Walchand College of Engineering

(Government Aided Autonomous Institute)

Vishrambag, Sangli. 416415

Credit System for
Final Year B.Tech. (Civil Engineering)
Sem-VII and VIII

2022-23

Walchand College of Engineering

(Government Aided Autonomous Institute)

Credit System for Final Year B.Tech. (Civil Engineering) Sem-VII AY 2022-23

Sr.No.	Category	Course Code	Course Name	L	T	P	I	Hrs	Cr	MSE/LA1	ISE/LA2	ESE	Ext
Professional Core (Theory)													
1	PC	5CV401	Estimating and Costing	2	0	0	0	2	2	30	20	50	
2	PC	5CV402	Reinforced and Prestressed Concrete Design	2	1	0	0	3	3	30	20	50	
3	HS	5CV403	Humanities-4 Legal, IPR, Safety	1	0	0	0	1	1	15	10	25	
Professional Core (Lab)													
4	PC	5CV451	Construction Project Management Lab	0	0	2	0	2	1	30	30	40	OE
5	PC	5CV447	Mini-Project-6 Estimating and Costing	0	0	2	0	2	1	30	30	40	OE
6	PR	5CV448	Mini-Project-7 Concrete Structures Design and Drawings	0	0	2	0	2	1	30	30	40	OE
7	PR	5CV453	Techno-Socio Activity	0	0	0	1	1	1	15	15	20	
8	PR	5CV491	Project-I	0	0	6	0	6	3	30	30	40	OE
9	HS	5CV455	Humanities-3 Project Management	0	0	0	1	1	1	15	15	20	
Professional Elective (Theory)													
10	PE	Refer list	Elective- 4	3	0	0	0	3	3	30	20	50	
Open Elective													
11	OE	Refer list	Open Elective-5	3	0	0	0	3	3	30	20	50	
AICTE Mandatory Courses													
12	MC	5IC401	Constitution of India	2	0	0	0	2	0	30	20	50	
			Total	**13**	**1**	**12**	**2**	**28**	**20**				

Notes:

For Theory courses: There shall be MSE, ISE and ESE. The ESE is a separate head of passing.

For Lab courses: There shall be continuous assessment (LA1, LA2, ESE). The ESE is a separate head of passing. The Y in the PoE indicates external component for ESE.

Minimum two AICTE mandatory courses need to be completed for award of degree.

The contact hours of guide for Final Year BTech project are 4 hrs for Sem VII and 8 hours/week for Sem VIII, for 9 students.

For further details, refer to Academic and Examination rules and regulations.

Walchand College of Engineering

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Elective Course List for Final Year B.Tech. (Civil Engineering) Sem-VII AY 2022-23

Sr.No.	Track	Course Code	Course Name
Elective- 4			
1	Structural Engineering	5CV411	Advanced Structural Analysis
2	Environmental Engineering	5CV412	Advances in Water and Wastewater Treatment
3	Environmental Engineering	5CV413	Air Pollution and Control
4	Infrastructure Engineering	5CV414	Maintenance and Rehabilitation of Structures
5	Transportation Engineering	5CV415	Bridge and Airport Engineering

Walchand College of Engineering

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Open Elective Course List for Final Year B.Tech. (Civil Engineering) Sem-VII AY 2022-23

Sr.No.	Offering Dept	Sem	Course Code	Course Name
Open Elective 5				
1	Mech	7	5OE429	Industrial Automation
2	Elect	7	5OE443	Industrial Automation NPTEL
3	Eln	7	5OE457	Medical Image Processing
4	CSE	7	5OE471	Cyber Security
5	IT	7	5OE485	Data Visualization & Interpretation

Walchand College of Engineering

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Credit System for Final Year B.Tech. (Civil Engineering) Sem-VIII AY 2022-23

Sr.No.	Category	Course Code	Course Name	L	T	P	I	Hrs	Cr	MSE/LA1	ISE/LA2	ESE	Ext
Professional Core (Theory)													
1	PC	5CV421	Valuation of Immovable Properties	2	0	0	0	2	2	30	20	50	
Professional Core (Lab)													
2	PC	5CV471	Structural Health Monitoring Lab	0	0	2	0	2	1	30	30	40	OE
3	PR	5CV492	Project-II	0	0	12	0	12	6	30	30	40	POE
Professional Elective (Theory)													
4	PE	Refer list	Elective- 5	3	0	0	0	3	3	30	20	50	
5	PE	Refer list	Elective- 6	3	0	0	0	3	3	30	20	50	
6	PE	Refer list	Elective- 7	3	0	0	0	3	3	30	20	50	
			Total	**11**	**0**	**14**	**0**	**25**	**18**				

Notes:

For Theory courses: There shall be MSE, ISE and ESE. The ESE is a separate head of passing.

