Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2021-22

Course Information

Programme	B.Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	5CV301
Course Name	Soil Mechanics
Desired Requisites:	Fluid mechanics

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 2**			

Course Objectives

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

Course Outcomes (CO)

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

Module	Module Contents	Hours
I	**Introduction:** • Definitions: soil mechanics, soil engineering, rock mechanics, geotechnical engineering. • Three-phase system and phase relationships • Determination of various soil parameters in laboratory	4
II	**Soil Classification** • Grain size and hydrometer analysis, • Plasticity Characteristics of Soil and their determination • Unified and IS soil classification system.	4
III	**Permeability and Seepage :** • One dimensional flow, Darcy's law, laboratory methods for determination of co-efficient of permeability. • Seepage through soils - two-dimensional flow, flow nets, uplift pressure, piping; • Principle of effective stress, capillarity, seepage force and quicksand condition.	5
IV	**Compaction of Soils:** • theory of compaction, laboratory determination of optimum moisture content and maximum dry density. • Compaction in field: specifications and quality control.	3

V	**Compressibility and Consolidation of soils** • Comparison between compaction and consolidation, initial, primary & secondary consolidation, spring analogy • Interpretation of consolidation test results • Terzaghi's theory of consolidation, • Final settlement of soil deposits	5
VI	**Shear Strength of Soils** • Mohr-Coulomb failure criterion, • Determination of effective and total shear strength parameters • Stress-Strain characteristics of clays and sand; Stress paths.	5

Text Books	
1	Gopal Ranjan and A.S.R. Rao (2016),"Basic and Applied Soil Mechanics",New Age International Publishers, 3rd Edition
2	Murthy, V. N. S.(2018), " Textbook of Soil Mechanics and Foundation Engineering Geotechnical Engineering Series ", CBS publishing; 1st edition
3	B.M.Das,"Principles of Geotechnical Engineering",Cengage Learning, 7th Edition
References	
1	Gulhati, S. K. and Datta, M., "Geotechnical Engineering", Tata McGraw-Hill, 1st Edition, 2005
2	Couduto, Donald P.(2017), "Geotechnical Engineering – Principles and Practices", Prentice-Hall.,2nd Edition
3	Muni Budhu(2011),"Soil Mechanics and Foundations", John Wiley & Sons, Inc,3rd Edition
Useful Links	
1	https://www.youtube.com/watch?v=Lng0hVDvsu0&list=PLOzRYVm0a65dtbpo_DP7acjsLYdmWT99r
2	https://www.youtube.com/watch?v=V1m3cB-Aqy8&list=PL940DD62E8781E147

CO-PO Mapping

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

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

Assessment

The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% 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	30	**50**
Apply	5	5	10	**20**
Analyze	5	5	10	**20**
Evaluate			10	**10**
Create				
Total	**20**	**20**	**60**	**100**

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2021-22

Course Information	
Programme	B. Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Semester V
Course Code	5CV302
Course Name	Water Treatment Technology
Desired Requisites:	Basic Hydraulics and Engineering Chemistry

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs./week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 2**			

Course Objectives	
1	To provide the pertinent knowledge on water treatment systems.
2	To impart necessary skill for the design and operation of water treatment units.
3	To prepare students for higher studies and research in the field of water treatment technology.

Course Outcomes (CO)	
CO1	***Explain*** water quality, and treatment technologies.
CO2	***Solve*** the problems on water related to quality, quantity, and treatment.
CO3	***Design*** water treatment units.

Module	**Module Contents**	**Hours**
I	**Water demand and quality** Water demand: Usage and rates, Governing factors, Variation, Estimation (Present, intermediate and ultimate) Water Quality: Physical, Chemical and Biological parameters, IS 10500-2012	5
II	**Aeration** Treatment: Philosophy, Unit processes and operations Aeration: Process, Types of aerator, Design of cascade aerator	3
III	**Mixing** Coagulation: Physics and chemistry, Practice, Design of rapid mixer Flocculation: Theory, Design of slow mixer (hydraulic and mechanical)	6
IV	**Settling** Settling: Theory, Types, Design of rectangular and circular clarifiers for type 1 settling, High rate clarifier	5

V	**Filtration** Granular Filtration: Classification, Theory of deep mono and dual bed filter, Components of deep bed filter, Clean filter bed head loss, Filter operation, Design of mono and dual bed filter	5
VI	**Disinfection** Disinfection: Types, Ideal and non-ideal disinfectant, Kinetics, Chlorination, Chemistry of chlorination, Chlorine demand, Chlorination practice, UV and Ozone disinfection	4

Text Books	
1	Raju, B.S.N., "Water Supply and Wastewater Engineering" Tata McGraw Hill Private limited, New Delhi, 2nd Edition, 2000.
2	Garg, S. K. "Water Supply Engineering", Khanna Publishers, 33rd Edition, 2010.
3	Modi, P. N., "Water Supply Engineering (Environmental Engineering I)", Standard Book House, 6th Edition, 2018.
References	
1	Manual on Water Supply and Treatment", CPHEEO, Ministry of Urban Development, GoI, New Delhi, 1999.
2	Hammer M, J and Hammer M, J, "Water and Wastewater Technology", PHI learning private limited, 6thEdition, 2011.
3	Davis, M, L, and Cornwell, D, A, "Introduction to Environmental Engineering", Tata McGraw Hill Publishing Company, Special Indian Edition, 2010.
4	Nathanson, J. A., "Basic Environmental Technology", PHI Learning private limited, 5th Edition, 2009.
Useful Links	
1	https://nptel.ac.in/course.html

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

Assessment
The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level				
Bloom's Taxonomy Level	**T1**	**T2**	**ESE**	**Total**
Remember				
Understand	5	5	15	**25**
Apply	10	5	15	**30**
Analyze		5	15	**20**
Evaluate				
Create	5	5	15	**25**
Total	**20**	**20**	**60**	**100**

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Course Information

Programme	B.Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	5CV303
Course Name	Design of steel Structures
Desired Requisites:	Solid Mechanics & Structural Mechanics

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 2**			

Course Objectives

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

Course Outcomes (CO) with Bloom's Taxonomy Level

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

Module	**Module Contents**	**Hours**
I	**Introduction** Introduction to steel structures, standard rolled steel sections and their properties and designation, Design philosophies, Types of loads acting on structure, Introduction to IS Codes and specifications: IS 875, IS 800. Introduction to Plastic theory- Plastic hinge concept, Plastic collapse load, Plastic moment, Shape factor, Plastic section modulus.	5
II	**Connections** Types of bolts, bolted and welded connections. Concentric and eccentrically loaded connections, simple connection of bracket plates to columns.	4
III	**Tension and Compression Members** Various types of failures such as yielding of gross area,rupture at criticalsection and block shear. Design of single and double angle sections. Buckling classification of various sections, Buckling curves, Design of single and double angle struts in trusses,	5

IV	**Beams and Girders** Laterally restrained and unrestrained simply supported beams. Design of compound beams and welded plate girder. Selection of section and positioning of stiffeners, Curtailment of flange plates.	5
V	**Columns and Column Bases** Column subjected to Axial load and biaxial bending, built up column sections, laced and battened columns. Column bases: Design of slab base, gusseted base, moment resisting base, Anchor bolts.	5
VI	**Roofing System** Trusses, Purlins. Dead load, Live load and Wind load calculations. Analysis and design of truss. Connections of truss to column.	5
	Moodle wise Outcomes: At end of each module students will be able to 1. Explain the concept of various design philosophies and solve problems on Plastic analysis. 2. Design of concentric and eccentric steel connections. 3. Design of tension and compression members. 4. Design of flooring system, beams and plate girders. 5. Design of columns and column bases. 6. Design of roofing system.	
Text Books		
1	Duggal S.K., *"Limit state design of steel structures"*, Tata McGraw-Hill Publications, New Delhi, 2nd Edition, 2014.	
2	Shiyekar, M.R., *"Limit state design in structural steel"*, PHI learning Pvt.Ltd Publications 2nd Edition 2013.	
3	Subramanian N., *"Design of steel structures",* Oxford University Press, 2010.	
References		
1	Dayaratnam, P., *"Design of steel structures",* S. Chand Publication, New Delhi, 2008.	
2	Englekirk, Robert, *"Steel structures: controlling behavior through design",* John Wiley and Sons, 2003.	
3	Gaylord, Edwin and Gaylord, Charles, *"Design of steel structures",* Tata McGraw Hill Publishing Company Ltd., New Delhi, 3rdEdition, 2010	
4	IS 800-2007 *"Code of Practice for General Construction in steel"*, and IS 875-1987 part 1 to 5; *"Code of Practice for Design Loads (other than earthquake) for building structures",* Bureau of Indian Standards, New Delhi.	
Useful Links		

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

Assessment
The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level				
Bloom's Taxonomy Level	**T1**	**T2**	**ESE**	**Total**
Remember	4	4	12	**20**
Understand	4	4	12	**20**
Apply	4	4	12	**20**
Analyze	3	3	9	**15**
Evaluate	3	3	9	**15**
Create	2	2	6	**10**
Total	**20**	**20**	**60**	**100**

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Course Information

Programme	B. Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	5CV304
Course Name	Highway Engineering
Desired Requisites:	Engineering Surveying

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 3**			

Course Objectives

1	To give exposures to highway planning and designing of geometric elements of roads.
2	To comprehend to pavements design and various practices adopted for construction of road.
3	To develop skills on construction and maintenance and traffic management of Highways.

