profile, CRZ.	6
VI	Port facilities: Port development, port planning, port building facilities, transit sheds, warehouses, cargo handling facilities, container handling terminal facilities, shipping terminals, inland port facilities. Inland waterways, Inland water transportation in India, classification of waterways, economics of inland waterways transportation, national waterways.	5

Text Books	
1	Saxena S.C., Tunnel Engineering, Dhanpat Rai & Sons, New Delhi, 1st Edition, 1984.
2	Bindra S. P, Docks and Harbour Engineering, Dhanpat Rai & Sons, New Delhi, 2012
3	Srinivasan R., Harbour, Dock And Tunnel Engineering, Charotar Publishing, 30th Edition 2022
References	
1	Megaw T. M. and Bartlett J., Tunnels Planning, Design, Construction, EHJW, 1st Edition 1981
2	Jarvis A., Port and Harbour Engineering, Ashgate, 1st Edition, 1998
Useful Links	
1	https://www.youtube.com/watch?v=gT0rAkmNuD8

CO-PO Mapping

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

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

Assessment

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)