For Lab courses: There shall be continuous assessment (LA1, LA2, ESE). The ESE is a separate head of passing. The Y in the PoE indicates external component for ESE.

Minimum two AICTE mandatory courses need to be completed for award of degree.

The contact hours of guide for Final Year BTech project are 4 hrs for Sem VII and 8 hours/week for Sem VIII, for 9 students.

For further details, refer to Academic and Examination rules and regulations.

Walchand College of Engineering

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Elective Course List for Final Year B.Tech. (Civil Engineering) Sem-VIII AY 2022-23

Sr.No.	Track	Course Code	Course Name
Elective- 5			
1	Structural Engineering	5CV431	Advanced Structural Design
2	Structural Engineering	5CV432	Structural Health Monitoring
3	Environmental Engineering	5CV433	Industrial Wastewater Treatment
4	Infrastructure Engineering	5CV434	Contracts Management
5	Transportation Engineering	5CV435	Inteligent Transportation systems
6	Infrastructure Engineering	5CV436	Sustainable and Energy Efficient Building Technologies
Elective- 6			
1	Structural Engineering	5CV437	Computer Applications in Structural Engineering
2	Structural Engineering	5CV438	Geosynthetics And Reinforced Soil Structures
3	Environmental Engineering	5CV439	Environmental Management Systems
4	Transportation Engineering	5CV440	Construction Equipment and Techniques
5	Transportation Engineering	5CV441	Tunnel and Harbour Engineering
6	Transportation Engineering	5CV442	Highway Construction and Pavement Design
Elective- 7			
1	Structural Engineering	5CV443	Advanced Numerical Analysis
2	Structural Engineering	5CV444	Design of Concrete Bridges
3	Structural Engineering	5CV445	Finite Element Methods
4	Infrastructure Engineering	5CV446	Structural Geology

Walchand College of Engineering, Sangli
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AY 2022-23

Course Information

Programme	B.Tech. (Civil Engineering)
Class, Semester	Final Year B. Tech. Sem. VII
Course Code	5CV447
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

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)

Walchand College of Engineering, Sangli

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AY 2022-23

Course Information

Programme	B.Tech. (Civil Engineering)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	5CV417
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	-	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)

Walchand College of Engineering, Sangli

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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
(Government Aided Autonomous Institute)

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-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/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 2022-23

Course Information	
Programme	B.Tech. (Civil Engineering)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	5CV453
Course Name	Techno Socio Activity
Desired Requisites:	No Requisite Course is required.

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture		**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	15	15	20	50
Practical	-				
Interaction	01 Hr./week	**Credits: 1**			

Course Objectives	
1	To promote / motivate the students for co-curricular activity
2	To develop the ability of "Out of Box" thinking.
3	To apply the knowledge acquired in engineering to solve nationwide, society and community problem.

Course Outcomes (CO) with Bloom's Taxonomy Level		
CO1	**Apply** the technical knowledge to solve the social problem	Applying
CO2	**Analyse** the real world problems	Analysing
CO3	**Demonstrate** the solution to techno socio problem	Evaluating

	Module Contents Open to students. Student can undertake any three techno-socio activity as listed below but not limited to it :	**Hours**
I	Each student or group of students may participate in any social activity like "Swach Bharat Abhiyan", "Blood Donation Camp", or any social activity announced by Govt. / Corporation / Panchayat.	
II	Each student or group of students participating in technical events / competition.	
III	Awards / recognition received in techno-socio activity	
IV	Completing the on line courses (on topics beyond syllabus) / certification of any companies / technologies (e.g. Coursera /CSIR/IIRS- Outreach Programme/ AICTE-ATAL Course /Sky-fi lab / SWAYAM / NPTEL .)	
V	Developing any innovative Patent /gadget / solution / system and transfer in the interest of Nation / Society / Institute (WCE)	
VI	Published a papers in national / international conferences / journals	
VII	Coordinating the students clubs / services	
VIII	Organizing techno-socio activity for the students / community in rural areas, backward areas.	