Course Outcomes (CO) with Bloom's Taxonomy Level

CO1	**Explain** and **apply** the principles of planning and designing of various geometric elements of highways.	
CO2	**Demonstrate** knowledge for selection of construction material and **select** appropriate method of construction for roads.	
CO3	**Analyze and adopt** various techniques for traffic management and **design** pavements.	

Module	**Module Contents**	**Hours**
I	**Highway Developments** Role and importance of infrastructure development, Various modes of transportation, characteristics and suitability, history of highway engineering, development plans, various organizations involved in highway development, their setups and working, finance options.	3
II	**Highway Alignment:** basic requirements for an ideal alignment, factors governing highway alignment, highway location surveys and studies.	3
III	**Geometric Design-I:** Cross sectional elements, sight distance, reaction time, analysis of safe sight distance, and analysis of overtaking sight distance, intersection sight distance	5
IV	**Geometric Design-II:** Horizontal, vertical and transition curves, super elevation, widening, requirements as per IRC, Basic concepts and methods of pavement design.	6
V	**Highway Construction:** Construction Materials – Stone aggregates, soil, cement, bitumen properties and their testing. Construction methods for various types of flexible and rigid pavements, Drainage, lighting and arboriculture, repairs and maintenance.	5
VI	**Traffic Engineering:** Traffic Surveys, traffic flow and capacity, traffic regulation and control; design of road intersections; design of parking facilities, Webster method of traffic signal design.	4

Text Books	
1	Bindra S. P., “A Course in Highway Engineering", Dhanpat Rai Publications, 5th Edition 2012.
2	Khanna S. K., Justo C. E. G., Veeraragavan A, "Highway Engineering", Nem Chand & Sons, 10th edition, 2018
3	Partha Chakraborty, ' Principles Of Transportation Engineering, PHI Learning, 2nd edition, 2017
References	
1	Kadiyalai, L.R., ' Traffic Engineering and Transport Planning', Khanna Publishers, 8th Edition 2013
2	Fred L. Mannering, Scott S. Washburn, Walter P. Kilareski,'Principles of Highway Engineering and Traffic Analysis', John Wiley, 4th Edition,
3	Wright, Paul H. and Dixon, “Highway Engineering”, John Wiley & Sons; 7th Edition 2003.
Useful Links	
1	https://nptel.ac.in/courses/105/101/105101087/
2	https://nptel.ac.in/courses/105/101/105101008/
3	https://nptel.ac.in/courses/105/105/105105107/
4	https://nptel.ac.in/courses/105/107/105107123/ https://nptel.ac.in/courses/105/104/105104098/

CO-PO Mapping															
	Programme Outcomes (PO)												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
CO1			3		1								1		
CO2			3			1							2	1	
CO3			3	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
The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom’s Taxonomy Level				
Bloom’s Taxonomy Level	**T1**	**T2**	**ESE**	**Total**
Remember				
Understand	5	5	10	**20**
Apply	10	10	20	**40**
Analyze	5	5	15	**25**
Evaluate			10	**10**
Create			5	**5**
Total	**20**	**20**	**60**	**100**

Professional Core (Lab) Courses

Walchand College of Engineering, Sangli

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Course Information

Programme	B. Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Semester V
Course Code	5CV351
Course Name	Water Quality Analysis Laboratory
Desired Requisites:	Engineering Chemistry Laboratory and Water Treatment Technology

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

Course Objectives

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

Course Outcomes (CO)

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

List of Experiments / Lab Activities

List of Experiments:

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

Text Books

1	Metcalf and Eddy, "Wastewater Engineering Treatment and Reuse", Tata McGraw Hill Publication, 5th Edition, 2014.
2	Sawyer. C.N. And McCarty. P.L., "Chemistry for Environmental Engineers", Tata McGraw-Hill Publishing Company Limited, 5th Edition, 2003.
References	
1	IS 3025 (Relevant parts), Bureau of Indian Standards.
2	Standard Methods for the Examination of Water and Wastewater, APHA, 23rd Revised Edition, 2017.
Useful Links	
1	https://www.youtube.com/channel/UCXOTUs9n8uhzYzBC8NHeacA

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

Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.				
Assessment	**Based on**	**Conducted by**	**Typical Schedule (for 26-week Sem)**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab activities, attendance, journal	Lab Course Faculty	During Week 15 to Week 18 Marks Submission at the end of Week 18	40
Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments.				

Assessment Plan based on Bloom's Taxonomy Level				
Bloom's Taxonomy Level	**LA1**	**LA2**	**Lab ESE**	**Total**
Remember				
Understand				
Apply	10	10	15	**35**
Analyze	10	10	15	**35**
Evaluate				
Create	10	10	10	**30**
Total	**30**	**30**	**40**	**100**

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Course Information

Programme	B.Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	5CV352
Course Name	Soil Mechanics Laboratory
Desired Requisites:	Soil Mechanics

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

Course Objectives

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

Course Outcomes (CO)

CO1	Perform common soil tests to identify index and Engineering properties of soils.
CO2	Analyze and interpret the behaviour of soils based on the experimental data.

List of Experiments / Lab Activities

List of Experiments:

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

Text Books

1	Lambe T.W., Soil Testing, Willey Eastern Ltd., New Delhi, 1978, 1st Edition.
2	Murthy, V. N. S., "Textbook of Soil Mechanics and Foundation Engineering Geotechnical Engineering Series", CBS publishing; 1st edition, 2018.

References

1	Bowles J.E., Engineering Properties of Soil & Their Measurement, Tata - McGraw-Hill Publishing Co., 4th Edition, 1992.
2	Beauro of Indian Standards, I.S.2720 (Various sections / parts)

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	3	
CO2				3									3	3	
The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High Each CO of the course must map to at least one PO.															

Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.				
Assessment	**Based on**	**Conducted by**	**Typical Schedule (for 26-week Sem)**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab activities, attendance, journal	Lab Course Faculty	During Week 15 to Week 18 Marks Submission at the end of Week 18	40
Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments.				

Assessment Plan based on Bloom's Taxonomy Level				
Bloom's Taxonomy Level	**LA1**	**LA2**	**Lab ESE**	**Total**
Remember				
Understand	5	5	10	**20**
Apply	10	10	15	**35**
Analyze	15	15	15	**45**
Evaluate				
Create				
Total	**30**	**30**	**40**	**100**

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Course Information

Programme	B.Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	5CV345
Course Name	Mini Project 2 : Concrete Technology
Desired Requisites:	Concrete Technology

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

Course Objectives

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

Course Outcomes (CO)

CO1	**Comprehend and Apply** test methods to assess the properties of cement and concrete.
CO2	**Decide** the quality of cement and concrete based on the analysis of test results.
CO3	**Analyse** the concrete quality by non-destructive test methods.

List of Experiments / Lab Activities

List of Experiments:

1. Consistency of cement
2. Initial and Final Setting time of Cement
3. Strength of Cement
4. Soundness of Cement
5. Gradation of fine aggregate and Coarse aggregate
6. Workability of concrete - Slump Cone and slump retention test
7. Compressive and Split tensile strength of concrete
8. Flexural Strength of Concrete
9. Rebound Hammer Test
10. Ultra-Sonic Pulse velocity test

Text Books

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

References

1	IS 4031 (1999). “Methods of physical tests for hydraulic cement” Bureau of Indian Standards (BIS), New Delhi, India.
2	IS 516 (1959). “Methods of tests for strength of concrete” Bureau of Indian Standards (BIS), New Delhi, India.
3	IS 13311 (1992). “Method of Non-destructive testing of concrete” Bureau of Indian Standards (BIS), New Delhi, India.
Useful Links	
1	https://www.digimat.in/nptel/courses/video/105106176/L01.html
2	
3	
4	

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

Assessment				
There are three components of lab assessment, LA1, LA2, and Lab ESE IMP: Lab ESE is a separate head of passing. Lab ESE is treated as End Semester Exam and is based on all experiments/lab activities.				
Assessment	**Based on**	**Conducted by**	**Typical Schedule**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab Performance and documentation	Lab Course faculty	During Week 13 to Week 18 Marks Submission at the end of Week 18	40
Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments.				