References	
1	National Institute for Engineering Ethics (NIEE)
2	Professional ethics, National Society of Professional Engineers (NSPE).

Useful Links	
1	(https://www.asce.org/pdf/ethics_manual.pdf)
2	https://www.aicte-india.org/atal

3	https://nptel.ac.in/
4	https://swayam.gov.in/

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

Walchand College of Engineering, Sangli

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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.				

Walchand College of Engineering, Sangli

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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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Course Information	
Programme	B.Tech. (Civil Engineering)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	5CV455
Course Name	Project Management
Desired Requisites:	Building Planning Design, Estimating and Costing

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	1Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	15	15	20	50
Practical	-				
Interaction	-	**Credits: 1**			

Course Objectives	
1	To stay competitive companies have sought to shorten the construction times of new infrastructure by managing construction development efforts effectively by using different project management tools.
2	To achieve this, we will use a basic project management framework in which the project life-cycle is broken into organizing, planning, monitoring, controlling and learning from old and current construction projects.
3	To effectively manage a construction project in an Architecture/Engineering/Construction (A/E/C) organization.
Course Outcomes (CO)	
CO1	Organize and Plan for various dimensions of construction projects such time, cost, quality , safety and scope.
CO2	Demonstrate knowledge in monitoring and controlling construction projects with respect to various dimensions such as time, cost, quality , safety and scope.
CO3	Apply standards of professional and ethical responsibility to determine an appropriate course of Action

Module	**Module Contents**	**Hours**
I	**Introduction to construction project management** Concepts and functions of Management • Construction project: unique features, types, phases, role in economic development, role of stakeholders, regulatory requirements. • Construction project management and its relevance • Construction project organization: structure, traits of project manager, project coordinator, • Ethical Conduct for Engineers	2
II	**Construction project planning and scheduling** Stages of project planning • Process of development of plans and schedules: work break-down structure, activity lists, assessment of work content, estimating durations, sequence of activities. • Planning techniques: Bar charts, Networks • Formulation and analysis of CPM networks (AOA , AON and precedence networks) • Introduction to line of balance technique, Simulation. • Resource Scheduling- resource constraints and conflicts, resource aggregation, allocation, smoothening and leveling, calendaring networks.	3

III	**Construction materials management and cost management-** Construction materials management: • Materials flow system, role of materials management, EOQ model, material codification and classification, concept of logistics and supply chain management, role of ERP in materials management Construction costs management- • cost classification, cost codes, • time cost trade-off in construction projects, compression and decompression • cost planning, cost budgeting, • value management in construction,	2
IV	**Project Monitoring & control** Measuring progress, periodic progress reports • Updating of plans. • Cost control,Earned value analysis • Introduction to Management Information System • Common causes of time and cost overruns and corrective measures.	2
V	**Construction Quality and Safety management** Quality assurance & control: • use of manuals and checklists for quality control • Introduction to TQM, quality audit, cost of quality, ISO standards x Safety and health on project sites: • accidents causes and effects, costs of accidents, occupational health problems in construction, • Safety and health management system • Health and safety act regulations	2
VI	Risk Management • Risk in Construction : Identification, Classification, Mitigation, • Basics of Decision Analysis, Decision Tree, Sources of risk in construction Scope Changes and Claims, Disputes and Project closure	1

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)
References	
1	Chitkara K K, ―Construction Project Management : Planning, Scheduling and Controlling‖, Tata McGraw - Hill Education, 2nd edition, 2010
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

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	

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

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Course Information	
Programme	B.Tech. Civil engineering
Class, Semester	Final Year B. Tech., Sem. VII
Course Code	5CV412
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)

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Course Information

Programme	B. Tech. (Civil Engineering)
Class, Semester	Final Year B. Tech., Sem. VII
Course Code	5CV413
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)

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Course Information

Programme	B. Tech. (Civil Engineering)
Class, Semester	Final Year B. Tech., Semester VII
Course Code	5CV414
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)

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Course Information	
Programme	B.Tech. (Civil Engineering)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	5CV415
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

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)

Course Contents for B.Tech Programme, Department of Civil Engineering, AY2021-22

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AY 2021-22

Course Information	
Programme	B. Tech. (Civil Engineering)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	5CV417
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 2022-23

Course Information

Programme	B.Tech. (Civil Engineering)
Class, Semester	Final Year B. Tech. Sem. VIII
Course Code	5CV421
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)

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AY 2022-23

Course Information

Programme	B.Tech. (Civil Engineering)
Class, Semester	Final Year B. Tech. Sem. VIII
Course Code	5CV421
Course Name	Valuation of Immovable Properties
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 valuation of immovable properties.
2	To develop proficiency with methods for valuation of immovable properties.
3	To acquaint the students with use of excel for computations in valuation.

Course Outcomes (CO) with Bloom's Taxonomy Level

CO1	***Describe*** elements of valuation of immovable properties	Understanding
CO2	***Appraise*** the different methods for valuation of immovable properties.	Analyzing
CO3	***Value*** the different immovable properties.	Evaluate

Module	**Module Contents**	**Hours**
I	**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.	3
II	**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
III	**Computational parameters for valuation** Years Purchase, Single rate and dual rate, reversion value of land, net yield, capitalized value, Valuation tables.	4
IV	**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.	5
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, Computation of buying or selling prices.	5

Text Books	
1	"Valuation of Real Properties" Rangwala, Charotar Publishing House, 10th Edition: 2015
2	"Civil Engineering Contracts & Estimates", B. S. Patil, Orient Langman Ltd., 1st Edition, 1981.

References	
1	"Professional Practices (Estimating & Valuation)", Roshan Namavati., LBD Publishers, 4th Edition, 1984.
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)

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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.				

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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.				

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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)

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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

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)

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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)

Walchand College of Engineering, Sangli
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AY 2022-23

Course Information

Programme	B. Tech. (Civil Engineering)
Class, Semester	Final Year B. Tech., Sem. VIII
Course Code	
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

	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	

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**

Walchand College of Engineering, Sangli

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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)

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

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)

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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)

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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)

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Course Information	
Programme	B. Tech. (Civil Engineering)
Class, Semester	Final Year B. Tech., Sem VIII
Course Code	5CV442
Course Name	Professional Elective - 6: Highway Construction and Pavement Design
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 introduce highway pavements, design concepts and material properties.
2	Impart the knowledge of design flexible and rigid highway pavements.
3	To introduce the concepts of pavement evaluation and rehabilitation.

Course Outcomes (CO)	
CO1	Apply the knowledge pavement construction material and techniques.
CO2	Analyze and design flexible and rigid pavements.
CO3	Evaluate structural condition of pavement.

Module	**Module Contents**	**Hours**
I	**Pavement Materials** Characterization for Earthwork, Subgrade, Effective CBR, Concept of Modulus of resilient of subgrade, Granular Subbase and Base layer - road aggregates used for WBM, WMM, Aggregate used in Bituminous layer, Its characteristics, gradation, Concept of Modulus of resilient of sub base and base course as per IRC 37, Bitumen, Emulsion, Modified bitumen, concept of modulus of resilient per IRC 37, Quality control and Quality Assurance plan for highway. Marshall Stability test, CBR method, Modified CBR method	7
II	**Flexible pavement:** Construction procedure of embankment, subgrade, Sub base (Granular, sub base), Drainage layer, Base course-WBM, WMM, Lime stabilized, cement stabilized (Granular layer), Bituminous mix – Binder course and wearing course, construction procedure as per specification of MORTH	6
III	**Rigid pavement:** Earthwork, Granular sub base, drainage layer, Dry lean concrete as per IRC-49, Pavement quality concrete construction requirements as per IRC:15 and IRC:58 and MORTH, Importance of joints and its provision.	5
IV	**Flexible Pavement:** Factors affecting pavement design, ESWL, EWLF, VDF, Stress analysis – Boussinesq's theory, Burmister's two and three-layer theory, Flexible pavement design as performance criteria- subgrade rutting criteria and fatigue cracking criteria for bituminous layer. Methods of design, Design of flexible pavement by IRC 37	8
V	**Rigid Pavement:** Types of rigid pavements, Methods of design, Terminologies used in design, Materials for rigid pavements, Stresses in rigid pavements, Joints in rigid pavements, Design of rigid pavement by IRC 58 and IRC SP 62, Construction of rigid pavement	8