Assessment Plan based on Bloom’s Taxonomy Level				
Bloom’s Taxonomy Level	**LA1**	**LA2**	**Lab ESE**	**Total**
Remember				
Understand	10	10	5	**25**
Apply	15	15	5	**35**
Analyze	5	5	15	**25**
Evaluate			15	**15**
Create				
Total	**30**	**30**	**40**	**100**

Professional Elective 1 Courses

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2021-22

Course Information

Programme	B. Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., SemV
Course Code	5CV311
Course Name	Professional Elective –I: Structural Mechanics
Desired Requisites:	Solid Mechanics, Structural Analysis

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**T1**	**T 2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 2**			

Course Objectives

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

Course Outcomes (CO) with Bloom's Taxonomy Level

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

Module	**Module Contents**	**Hours**
I	**Flexibility Method- Beams & Frames** Flexibility coefficient matrix, Compatibility conditions, Development of flexibility matrix equations, Analysis of indeterminate beams and rigid jointed frames by using flexibility method.	5
II	**Flexibility Method- Trusses** Analysis of indeterminate trusses by using flexibility method, Stresses due to lack of fit or error in length, Temperature stresses.	4
III	**Stiffness Method- Structure Approach** Stiffness coefficient matrix, Relation between flexibility and stiffness coefficient matrix, Development of stiffness matrix equilibrium equations, Analysis of continuous beams and frames.	5

IV	**Stiffness Method–Element Approach: Beams & Frames** Formulation for element stiffness matrix for beam element and plane frame element, Local and global coordinates, Transformation of matrices, Analysis of continuous beams and frames by using direct stiffness method.	5
V	**Stiffness Method–Element Approach: Trusses** Direct stiffness method- Element approach, Development of element stiffness matrix and nodal load vector for truss element, Analysis of trusses.	5
VI	**Finite Element Method** Introduction finite element method, Basic concept, General procedure of finite element analysis, Discretization, nodes, element incidences, displacement model, shape function, selection of order of polynomials, Principle of minimum potential energy, variational principle, Development of element stiffness matrix and nodal load vector for bar element, Applications to bars with constant and variable cross sections subjected to axial forces.	5
	Moodle wise Outcomes: At end of each module students will be able to 1. At end of each module students will be able to: 2. Analyse statically indeterminate structures such as beams and frames by using flexibility method. 3. Analyse statically indeterminate trusses by using flexibility method. 4. Apply physical concept of stiffness method for analysis of continuous beams and frames. 5. Derive element stiffness matrix for various types of elements and analyze trusses. 6. Analyse continuous beams and frames by using direct stiffness method. 7. Apply the concept of finite element method for solving problems in structural engineering.	
Text Books		
1	Gere, J. M. & Weaver, W.,"Matrix Analysis of Framed Structures", CBS Publishers and Distributor, 2nd Edition, 2004.	
2	Godbole, P. N., "Introduction to Finite Element Methods", I K International Publishing House Pvt. Ltd., 1stEdition, 2013.	
3	Reddy, C. S., "Basic Structural Analysis", McGraw Hill Education, 3rd edition, 2017.	
References		
1	Cook, Robert D., Malkus, David S., Plesha, Michael E., and Witt, Robert J., "Concepts and Applications of Finite Element Analysis", 2003.	
2	McGuire, William, Gallaghar, Richard H. and Ziemian, Ronald D., "Matrix Structural Analysis", John Wiley, 2nd Edition, 2000.	
3	Meghare A. S.&Deshmukh S. K.,"Matrix Methods of Structural Analysis" Charotar Publishing House, 2nd Edition, 2016.	

Useful Links	
1	https://nptel.ac.in
2	https://nptel.ac.in/content/syllabus_pdf/105105180.pdf
3	https://onlinecourses.nptel.ac.in/noc20_me91/preview

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		**3**												**2**	
CO3			**2**		**2**									**1**	
The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High Each CO of the course must map to at least one PO.															

Assessment
The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% 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	30	**50**
Apply	05	05	15	**25**
Analyse	05	05	15	**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	Third Year B. Tech., Sem V
Course Code	5CV312
Course Name	Water Distribution System
Desired Requisites:	Water Treatment Technology

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 2**			

Course Objectives

1	To introduce concepts of Water Distribution System.
2	To provide pertinent knowledge for the design and operation of Water Distribution System.
3	To prepare students for higher studies and research in the field of Water Distribution System.

Course Outcomes (CO) with Bloom's Taxonomy Level

CO1	Explain Water Distribution System.	Understand
CO2	Analyze and Solve the problems on Water Distribution System.	Apply
CO3	Design Water Distribution System.	Create

Module	**Module Contents**	**Hours**
I	**Pumped and Gravity Water Mains** Review of closed conduit hydraulics: Continuity and Energy equation, Head loss calculations Sizing water mains: Design flow, Design of pumped and gravity system of water mains, Concept of Optimal design, Economic design of pumped and gravity water mains Pumping system: Design of water pumping system.	**4 L**
II	**Water Distribution System (WDS)** Water Distribution System (WDS): System configurations, Hydraulic and functional requirements, Types of network, Water demand allocation Types of problem, Network hydraulics, Flow, node and loop equations Steady state hydraulic analysis, Quasi- state hydraulic analysis (Extended period simulation), 24x7 supply Analysis and Design of WDS: Linear theory, and Newton-Raphson methods, Design, Optimization of WDS Computer modelling of WDS	**6 L**
III	**Water Quality in WDS** Concept, Causes of variation, transport of constituents in pipe, chemical reactions, water quality simulations for source trace, constituent and water age.	**4 L**
IV	**Calibration of WDS** Concept, Hydraulic and water quality calibration, Identifying calibration parameters, Approaches	**4 L**

V	**Hydraulic design of Service Reservoirs** Necessity, Components, Location, Head, and Capacity requirements, Quality in storage	**5 L**
VI	**Operation and Maintenance of WDS** Pipe breaks and leakages, leak detection, Loss of carrying capacity of pipes, Appurtenances in WDS, Use of computer models in O and M, Maintenance of WDS Identifying and solving common WDS problems, Extension of WDS, Rehabilitation	**5 L**
Tutorial: N/A		
Text Books		
1	Walski, Chase and Savic, "Water Distribution Modeling", Haestad Press, First edition, 2007.	
2	Hammer M, J and Hammer M, J, "Water and Wastewater Technology", PHI learning private limited, 7th Edition, 2018.	
References		
1	"Manual on Water Supply and Treatment", CPHEEO, Ministry of Housing and Urban Affairs Development, Govt., of India, New Delhi, 1999.	
2	Larry W. Mays, Water Distribution System Handbook, The McGraw-Hill Companies, Inc. 2000.	
Useful Links		

CO-PO Mapping

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

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

Assessment

The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level

Bloom's Taxonomy Level	T1	T2	ESE	Total
Remember				
Understand	5	5	15	**25**
Apply	10	5	15	**30**
Analyze		5	15	**20**
Evaluate				
Create	5	5	15	**25**
Total	**20**	**20**	**60**	**100**

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Course Information

Programme	B. Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	5CV313
Course Name	Professional Elective-I : Town & Country Planning
Desired Requisites:	Engi Quantity Surveying & Valuation, Water supply and Treatment Technology, Waste Management & Pollution control, Transportation Engineering-I, Building planning and Design

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 3**			

Course Objectives

1	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.
2	It focuses on relevant practices in preparation of RP, DP, TPS etc.
3	It also includes relevant legislations knowledge required for a modern town planner.

Course Outcomes (CO)

CO1	Comprehend general principles of town planning.
CO2	Explain elements of regional plan(RP) and development plan(DP).
CO3	Describe important provisions of different town planning legislations and town planning schemes.

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.)	5
II	**Regional Plan (R.P)** Need , Regional Delimitation, Surveys , Analysis and Projections, Necessary Steps for process of Regional Planning, Relation with the state Plan and surroundings	6
III	**Development Plan (D.P)** Surveys, types, duration etc., Analysis and Projections, Demographic Projections, Goals and objectives, Public Participation, Implementation and Financial Aspects, Delineation, Relation with R.P., Content of DP and Planning norms, Modifications, purchase notice, Legal and Administrative process to start D.P.	5
IV	**Town Planning Scheme** Concept of T.P.S, Legal Provision, Relation with D.P., Original Plot, final Plot, Semi-final Plot, Incremental Contribution (Betterment charge), Rational for charging Incremental Contribution, Function of Arbitrator, Advance Possession, Amenities, Partially beneficial, Cost of Scheme	5

V	**Acts and Rules** Municipal Act, MR and TP Act 1966, LA Act. 1894, and LARR 2013, SEZ, DCR	4
VI	**Special Townships** Special Township Policy, Land requirement, Procedures for locational clearance, salient feature, Responsibilities of developer, Hill station Policy	4

Text Books	
1	G.K. Hiraskar,"Fundamentals Of Town Planning", Dhanpat Rai Publication (p) Ltd., New Delhi,17th Edition (English)2012
2	S. C. Rangawala "Town Planning", Charotar Publications, Pune ,27th : 2014
3	Biswas Hiranmay "Principles Of Town Planning And Architecture", VAYU Education of India, 2012 edition

References	
1	MRTP Act 1966
2	Land Acquisition Act
3	Economic development in Third world: Todaro Michael, Orient Longman Publication, New delhi
4	Planning legislation by Koperdekar and Diwan.
5	UDPFI guidelines, ministry of urban affairs and employment, Govt. & India.