VI	**Maintenance of pavement** Distresses in flexible pavements and rigid pavements, Evaluation of pavement condition, Pavement rehabilitation, Pavement management system, Design of overlay, Road safety audit	4

Text Books	
1	Kadhiyali L.R., "Traffic Engineering and Transport Planning", Khanna Publishers, 9th Edition, 2017
2	Dr. Sharma S. K., Principles, Practice and Design of Highway Engineering (Including Airports), S. Chand & Company Ltd.
3	Kandhal Prithvi Singh "Bituminous Road Construction in India", PHI learning, 2016
References	
1	Yoder E. J. and Witczak M. W., Principles of Pavement Design, John Wiley and Sons, New York, 1975
2	Yang Huang, "Pavement Analysis and Design", Pearson Publication, 2nd Edition, 2008
3	MORTH Specifications for Road and Bridge Works, Indian Roads Congress (IRC) 5th Revision 2013, New Delhi, India
Useful Links	
1	https://www.youtube.com/watch?v=HLVjhGDdsSM&t=2451s
2	https://www.youtube.com/watch?v=XOyusu4QC8s
3	

CO-PO Mapping

	Programme Outcomes (PO)												**PSPO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1			2										1	
CO2			2										2	
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, 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 At the end of the course, the students will be able to,	Blooms Taxonomy
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)

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AY 2022-23

Course Information

Programme	B.Tech. (Civil Engineering)
Class, Semester	Final Year B. Tech., Sem VIII
Course Code	5CV443
Course Name	Elective – 7 : Advanced Numerical Analysis
Desired Requisites:	Engineering Mathematics

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

Course Objectives

- To impart knowledge of various numerical techniques to simulate and solve the problems of civil engineering.
- To solve generic versions of equations that arise in engineering disciplines.

Course Outcomes (CO)

CO1	Solve problems numerically related to non-linear equation, polynomials.
CO2	Solve problems numerically related to linear and nonlinear algebraic equations.
CO3	Solve problems related to numerical differentiation and integration.

Module	**Module Contents**	**Hours**
I	Introduction, roots of a non-linear equation and roots of a polynomial of n^{th} degree [incremental search method, method of successive approximations, Newton's method, bisection method, secant method, Müller's method, synthetic division, Bairstow's method] and convergence study	7
II	Solution of (non-homogeneous) linear algebraic equations, review of matrix algebra, Gauss elimination method, Cholesky's decomposition method, householder method, Gauss-Siedal iterative method	7
III	Solution of non-linear algebraic equations, method of successive approximation, Newton's method, modified Newton – Raphson method, secant method	7
IV	Eigen values and Eigen vectors, reduction of generalized Eigen value problem to the standard Eigen value problem, methods for obtaining Eigen values and Eigen vectors [polynomial method, vector iteration method, Mises power method, Jacobi method]	7
V	Time marching schemes for solution of problems in time domain, numerical integration (2 – D) [Newton – Cotes method, Gauss – Legendre method]	7

VI	Solution of ordinary and partial differential equations, Euler's method, Runge – Kutta method, finite difference method, applications to problems of beam and plates on elastic foundation, Laplacian equation, consolidation equation, laterally loaded piles etc.	7
Text Books		
1	Chapra, S. C. and Canale R. P. (2003) , "*Numerical Methods for Engineers*", Tata McGraw hill	
2	Douglas Faires, J. and Richard Burden (2003), "*Numerical Methods*", Thomson	
3	Rajasekaran, S.(1999) , "*Numerical Methods in Science and Engineering*", S. Chand	
References		
1	George F. Pinder (2018), *"Numerical Methods for Solving Partial Differential Equations: A Comprehensive Introduction for Scientists and Engineers"*, Wiley	
2	E. Joseph Billo (2007)*,"Excel for Scientists and Engineers - Numerical Methods"*, Wiley-Interscience	
Useful Links		
1	https://nptel.ac.in/courses/111106101	

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 2022-23

Course Information	
Programme	B.Tech. (Civil Engineering)
Class, Semester	Final Year B. Tech., Sem VIII
Course Code	5CV444
Course Name	Design of Concrete Bridges
Desired Requisites:	Design of Concrete structures I & Design of Concrete structures II

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 loads and analysis for different types of bridges.
2	To impart knowledge for design of different types of bridges including substructures with relevant codes.
3	To provide knowledge for construction, inspection, and maintenance of bridges.

Course Outcomes (CO)	
CO1	**Illustrate** types of bridges, their components and selection of bridge site.
CO2	**Analyze** various types of bridges with appropriate loads and methods.
CO3	**Design** of bridges and bearings along with reinforcement details.

Module	**Module Contents**	**Hours**
I	Components of bridge, Importance of bridges, various types of bridges, Selection of bride site and type of bridge and economic span length, super structure – philosophy, geometric alignment, drainage, road curb.	6
II	Design loads for bridges, IRC loading, Design of R. C. deck slab, beam, and slab	7
III	Design of Box culvert, Pipe Culvert, Composite Bridge	7
IV	Construction & maintenance, Short & long span concrete bridge, Form work and False work, Construction management, inspection, maintenance, innovative construction techniques, Lessons from bride failures.	6
V	Design of sub – structure - abutments, Piers, approach slab, Pile and Well foundation, Pneumatic caissons	6
VI	Bearing and expansion joints – forces on bearings – Types of bearings, design of unreinforced& reinforced elastomeric bearings, expansion joints	7

Textbooks	
1	Krishna Raju N., “Design of Bridges, Oxford and IBH Publishing Co. Ltd.”, New Delhi and Kolkata, 2001.
2	Jagdeesh T. R., Jayaram M. A., “Design of Bridge Structures, Prentice Hall of India Pvt. Ltd.”, New Delhi, 2003.
3	Johnson Victor, “Essentials of Bridge Engineering, Oxford and IBH Publishing Co. Ltd.”, 5th Edition, 2001.
4	

References	
1	Raina V. K., “Concrete Bridge Practice: Construction and maintenance and rehabilitation”, Tata Mc Graw Hill Publishing Company, New Delhi.
2	Raina V. K., “Concrete Bridge Practice: Analysis, design and economics”, Tata Mc Graw Hill Publishing Company, New Delhi.
3	IRC Codes.

Useful Links	
1	https://onlinecourses.nptel.ac.in/noc19_ce23/preview
2	https://www.classcentral.com/course/swayam-reinforced-concrete-road-bridges-14270
3	https://www.youtube.com/playlist?list=PLYX9X4ZldqpYMaPURxSbY1i8vgfVsZfmQ
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	**3**		**2**	**2**											
CO3	**2**		**2**	**1**											
The strength of mapping is to be written as 1,2,3; Where, 1: Low, 2: Medium, 3: High. Each CO of the course must map to at least one PO.															

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

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AY 2022-23

Course Information	
Programme	B.Tech. (Civil Engineering)
Class, Semester	Final Year B. Tech., Sem VIII
Course Code	5CV445
Course Name	Finite Element Method
Desired Requisites:	Solid Mechanics and Structural Mechanics

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

Course Objectives	
1	To provide knowledge of principles and philosophy of finite element method in structural engineering.
2	To impart knowledge of element stiffness matrix formulation for 1D,2D and 3D elements
3	To demonstrate applications of finite element method to model to solve continuum structures.

Course Outcomes (CO) with Bloom's Taxonomy Level		
CO1	**Determine** element stiffness matrix using finite element methodology.	Understand
CO2	**Solve** nodal degrees of freedom, strains and stress resultants.	Analyzing
CO3	**Apply** finite element methodology for solutions of various field problems.	Apply

Module	**Module Contents**	**Hours**
I	**Module 1 : FEM in skeleton structures-I** Basic concept of finite element analysis, Discretization, nodes, element incidences, formulation of element stiffness matrices for spring, bar and plane truss elements. Solutions for unknown nodal displacements; Applications of method to spring, bar and plane truss problems	6
II	**Module 2 : FEM in skeleton structures-II** Formulation of element stiffness matrices for beam and plane portal frame element by direct method; Transformation of matrix from local to global system; Numbering of nodes; minimization of band width; force displacement relations; Solution for displacement unknowns; Applications of method to plane truss; Continuous beams and plane portal frames.	6
III	**Module 3 : Field Problems Idealization** Elementary theory of Elasticity: Stress strain relation; Strain displacement, relations; plane stress and plane strain problems; Compatibility conditions; differential equations of equilibrium; equations for two dimensional and three dimensional problems.	6