Useful Links	
1	https://nptel.ac.in/content/storage2/courses/109104047/pdf/lecture35.pdf
2	http://www.iitb.ac.in/newacadhome/MUDEbrouchure28032019.pdf
3	https://www.civil.iitb.ac.in/~dhingra/local/preview/pages/lectures.htm
4	https://www.youtube.com/watch?v=QJZcCs9RwDY

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1			1										1	
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 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level

Bloom's Taxonomy Level	**T1**	**T2**	**ESE**	**Total**
Remember				
Understand	10		20	**20**
Apply	10	10	20	**20**

Analyze		10	20	**20**
Evaluate				**20**
Create				**20**
Total	**20**	**20**	**60**	**100**

Walchand College of Engineering, Sangli

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Course Information

Programme	B.Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	5CV314
Course Name	Remote Sensing and GIS
Desired Requisites:	-

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 2**			

Course Objectives

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

Course Outcomes (CO) with Bloom's Taxonomy Level

CO1	Identify and describe the fundamentals of Remote Sensing and photogrammetry.	Understanding
CO2	Demonstrate, Classify, Interpret spatial data to extract maximum information.	Analyzing
CO3	To investigate, manipulate and generate spatial database useful to formulate or forecast the future civil engineering activities/events.	Applying

Module	**Module Contents**	**Hours**
I	Definition, History of Remote sensing, Remote sensing process, interaction of EMR with atmosphere, interaction of EMR with ground objects data transmission and reception GRS, RS platforms, EMR and spectrum, atmospheric windows.	4
II	Early history of aerial photography, simple camera, aerial camera, types of aerial photographs , taking vertical aerial photograph and flight planning , scale determination, image parallax, parallax measurement, relief displacement of vertical features, stereoscopy .	6
III	Introduction of ISRO, NASA, NRSC, IIRS and SAC. Earth observation sensors and platforms, India and foreign remote sensing satellites and sensors, sensor applications	5
IV	Types of remote sensing, types of satellite, digital image, spatial resolution, spectral resolution , radiometric resolution and temporal resolution, visual image interpretation ,image interpretation keys ,spectral signature, spectral reflectance curves, hyperspectral data and its applications.	4
V	Digital image processing , pre-processing and post-processing, image registration ,image enhancement, image transformation, digital image classification, supervised and unsupervised classification.	6

VI	Geographical information system, definition, spatial and non-spatial data, data inputs, data storage, data transformation, data reporting ,advantages of GIS, essential elements of GIS hardware, software GIS data types, thematic layers and layer combinations. introduction to GPS applications of RS and GIS in civil Engineering.	5
	Moodle wise Outcomes: At end of each module students will be able to 1. Understand and remember basic concepts of remote sensing. 2. Understand and remember basic concepts of aerial photogrammetry. 3. Understand various sensors and explain their applications. 4. Interprete various remote sensing data. 5. Evaluate various spatial data parameters and manipulate satellite imageries. 6. Apply remote sensing data in GIS environment.	
Text Books		
1	M. Anji Reddy 2002: "Remote Sensing & Geographical Information System", BS Publications, Hyderabad.	
2	Lillesand Thomas M. & Kiefer Ralph 1999 : "Remote Sensing and Image Interpretation" , John Villey	
3	A.N. Patel, Surendra Singh, "Remote Sensing Principles and Applications", Scientific Publishers, Jodhpur	
References		
1	John R. Jensen 2003: "Remote Sensing & Digital Image Processing", Department of Geography University of South Carolina Columbia	
2	Panda B C 2002 : "Principals of Remote Sensing", Viva Books Private Limited.	
3	ShahabFazal,"Remote Sensing Basics", Kalyani Publishers Ludhiyana3.	
4	Gupta Ravi P., "Remote Sensing Geology" Springer; 2nd ed. 2003 edition	
5	George Joseph, 2003: "Fundamentals of Remote Sensing", Universities Press	
Useful Links		
1	www.nrsc.gov.in	
2	www.itc.nl/ilwis	

CO-PO Mapping

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

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

Assessment

The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level				
Bloom's Taxonomy Level	**T1**	**T2**	**ESE**	**Total**
Remember	10			**10**
Understand	10	10	30	**50**
Apply			15	**15**
Analyze		10	15	**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	Third Year B. Tech. SEM- V
Course Code	5CV346
Course Name	Mini Project 3 – Repairs and Rehabilitations of Structures
Desired Requisites:	Building Design and Drawing , Concrete Technology

Teaching Scheme		**Examination Scheme (Marks)**				
Lecture	-	**LA1**	**LA2**	**LA3**	**Lab ESE**	**Total**
Tutorial	-	10	30	10	50	100
Practical	2					
Interaction	-	**Credits: 1**				

Course Objectives

1	To understand need for repair and rehabilitation.
2	To develop clear understanding of concepts, and practical knowledge of modern Civil Engineering techniques.
3	To deal with social, environmental and economic issues when applying various techniques.

Course Outcomes (CO)

CO1	Understand and use the different techniques for structural retrofitting	Understand
CO2	Application of various repair techniques as per the requirement of the problem.	Apply
CO3	To Develop various maintenance and repair strategies.	Create

List of Experiments / Lab Activities

List of Experiments/ Lab Activities :

The Mini project work consists of Detailed Case study based on the following theory for Any of the following structures.

1. Buildings

2. Bridges

3. Heritage structures

4. Roads

5. Hydraulic Structures

1.	**Introduction** – Deterioration of Structures – Distress in Structures – Causes and Prevention. Mechanism of Damage – Types of Damage
2.	**Corrosion of Steel Reinforcement** – Causes – Mechanism and Prevention. Damage of Structures due to Fire – Fire Rating of Structures – Phenomena of Desiccation.

3.	**Inspection and Testing –** Symptoms and Diagnosis of Distress – Damage assessment –NDT**.**
4.	**Repairs of Structure** – Common Types of Repairs – Repair in Concrete Structures – Repairs in Under Water Structures – Guniting – Shot Create – Underpinning. Strengthening of Structures – Strengthening Methods – Retrofitting – Jacketing.
5.	**Health Monitoring of Structures** – Use of Sensors – Building Instrumentation.
6.	**Post-Repair Maintenance of Structures:** Protection & Maintenance schedule against environmental distress to all those structures

Text Books	
1	Maintenance and Repair of Civil Structures, B.L. Gupta and Amit Gupta,Standard Publications.
2	Concrete Repair and Maintenance: Peter H .Emmons and Gajanan M. Sabnis, Galgotia Publication.
3	Non-Destructive Evaluation of Concrete Structures by Bungey – Surrey University Press
References	
1	CPWD hand book on Repairs and Rehabilitation of RCC buildings published by DG(Works), CPWD, Government of India (Nirman Bhawan), http://www.cpwd.gov.in/handbook.pdf
2	Concrete Repair, Rehabilitation and Retrofitting: M. Alexander, H. D. Beushausen, F. Dehn & P. Moyo, Taylor & Francis Publication
3	Defects and Deterioration in Buildings, EF & N Spon, London
Useful Links	
1	https://nptel.ac.in
2	https://law.resource.org/pub/in/bis/S03/is.13935.2009.pdf
3	https://theconstructor.org/wp-content/uploads/2016/09/handbook-rrs.pdf

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	1	1			1							1		
CO2	1	1	1			1							1		
CO3	1	1	1			1							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 four components of lab assessment, LA1, LA2, LA3 and Lab ESE.
IMP: Lab ESE is a separate head of passing.

Assessment	**Based on**	**Conducted by**	**Typical Schedule**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 4 Marks Submission at the end of Week 5	25
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 5 to Week 8 Marks Submission at the end of Week 9	25

LA3	Lab activities, attendance, journal	Lab Course Faculty	During Week 10 to Week 14 Marks Submission at the end of Week 14	25
Lab ESE	Lab Performance and documentation	Lab Course faculty	During Week 15 to Week 18 Marks Submission at the end of Week 18	25
Week 1 indicates starting week of Semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments.				

Assessment Plan based on Bloom's Taxonomy Level					
Bloom's Taxonomy Level	**LA1**	**LA2**	**LA3**	**Lab ESE**	**Total**
Remember					
Understand	10	10	5		**30**
Apply	10	10	10	5	**35**
Analyze				10	**10**
Evaluate					
Create	5	5	10	5	**25**
Total	**25**	**25**	**25**	**25**	**100**

Open Elective 1

Walchand College of Engineering, Sangli

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Course Information

Programme	B.Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	5OE315
Course Name	Applications of Remote Sensing
Desired Requisites:	-

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 2**			

Course Objectives

1	Introduce students the necessary knowledge and concepts in the field of Remote Sensing.
2	Introduce the techniques of photo/Image processing and interpretation and classification.
3	Introduce multifarious applications of remote sensing in various fields.

Course Outcomes (CO) with Bloom's Taxonomy Level

CO1	Identify and describe the fundamentals of Remote Sensing and photogrammetry.	Understanding
CO2	Manipulate and interpret satellite imagery as per requirement.	Analyzing
CO3	Apply the image interpretation for any desired decision making	Applying

Module	**Module Contents**	**Hours**
I	Definition, History of Remote sensing, Remote sensing process, interaction of EMR with atmosphere, interaction of EMR with ground objects data transmission and reception GRS, RS platforms, EMR and spectrum, atmospheric windows.	4
II	Early history of aerial photography, simple camera, aerial camera, types of aerial photographs , taking vertical aerial photograph and flight planning , scale determination, image parallax, parallax measurement, relief displacement of vertical features, stereoscopy, aerial mosaics.	4
III	Introduction of ISRO, NASA, NRSC, IIRS and SAC. Earth observation sensors and platforms, Indian and foreign remote sensing satellites and sensors, sensor applications	4
IV	Types of remote sensing, types of satellite, digital image, spatial resolution, spectral resolution , radiometric resolution and temporal resolution, visual image interpretation, image interpretation keys ,spectral signature, spectral reflectance curves, hyperspectral data and its applications, thermal remote sensing.	4
V	Digital image processing, pre-processing and post-processing, image registration ,image enhancement, image transformation, digital image classification, supervised and unsupervised classification.	4

VI	Applications of Remote Sensing in Geology, Agriculture and forestry, disaster management (landslide, flood, earthquake), natural resources, watershed management, pollution study, urban planning, PFZ mapping, study of glaciers, reservoir sedimentation, energy sources, cartography etc.	4
	Moodle wise Outcomes: At end of each module students will be able to 1. Understand and remember basic concepts of remote sensing. 2. Understand and remember basic concepts of aerial photogrammetry. 3. Understand various sensors and explain their applications. 4. Interprete various remote sensing data. 5. Analyze, enhance and manipulate satellite imageries. 6. Apply remote sensing data for decision making.	
Text Books		
1	M. Anji Reddy 2002: "Remote Sensing & Geographical Information System", BS Publications, Hyderabad.	
2	Lillesand Thomas M. & Kiefer Ralph 1999 : "Remote Sensing and Image Interpretation" , John Villey	
3	A.N. Patel, Surendra Singh, "Remote Sensing Principles and Applications", Scientific Publishers, Jodhpur	
References		
1	John R. Jensen 2003: "Remote Sensing & Digital Image Processing", Department of Geography University of South Carolina Columbia	
2	Panda B C 2002 : "Principals of Remote Sensing", Viva Books Private Limited.	
3	ShahabFazal,"Remote Sensing Basics", Kalyani Publishers Ludhiyana3.	
4	Gupta Ravi P., "Remote Sensing Geology" Springer; 2nd ed. 2003 edition	
5	George Joseph, 2003: "Fundamentals of Remote Sensing", Universities Press	
Useful Links		
1	www.nrsc.gov.in	
2	www.itc.nl/ilwis	
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													2	
CO2		2		3									2	2	
CO3			2	3	1				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 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level				
Bloom's Taxonomy Level	**T1**	**T2**	**ESE**	**Total**
Remember	10	10	30	**50**
Understand	10	10	15	**35**
Apply			15	**15**
Analyze				
Evaluate				
Create				
Total	**20**	**20**	**60**	**100**

Walchand College of Engineering, Sangli

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AY 2021-22

Course Information	
Programme	B.Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	5CV321
Course Name	Foundation Engineering
Desired Requisites:	Soil Mechanics, Soil Mechanics Lab

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 2**			

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

Course Outcomes (CO)	
CO1	**Describe** various subsurface exploration techniques and **Identify** a suitable geotechnical structure for a given situation.
CO2	**Discuss and Analyse** earth pressure distribution on retaining structures and stability of slopes
CO3	**Analyse and Design** shallow and deep foundations from the geotechnical aspect.

Module	**Module Contents**	**Hours**
I	**Introduction :**Role of civil engineer in the selection, design and construction of foundation of civil engineering structures, brief review of soil mechanics principles used in foundation engineering. **Sub-surface investigations :**Drilling bore holes, sampling, plate load test, standard penetration and cone penetration tests	4
II	**Earth Pressure :**Rankine‘s and Coulomb‘s theory, Application of theory to analysis of different types of soil retaining structures	4
III	**Shallow foundations** Terzaghi‘s and Meyerhoff‘s bearing capacity theories, effect of water table, Combined footing and raft foundation, Contact pressure; Settlement analysis in sands and clays.	5
IV	**Stress distribution in soils** Boussinesq‘s theory, pressure bulbs, mechanism of load transfer in shallow and deep foundations.	4
V	**Deep Foundations** dynamic and static formulae, Axial load capacity of piles in sands and clays, pile load test, pile under lateral loading, pile group efficiency, negative skin friction.	5
VI	**Slope Stability** Failure mechanisms, stability analysis of infinite and finite slopes, Bishop‘s simplified method	4

Text Books	
1	B.M.Das, ‖Principles of Foundation Engineering‖, Cengage Learning, 7th Edition
2	Gopal Ranjan and A.S.R. Rao (2016),–Basic and Applied Soil Mechanics‖,New Age International Publishers, 3rd Edition
3	Murthy, V. N. S.(2003), –Geotechnical Engineering: Principles and practices of Soil Mechanics and Foundation Engineering –, Marcel Dekker Inc., New York

References

1	IS 1888 : 1982,‖ Method of load test on soils (Second Revision)‖, IS 1892 : 1979‖ Code of practice for subsurface investigation for foundations (First Revision)‖
2	IS 1080 : 1985,‖ Code of practice for design and construction of shallow foundations in soils (Other Than Raft, Ring And Shell) (Second Revision)‖, IS 2911,‖ Design and construction of pile foundations‖
3	Couduto, Donald P.(2017), ‒Geotechnical Engineering – Principles and Practices‖, Prentice-Hall.,2nd Edition
Useful Links	
1	https://nptel.ac.in/courses/105/101/105101083/
2	https://www.youtube.com/watch?v=H6_J8LuTa-M&list=PLA4019BB0B0CF6518

CO-PO Mapping

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

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

Assessment

The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% 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	30	**50**
Apply	5	5	10	**20**
Analyze	5	5	10	**20**
Evaluate			10	**10**
Create				
Total	**20**	**20**	**60**	**100**

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AY 2021-22

Course Information	
Programme	B. Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Semester VI
Course Code	5CV322
Course Name	Sewerage and Sewage Treatment
Desired Requisites:	Water Treatment Technology, Environmental Science

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs./week	**T1**	**T2**	**ESE**	**Total**
Tutorial		20	20	60	100
Practical	-				
Interaction	-	**Credits: 2**			

Course Objectives	
1	To introduce concepts of sewerage and sewage treatment.
2	To provide pertinent knowledge for the design and operation of sewage treatment facilities.
3	To prepare students for higher studies and research in the field of sewerage and sewage treatment.
4	To make students aware of decentralized sewage treatment.

Course Outcomes (CO)	
CO1	***Explain*** collection and characteristics of sewage.
CO2	***Solve*** the problems on sewage associated with generation, characteristics, collection and treatment/processing.
CO3	***Design*** sewerage and sewage treatment system.

Module	**Module Contents**	**Hours**
I	**Sewerage** Sewage: Sources, Flow rate and variations, Quantitative estimation Gravity sewer collection system: Nomenclature, Manhole, Inverted siphon, Pumping station Design of sanitary and storm sewer, Computer application SEWERCAD	5
II	**Introduction to Sewage treatment** Sewage treatment: Philosophy, Unit operations and unit processes Primary treatment: Screening, Grit removal, Settling Biological/Secondary treatment: Fundamentals of aerobic and anaerobic treatment, Classification	4
III	**Aerobic Sewage Treatment** Aerobic suspended growth: Conventional Activated Sludge Process (ASP) and modifications, Process design and operating parameters (ASP), Operational problems (ASP), Biological filtration	5
IV	**Decentralized Treatment and Disposal** Concept, Septic tank and soakage pit, Anaerobic baffled reactor (ABR), Anaerobic filter (AF), Constructed wetland (CW), Typical system Process design of Oxidation ditch and Waste stabilization pond	5
V	**Sludge** Sludge: Types, Characteristics, Thickening, Dewatering, Digestion (Anaerobic digester), Disposal	4
VI	**Disposal of wastewater** Methods, Effluent standards Stream pollution: Self-purification (Stream rejuvenation), DO sag curve, Streeter Phelps‘s equation for point source, Stream classification	5

Text Books	
1	Nathanson, J. A., ‒Basic Environmental Technology‖, PHI Learning private limited, 5th Edition, 2009.
2	Modi, P. N., ‒Wastewater Engineering‖ Standard Book House, 6th Edition, 2018.