IV	**Module 4 : FEM principles and general approach** Principle of minimum potential energy; variational method; continuum problems; Two dimensional Elements; use of displacement functions; Pascal's triangle; triangular and rectangular elements; Formulation of element stiffness matrix. Convergence requirements – Selection of the order of polynomial, conforming and non-conforming elements, Effect of element aspect ratio, finite representation of infinite bodies..	6
V	**Module 5 : Iso-parametric Formulation** Shape function in Cartesian and natural co-ordinate system, Lagrange's interpolation formulae, concept of iso-parametric element, relation between Cartesian and natural coordinate system, Jacobian matrix, one and two dimensional Iso-parametric elements	6
VI	**Module 6 : 3D Elements formulation** Introduction to three-dimensional problem, various three-dimensional elements, Axisymmetric problems, formulation of stiffness matrix of three dimensional and axisymmetric elements.	6
	Module wise Measurable Students Learning Outcomes: 1.Understand basic concept of F.E.M. and formulation of [k] for spring, bar and truss element with their applications. 2. Develop element stiffness matrix for beam and frame element and solve the problems of continuous beams and portal frames. 3.Demonstrate theory of elasticity for analysis of stress/strain problems. 4. Understand the concept of displacement function and its convergence requirements. 5. Develop shape functions in Cartesian and natural coordinate system and understand the isoparametric elements. 6. Solve three dimensional and axisymmetric problems by using finite element method.	
Text Books		
1	P.N.Seshu "Finite Element Analysis", PHI learning private Lim. Delhi,2013.	
2	T. R. Chandrupatla and A.D. Belegundu,"Introduction to Finite Element in Engineering",Prentice Hall of India Private Limited, 3rd Edition,2002	
3	C. S. Desai & J. F. Abel "Introduction to Finite Element Method",AEP,1st Edition,1972,	
References		
1	Robert D. Cook, David S. Malkus, Michael E. Plesha,Robert J. Witt,"Concepts and Applications of Finite Element Analysis",2003	
2	J. N. Reddy. "An Introduction to the Finite Element Method" McGraw Hill, 3rd Edition, New York, ,3rd edition, 2006.	
3	Zienkiewicz.O.C. &Taylor.R.L., "The Finite Element Method- Vol I &Vol II Tata McGraw-Hill Publishing Company Limited, 6th Edition,2005.	

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)

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AY 2022-23

Course Information	
Programme	B.Tech (Civil Engineering)
Class, Semester	Final Year B. Tech., Sem. VIII
Course Code	5CV446
Course Name	Structural Geology
Desired Requisites:	Engineering Geology

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

Course Objectives	
1	Introduce students the necessary knowledge and concepts of structural geology and geotectonics.
2	Make the student able in recognizing, classifying and describing various geological structures and structural phenomena.
3	Enable students to understand geological problem before undertaking any civil engineering project.

Course Outcomes (CO) with Bloom's Taxonomy Level		
CO1	Describe the geotectonic especially continental drift and plate tectonics.	Understanding
CO2	Explain the mechanism of geological structures in the field.	Understanding
CO3	Use the knowledge of structural geology to solve the problems in civil engineering.	Applying

Module	Module Contents	Hours
I	**Continental Drift** Introduction to geotectonics, origin of the Earth, interior of the Earth, isostasy, Pratt's and Airy's hypothesis, continental drift, evidances for Gondwana land and Laurasia	6
II	**Plate Tectonics** Plate tectonics, plate boundaries and their types, plate margins, Convection current hypothesis, opening and closing of oceans, Sea floor spreading, relevance of geotectonics with structural geology.	7
III	**Structural Geology-Folds** Primary and secondary geological structures, outcrop, bedding or stratification, dip and strike, extrusions and intrusions, flows and masses, causes for the development of structures, folds and folding, definition and parameters/morphology of folds, types of folds, mechanics of folding, recognition of folds in the field, civil engineering significance of folds.	6