3	Peavy H, S, Rowe D, R, and Tchobanoglous G, –Environmental Engineering‖, McGraw-Hill Book Company, Indian Edition, 2017.
References	
1	Hammer M, J and Hammer M, J, –Water and Wastewater Technology‖, PHI learning private limited, 7th Edition, 2018.
2	"Manual on Sewerage and Sewage Treatment", CPHEEO, Ministry of Housing and Urban Affairs Development, Govt., of India, New Delhi, 2013.
3	Hammer M, J and Hammer M, J, –Water and Wastewater Technology‖, PHI learning private limited, 7th Edition, 2018.
Useful Links	
1	https://nptel.ac.in/course.html

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

Assessment
The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level				
Bloom's Taxonomy Level	**T1**	**T2**	**ESE**	**Total**
Remember				
Understand	5	5	15	**25**
Apply	10	5	15	**30**
Analyze		5	15	**20**
Evaluate				
Create	5	5	15	**25**
Total	**20**	**20**	**60**	**100**

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Course Information

Programme	B.Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	5CV323
Course Name	Design of Concrete Structures
Desired Requisites:	Solid Mechanics, Structural Analysis

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2Hrs/week	**T1**	**T22**	**ESE**	**Total**
Tutorial	1 Hrs/week	20	20	60	100
Practical	-				
Interaction	-	**Credits: 3**			

Course Objectives

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

Course Outcomes (CO) with Bloom's Taxonomy Level

CO1	**Apply** the concept of limit state for design of reinforced concrete components.	Applying
CO2	**Calculate** the strength of reinforced concrete members.	Evaluating
CO3	**Design** various components of reinforced concrete structures	Creating

Module	**Module Contents**	**Hours**
I	**Introduction** Design Philosophies- Working Stress Method, Ultimate Load Method, Limit State Method, Limit state of collapse, Characteristic strength, Characteristic load, Partial safety factors, Stress-strain curves for concrete and steel, Limit state of serviceability, Provisions in IS code.	3
II	**Design of Reinforced Concrete Beams** a) Singly reinforced rectangular beam, Balanced section, Under-reinforced section and over-reinforced section, Moment of resistance, Design of rectangular, T and L sections. b) Moment of resistance for doubly reinforced rectangular, T and L beams. c) Design of doubly reinforced rectangular, T and L beams.	7
III	**Shear, Bond, and Torsion** a) Shear: Truss analogy, Design of beam for shear according to IS code. b) Bond: Bond and development length, Bond stress, Standard hooks, Anchorages. c) Torsion: Design of beam subjected to torsion according to IS code.	5
IV	**One Way and Two Way Slab** a) Design of single span, continuous and cantilever one way slab. b) Design of two way slab by IS code method. c) Design of staircases.	5

V	**Columns** Load carrying capacity of axially loaded column, Short and long columns, Rectangular and circular columns, Design according to IS, Column subjected to combined axial load and uniaxial bending, P-M interaction diagram.	4
VI	**Design of Footing** Design of square/rectangular isolated footing, Design of raft foundation.	5
	Moodle wise Outcomes: At end of each module students will be able to 1. Apply the concept of limit state method and explain different design philosophies. 2. Design of reinforced concrete beams. 3. Design the beam for shear, bond, and torsion. 4. Design one way, two way slab, and dog-legged staircase. 5. Design axially and eccentrically loaded columns. 6. Design square, rectangular isolated footings, and raft foundation.	
	Tutorials: One hour per week per batch tutorial is to be utilized for problem solving to ensure that students have properly learnt the topics covered in the lectures. This shall include assignment, tutorials, quiz, surprise test, declared test, seminar, final orals etc.	
	Text Books	
1	Punmia, B. C. and Jain, A. K. ‐Limit state design of reinforced concrete‖, Laxmi Publication, 1st Edition, 2013.	
2	Shah, V. and Karve, S. ‐Limit state theory and design of reinforced concrete‖, Structures Publications, 4th Edition, 2003.	
3	Varghese, P. C. ‐Limit State Design of Reinforced Concrete Structures‖, Prentice Hall, 4th Edition, 2010.	
	References	
1	IS 456:2000– Code of Practice for Plain and Reinforced Concrete, BIS and SP 34-1987 – Handbook on concrete reinforcement and detailing.	
2	Pillai, S. V. and Menon. D, "Reinforced concrete design", Tata McGraw Hill Book Co., 5th Edition, 2006.	
3	Ramamruthm, S. ‐Design of reinforced concrete structures‖, Dhanpat Rai Publishing, 17th Edition, 2010	
	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**												**1**	**1**	
CO2		**3**											**2**	**2**	
CO3			**3**										**3**	**3**	

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

Assessment
The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level				
Bloom's Taxonomy Level	**T1**	**T2**	**ESE**	**Total**
Remember				
Understand				
Apply	5	5	10	**20**
Analyze				
Evaluate	10	5	20	**35**
Create	5	10	30	**45**
Total	**20**	**20**	**60**	**100**

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Course Information

Programme	B.Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	5CV371
Course Name	Highway Materials and Traffic Engineering Laboratory
Desired Requisites:	Highway Engineering

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

Course Objectives

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

Course Outcomes (CO)

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

List of Experiments / Lab Activities

List of Experiments:

1. Specific Gravity of Bitumen
2. Penetration Test on Bitumen
3. Viscosity of Bitumen
4. Softening Point of Bitumen
5. Flash and Fire Point of Bitumen
6. Ductility of Bitumen
7. Bituminous Extraction Test
8. Spot Speed Study
9. Intersection Volume Study
10. Parking Usage Study
11. Demonstration of Marshall Stability Test
12. Demonstration of CBR Test on Soil and Aggregates

Text Books

1	Khanna S. K., Justo C. E. G., Veeraragavan A, "Highway Engineering", Nem Chand & Sons, 10th edition, 2018
2	Khanna S. K., Justo C. E. G., Veeraragavan A, " Highway Materials And Pavement Testing", Nem Chand & Sons, 2013
3	

References

1	IS 1201 to 1220 (1978). ‐Methods for testing tar and bituminous materials.‖ Bureau of Indian Standards (BIS), New Delhi, India.

2	IS 73 (2013). ‑PAVING BITUMEN — SPECIFICATION‖ Bureau of Indian Standards (BIS), New Delhi, India
3	MORTH Specifications for Road and Bridge Works, Indian Roads Congress (IRC) 5th Revision 2013, New Delhi, India
Useful Links	
1	https://ts-nitk.vlabs.ac.in/List of experiments.html
2	
3	
4	

CO-PO Mapping

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

Assessment Plan based on Bloom's Taxonomy Level

Bloom's Taxonomy Level	LA1	LA2	Lab ESE	Total
Remember				
Understand	10	10	5	**25**
Apply	10	10	15	**35**
Analyze	10	10	15	**35**
Evaluate			5	**5**
Create				
Total	**30**	**30**	**40**	**100**

Walchand College of Engineering, Sangli

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Course Information	
Programme	B.Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	5CV348
Course Name	Mini-Project-3: Steel Structures Design and Drawings
Desired Requisites:	Engineering Mechanics, Solid mechanics, Design of steel structures

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	-	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	30	30	40	100
Practical	2 Hrs/week				
Interaction	-	**Credits: 1**			

Course Objectives

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

Course Outcomes (CO) with Bloom's Taxonomy Level

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

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

Text Books

1	Duggal S. K., *"Limit state design of steel structures",* Tata McGraw-Hill Publications, New Delhi, 2nd Edition, 2014.

2	Shiyekar, M. R., *"Limit state design in structural steel"*, PHI learning Pvt. Ltd Publications 2nd Edition 2013.
3	Subramanian N., *"Design of steel structures",* Oxford University Press, 2010.
References	
1	Dayaratnam, P., *"Design of steel structures",* S. Chand Publication, New Delhi, 2008.
2	Gaylord, Edwin and Gaylord, Charles, *"Design of steel structures",* Tata McGraw Hill Publishing Company Ltd., New Delhi, 3rd Edition, 2010.
3	IS 800-2007 *"Code of Practice for General Construction in steel",* and IS 875-1987 part 1 to 5; *"Code of Practice for Design Loads (other than earthquake) for building structures",* Bureau of Indian Standards, New Delhi.
4	SP: 6(1)- 1998, Hand Book for Structural Steel Sections.
Useful Links	
1	

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

Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.				
Assessment	**Based on**	**Conducted by**	**Typical Schedule (for 26-week Sem)**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab activities, attendance, journal	Lab Course Faculty	During Week 15 to Week 18 Marks Submission at the end of Week 18	40
Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments.				

Assessment Plan based on Bloom's Taxonomy Level				
Bloom's Taxonomy Level	**LA1**	**LA2**	**Lab ESE**	**Total**
Remember				
Understand				
Apply				
Analyze				
Evaluate				
Create				
Total	**30**	**30**	**40**	**100**

Professional Elective 3 Courses

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Course Information

Programme	B. Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	5CV331
Course Name	Advanced Concrete Technology
Desired Requisites:	Concrete Technology

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 3**			

Course Objectives

1	To give exposure to necessary knowledge and concepts of the manufacturing of cement, hydration of cement.
2	To provide the student well versed with admixtures used in concrete to improve properties of concrete and develop skills to design concrete mix.
3	To make students conversant with durability issues of concrete and make acquainted with special types of concrete.

Course Outcomes (CO)

CO1	Apply the knowledge cement, concrete and admixtures to fulfil the requirement of construction industries.
CO2	Demonstrate and analyse durability of issues of concrete and apply knowledge of non-destructive testing of concrete and special concretes.
CO3	Design a concrete mix according to construction industries requirements.

Module	**Module Contents**	**Hours**
I	**Cement** Clinkering reactions, Hydration Reactions & Chemistry of Cement paste, Setting of Cements, Heat of Hydration, Microstructure of hydrated cement paste.	5
II	**Admixtures in Concrete - I** Specification, Functions, Classification and Working principles. a) Chemical Admixtures: Plasticizers, Super-plasticizer, Accelerators, Retarders, Air entraining agents:, Compatibility of Admixtures	4
III	**Admixtures in Concrete - II** Specification, Functions, and Classification. a) Mineral Admixtures: Fly ash, Silica Fume, Slag, GGBS, Rice husk ash. b) Pozzolanic Reactivity of Mineral admixtures	4
IV	**Concrete Mix Design** Factors to be considered, Statistical quality control, Mix design for compressive strength by IS: 10262 (2019) method, Concept of Particle Packing density	5
V	**Durability of Concrete** Permeability and Pore Structure, Ionic Diffusion, Chemical Attack (Sulphate, Chloride, acids, leaching), Physical Attack (freeze-thaw, scaling, abrasion, Carbonation), Corrosion of reinforcement, Alkali-Aggregate Reaction	5

VI	**Special Concretes:** Fibre reinforced concrete, High performance concrete, Ultra-high strength concrete, Non-destructive testing and evaluation of concrete.	3

Text Books	
1	Mehta P. K. and Paulo J. M. M, ―Concrete – Microstructure, Properties and Material‖, McGraw Hill Professional 3rd Edition, 2009.
2	Neville A. M. and Brooks J. J., ―Concrete Technology‖, Pearson Education Limited, 1987
3	Shetty M. S., ―Concrete Technology‖, S. Chand & Company Ltd. New Delhi, 7th Edition, 2013.
References	
1	Neville A. M.., ―Properties of Concrete‖, Prentice Hall, 5th edition, 2012
2	Newman J., Choo B.S., Advanced Concrete Technology-Constituent Materials, Elsevier Ltd. 1st edition, 2003
3	Taylor H.F.W., Cement chemistry, Thomas Telford, 2nd edition, 1997
Useful Links	
1	https://www.digimat.in/nptel/courses/video/105102012/L01.html
2	https://www.digimat.in/nptel/courses/video/105104030/L01.html
3	https://www.digimat.in/nptel/courses/video/105106176/L01.html

CO-PO Mapping

	Programme Outcomes (PO)												**PSPO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1			2				2					1	2	
CO2			2				1						2	
CO3			3		2							2	3	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 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level

Bloom's Taxonomy Level	**T1**	**T2**	**ESE**	**Total**
Remember				
Understand	5		5	10
Apply	10	5	20	35
Analyze	5	10	15	30
Evaluate		5	10	15
Create			10	10
Total	**20**	**20**	**60**	**100**

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Course Information	
Programme	B.Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	5CV332
Course Name	Earthquake Engineering
Desired Requisites:	Nil

Teaching Scheme		Examination Scheme (Marks)			
Lecture	2 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 2**			

Course Objectives

1	To develop awareness about the earthquake engineering and its effects on Civil Engineering structures.
2	To impart the knowledge of dynamic response systems under earthquake loading.
3	To illustrate codal provisions for design of earthquake resistant structures.

Course Outcomes (CO) with Bloom's Taxonomy Level

CO1	Comprehend engineering Seismology and different terminologies related to earthquake.	remembering, understanding
CO2	Compute characteristics of earthquake and its effect on structures	applying ,analyzing
CO3	Find response of structures subjected to earthquake loads for various building configuration.	Evaluate

Module	Module Contents	Hours
I	Elements of seismology – terminology, structure of earth, causes of an earthquake, plate tectonic theory, seismic waves, magnitude and intensity, methods of measurement, energy released, seismograph, strong motion earthquakes, accelerando, prominent earthquakes of India	4
II	Fundamentals of theory of vibration, Single-Degree of freedom Systems, Analytical models, Equations of motion free and forced vibrations of single degree of freedom systems, Response to harmonic loading, Resonance, SDOF systems subjected to general loading by Duhamel Integral. Support motion, Transmissibility, Vibration isolation.	6
III	Response Spectrum theory, Strong ground motion, Peak parameters, Concept of earthquake response spectrum, Tripartite plot of response spectrum, design response spectrum of IS1893.	4
IV	Earthquake Resistant Design Philosophy, MCE and DBE planning aspects, symmetry, simplicity, regularity, Lateral load analysis, Provisions of IS: 1893 for buildings, Multi-storey buildings base shear, Load combinations.	4

V	Concept of earthquake resistant design, Objectives, Ductility, Ductility reduction factors, Ductile detailing, Provisions of IS: 13920.	4
VI	Conceptual design, Building configuration in plan and elevation, eccentricity, Concepts of structural Control.	4
	Module wise Measurable Students Learning Outcomes : 1: Comprehend the concept of seismology. 2: Apply the concept of theory of vibration & SDOF system. 3: Demonstrate response spectrum analysis. 4: Find base shear as per IS: 1893 of multistoried buildings. 5: Apply knowledge of ductility in earthquake resistant design of structures. 6: Devise various structural control techniques for earthquake resistance.	
Text Books		
1	A.K. Chopra, ―Dynamics of Structure: Theory & Application to Earthquake Engineering‖, Pearson Education Lim., 4th Edition, 2014. D. J. Dowrick, ―Earthquake Resistant Design for Engineers & Architects‖, John Wiley & Sons,2nd Edition, 1987.	
2	P. Agarwal and M. Shrikhande, ―Earthquake Resistant Design of Structures‖, PHI publications, New Delhi, 3rd Edition,2006.	
3	D. J. Dowrick, ―Earthquake Resistant Design for Engineers & Architects‖, John Wiley & Sons,2nd Edition, 1987.	
References		
1	David Key, ―Earthquake Design Practice for Buildings‖, Thomas Telford Publication,London,2nd Edition,2006.	
2	James M. Kelly, ―Earthquake Resistant Design with Rubber‖, Springler-Verlag Publication, London, 2nd Edition, 2012.	
3	Manual of ―Earthquake Resistant Non engineering Construction‖, University of Roorkee ,2000.	
Useful Links		
1	https://www.nicee.org/	
2	https://bis.gov.in/other/quake.htm	
3	https://www.eeri.org/	
4	https://eq.iitr.ac.in/	

CO-PO Mapping															
	Programme Outcomes (PO)												**PSO**		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	**2**														
CO2	**2**			**2**											
CO3	**3**		**3**	**3**											
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 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% 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	25	**45**
Apply	5	5	15	**25**
Analyse	5	5	10	**20**
Evaluate			10	**10**
Create				
Total	**20**	**20**	**60**	**100**

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Course Information

Programme	B. Tech (Civil Engineering)
Class, Semester	Third Year B. Tech., Sem. VI
Course Code	5CV333
Course Name	Municipal Solid Waste Management
Desired Requisites:	--

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 2**			

Course Objectives

1	To provide necessary knowledge regarding functional elements of municipal solid waste management.
2	To create awareness about environmental legislation and government initiatives pertaining to solid waste.

Course Outcomes (CO)

CO1	***Explain*** functional elements of municipal solid waste management and associated rules and government initiatives regarding solid waste disposal
CO2	***Choose*** proper vehicle routing and sites for storage and disposal of municipal solid waste.
CO3	***Identify*** proper processing and disposal technique for municipal solid waste.

Module	**Module Contents**	**Hours**
I	**Sources, Composition and Characteristics of Municipal Solid Waste** Introduction, Sources and types of solid waste, Composition of solid waste, Physical, Chemical and Biological characteristics of municipal solid waste, Solid Waste Management: Objectives, Functional elements, Environmental impact of mismanagement, Present Indian Scenario of solid waste management system.	4
II	**Solid Waste Generation, Collection and Storage** Waste Generation Rate: Definition, Typical values for Indian cities, Factors affecting. Storage and collection: General considerations for waste storage at source, Collection components, Types of collection systems and its design, Transportation of solid waste: Means and methods, Routing of vehicles. Transfer station: Need, Types, factors affecting Capacity and Location	5
III	**Waste Processing Techniques & Material Recovery** Waste Processing Techniques: Purpose, Mechanical volume and size reduction, component separation techniques. Material Recovery and Recycling: Objectives, Recycling program elements, Commonly recycled materials and processes. Energy recovery from solid waste	5
IV	**Thermal Processing and Landfills** Fundamentals of thermal processing, Combustion, Effects of combustion, Pyrolysis, Incineration, Refuse derived fuels, Energy recovery, Landfill: Classification, planning, landfill processes, design and operation, maintenance	5
V	**Biochemical Processes** Factor affecting, properties, benefits, Aerobic and Anaerobic digestion, Composting, Vermi-composting and other biochemical processes	5

VI	**Municipal Solid Waste Rules and Government Initiatives** Waste Management legislation in India, integrated management-public awareness; Role of NGO's; Introduction to various initiatives of the Govt. of India such as Swachh Bharat Mission, occupational hazards and safety measures.	4

Text Books	
1	Bhide. A. D. and Sundaresan. B. B., ‒Solid Waste Management‖, Indian National Scientific Documentation Centre, 1st Edition, 1983.
2	George Tchobanoglous, Hilary Theisen, and S. A. Vigil, ‒Integrated Solid Waste Management‖, McGraw-Hill Publications, Indian edition, 2015.
3	Reddy Jayarama P., ‒Municipal Solid Waste Management‖, B S publications, 1st edition, 2018.

References	
1	George Tchobanoglous and Frank Kreith, ‒Handbook of Solid Waste Management‖, McGraw-Hill Education, 2nd edition, 2002.
2	‒Manual on Municipal Solid Waste Management‖ - CPHEEO, Ministry of Urban Development, GoI, New Delhi, 2000.
3	Peavy H. S., Rowe D. R. and Tchobanoglous G, ‒Environmental Engineering‖, McGraw-Hill Book Company, International edition, 1985.