IV	**Structural Geology-Faults** Faults, definition and parameters of faults and fault terminology, classification of faults, mechanics of faulting, effect of faults on outcrops, field evidences of faulting, civil engineering significance of faults, Foliation and lineation, their origin and relation with structures, Shear zones and their development.	7
V	**Unconformity, Joints and Mountain building** Unconformities and joints, types of unconformity, recognition of unconformity in the field, concept of overlap, types of joints, common joints in different rocks, concept of stress and strain in developing joints, study of landforms, mountain building and types of mountain, roll of plate tectonics in mountain building, mountains of India, Structural geological aspects of physiographic divisions of India.	7
VI	**Applications of Geology in Civil Engineering** Geological maps, description, outcrop patterns and geological structures, determination of strike and dip, problems with outcrops, borehole data and thickness of beds. Dip-strike three point problem, completion of outcrop.	7
	Moodle wise Outcomes: At end of each module students will be able to 1. Explain the theories related to origin of the earth, continental drift and evidences for Gondwana and Laurasia. 2. Explain earthquake, volcano and continental drift with the theory of plate tectonics. 3. Understand dip,strike and various folds in rocks and explain mechanism of their formation and significance. 4. Understand various faults and explain their mechanics and effects on outcrops. 5. Understand unconformity and joints and explain physiography of India. 6. Solve various problems related with structural geology.	
Text Books		
1	Gokhale N. W. , "Theory of Structural Geology", CBS Publishers, Delhi, 2019.	
2	Marland P Billings,“Structural Geology”, Pearson Education, Third edition,2016.	
3	Philip Kearly, Keith A. Klepeis, Frederick J. Vine, "Global Tectonics", John Wiley & Sons Ltd,Third Edition,2009.	
References		
1	Gokhale N. W., "A Manual of Problems in Structural Geology", CBS Publishers, Delhi.2019.	
2	Leo A. W. Wiegman, "Earth Structure : An Introduction To Structural Geology And Tectonics" , W. W. Norton & Company, Inc., 2nd ed. 2004.	
3	Marshak Stephen and MitraGautum, "Basic Methods of Structural Geology",Pearson Education; 2017.	
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	1													1	
CO2	1	2												2	
CO3	2	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)

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AY 2022-23

Course Information

Programme	B.Tech. (Civil Engineering)
Class, Semester	Final Year B. Tech., Sem VIII
Course Code	5CV447
Course Name	Elective – 7 : Town and Country Planning
Desired Requisites:	Building Planning and Design

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

Course Objectives

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

Course Outcomes (CO)

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

Module	**Module Contents**	**Hours**
I	**Introduction** - Objective of town planning, principles, stages in town development, brief history - growth of towns and theories of developments (ribbon, sector zone, concentric, multiple zone etc.) - Institutional arrangements in Maharashtra (CIDCO, MMRDA, MHADA, SRA, TPVD etc.)	7
II	**Regional Plan (R.P)** - Need of contents of Regional Plan - Regional Delimitation - Surveys necessary for Regional Plan - Analysis and Projections - Necessary Steps for starting and ending the process of Regional Planning - Relation with the state Plan and surroundings	7

III	**Development Plan (D.P)** - Surveys, types, duration etc. - Analysis and Projections - Demographic Projections - Goals and objectives, Public Participation - Implementation and Financial Aspects. - Delineation - Relation with R.P. - Content of DP and Planning norms - Modifications, purchase notice - Legal and Administrative process to start D.P.	7
IV	**Town Planning Scheme** - Concept of T.P.S - Legal Provision - Relation with D.P. - Original Plot, final Plot, Semi-final Plot - Incremental Contribution (Betterment charge) - Rational for charging Incremental Contribution - Function of Arbitrator - Advance Possession - Amenities, Partially beneficial - Cost of Scheme	7
V	**Acts and Rules** - Municipal Act - MR and TP Act 1966 - LA Act. 1894, and LARA 2013 - SEZ - DCR	7
VI	**Special Townships** - Special Township Policy - Land requirement , procedures for locational clearance, salient feature - Responsibilities of developer - Hill station Policy - few case studies	7
Text Books		
1	G.K. Hiraskar(2012),"*Fundamentals Of Town Planning*", Dhanpat Rai Publication (p) Ltd., New Delhi,17th Edition	
2	S.C.Rangawala (2014), "*Town Planning*", Charotar Publications, Pune ,27th	
3	Biswas Hiranmay (2012), "*Principles Of Town Planning And Architecture*", VAYU Education of India	
References		
1	MRTP Act 1966, Land Acquisition Act, UDPFI guidelines, ministry of urban affairs and employment, Govt. & India.	
2	Todaro Michael, "*Economic development in Third world",* Orient Longman Publication	
3	Koperdekar and Diwan, " *Planning legislation* "	

Useful Links	
1	https://nptel.ac.in/courses/124107158

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