Useful Links	
1	https://www.youtube.com/watch?v=ZHdBK5QDd54
2	https://www.youtube.com/watch?v=jBcceB0uJ_I

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											1	
CO3		3											1	

Assessment

The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level

Bloom's Taxonomy Level	**T1**	**T2**	**ESE**	**Total**
Remember				
Understand	10	5	20	**35**
Apply	10	5	20	**35**
Analyze				
Evaluate		10	20	**30**
Create				
Total	**20**	**20**	**60**	**100**

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Course Information	
Programme	B. Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Sem. VI
Course Code	5CV334
Course Name	Hazardous waste management
Desired Requisites:	-

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs./week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 2**			

Course Objectives	
1	Provide in-depth knowledge of hazardous waste management.
2	To enhance the technical competency and apply the acquired knowledge for research and Development, industry, and consultancy activities.

Course Outcomes (CO)	
CO1	***Explain*** characterization, waste minimization, transportation, site remediation, and risk associated with hazardous waste.
CO2	***Explain*** and ***Apply*** the physical, chemical, and biological methods of treating hazardous waste.
CO3	***Design*** treatment and disposal facilities for hazardous waste.

Module	**Module Contents**	**Hours**
I	**Introduction to hazardous Waste Management** Hazardous waste: Definition, Sources, Characterization, Classification, Magnitude of problem, Concept of toxicity, Assessment of sites	4
II	**Waste minimization and Treatment** Waste minimization: Benefits, Approaches, Priorities in hazardous waste management, Resources recovery, Case studies. Treatment: Physical, Chemical and Biological treatment systems applicable for hazardous waste, Hazard in processing, Case studies of treatment	5
III	**Transportation of Hazardous Waste** Transportation: Storage of hazardous waste, Regulations governing transporters, Containers, Bulk transport, Non-bulk transport, Hazardous substances emergency response.	5
IV	**Disposal of Hazardous Waste** Land fill disposal: Land fill as disposal sites, Siting, Designing, Closure, Case studies Injection well disposal: Classifications, Deep well injection, Case studies.	5
V	**Site Remediation** Site remediation: Site assessment and inspection, Hazard ranking system, Containment and treatment technologies, financial considerations, Case studies.	5
VI	**Risk Assessment** Risk Assessment: Process, Risk management, Hazardous waste management rules.	4

Text Books	
1	LaGrega, M. D., Buckingham, P. L. and Evans, J. C., Hazardous Waste Management, 2nd Edition, McGraw Hill, 2001.

2	Metcalf and Eddy –Wastewater Engineering Treatment and Reuse‖, Tata McGraw Hill Publication, 6th Reprint, 2003.
References	
1	Sincero A, P and Sincero G, A, –Environmental Engineering A Design approach‖, PHI learning private limited, 2004.
2	Wentz, C. A., Hazardous Waste Management, 2nd Ed., McGraw Hill, 1995.
3	Lewandowski G.A. and DeFilippi L.J., Biological Treatment of Hazardous Wastes, John Wiley & Sons, 1998.
Useful Links	
1	https://www.youtube.com/watch?v=ri9Op5vQfA&list=PLL9jm6CAGn2UzZZfZzSycEANAQUkc5E_e
2	https://www.youtube.com/watch?v=x8ViYoqjEhc

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

Assessment
The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level				
Bloom's Taxonomy Level	**T1**	**T2**	**ESE**	**Total**
Remember				
Understand				
Apply				
Analyze				
Evaluate				
Create				
Total	**20**	**20**	**60**	**100**

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Course Information	
Programme	B.Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	5CV335
Course Name	PE-II: Design of Hydraulic Structures
Desired Requisites:	Water Resources Engineering

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 2**			

Course Objectives	
1	To introduce students the concepts of reservoir planning and irrigation engineering
2	To provide students with necessary skill for the design of various hydraulic structures.
3	To prepare the students for higher studies and research in the field of water resources and irrigation engineering.

Course Outcomes (CO)	
CO1	Explain basics of reservoir, gravity dam, earth dam, spillway, weirs, canal, river training work and water power.
CO2	Apply the knowledge of hydraulic structures to solve/analyze the problems associated with.
CO3	Design hydraulic structures in irrigation engineering.

Module	**Module Contents**	**Hours**
I	**Planning of reservoir and classification of dams** Planning of reservoirs: storage calculations, control levels of reservoir, silting of reservoir, losses in reservoirs and calculation of life of reservoir. Dams: necessity and types, selection of suitable site for construction, selection of type	5
II	**Gravity dam and arch dam** Gravity Dam: forces acting on gravity dam, failure criteria of gravity dam, theoretical and practical profile of gravity, methods of stability analysis and construction of gravity dam. Arch dams: types, layout of constant angle and constant radius arch dam, forces acting on arch dam.	5
III	**Earthen dam** Components and their functions, stability and design criteria; seepage through the body of the earth dam and below earth dam, application of slip circle method, different type of filters, upstream and downstream drainage arrangement, construction of earthen dam.	5
IV	**Spillway** Necessity and different types, factors affecting choice and type of spillway, elementary hydraulic design, energy dissipation devices, jump height and tail water rating curve, energy dissipation below spillway, type of gates provided at the crest of the spillway	5

V	**Weir on permeable foundation and canal** Weirs on permeable foundation: theories of seepage, Bligh's creep theory, Khosla's theory Canal: types, alignment, Kennedy's and Lacey's silt theories, canal losses, typical canal sections, necessity and types of canal lining Canal structures: cross drainage works and canal regulatory works, aqueduct, culvert, super passage, level crossing, cross and head regulator, canal Siphon, canal escape, canal fall and canal outlets	4
VI	**River training work and hydro power engineering** River training works: types of rivers, meandering phenomenon, types of river training works. Hydropower engineering: types of water power plants, layout and components of each type, intakes, conveyance system, surge tanks, power house types, components and layout.	5

Text Books	
1	Garg, S.K., ‐Irrigation Engineering‖, Khanna publisher, Delhi, 11th Edition, 2014.
2	Modi, P.N.,‐Water Recourses Engineering and Water Power Engineering‖, Standard Book House, 10th Edition, 2008.
3	Punmia,B.C. andPande, B.B., ‐Irrigation Water Power Engineering‖,Laxmi Publication Private Limited, 4th Edition, 2009.
References	
1	Sharma, R.K,‐Hydrology and Water Resources‖, Dhanpatrai and sons Delhi,8th Edition,2007
2	Sahasrabudhe, S.R.,‐Irrigation and Hydraulic structures‖, S.K Kataria and Sons Dehhi,3rd Edition, 2011
3	Varshney and Gupta ‐Theory Design of Irrigation Structures‖, Vol. I, II, III, Nemechand and Brothers,6th Edition,2008
Useful Links	

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											3	3	
CO3			3										3	3	
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 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level

Bloom's Taxonomy Level	T1	T2	ESE	Total
Remember				
Understand				
Apply				
Analyze				
Evaluate				
Create				
Total	**20**	**20**	**60**	**100**

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Course Information	
Programme	B.Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	5CV336
Course Name	**Advanced Surveying**
Desired Requisites:	Engineering Surveying

Teaching Scheme		Examination Scheme (Marks)			
Lecture	2 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	0	20	20	60	100
Practical	-				
Interaction	-	**Credits: 2**			

Course Objectives

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

Course Outcomes (CO)

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

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

Text Books

1	Chandra A.M., Higher Surveying, New Age International Private Limited, 2015
2	K. R. Arora –Surveying‖, Vol. 1 & 2, Standard Book House, 16th edition, 2018, Kota.
3	Agrawal N.K., –Essentials of GPS‖ Spatial Network Pvt. Ltd., Hydrabad(1997).
4	

References

1	James Anderson and Edward Mikhail, Surveying: Theory and Practice, McGraw Hill Education; 7th edition, 2017
2	Lillesand T. M. and Kiefer. R.W., "Remote Sensing and Image Interpretation", 4th Edition, John Wiley and Sons, New York, (2002)
3	R. E. Davis, F. Foote and J. Kelly, ‐Surveying; Theory and Practice‖, McGraw Hill Book Company, New York.
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	1	1											1		
CO2	1	1											1		
CO3	3	1													
The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High Each CO of the course must map to at least one PO.															

Assessment
For Theory courses: There shall be two tests (T1 and T2) and one ESE. The ESE is a separate head of passing.

Assessment Plan based on Bloom's Taxonomy Level				
Bloom's Taxonomy Level	**T1**	**T2**	**ESE**	**Total**
Remember		5	10	**15**
Understand	5		10	**15**
Apply	5	5	10	**20**
Analyze		5	10	**15**
Evaluate	5		10	**15**
Create	5	5	10	**20**
Total	**20**	**20**	**60**	**100**

Professional Elective: 4

Lab

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Course Information

Programme	B.Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	5CV372
Course Name	Advanced Concrete Technology Lab
Desired Requisites:	Concrete Technology

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

Course Objectives

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

Course Outcomes (CO)

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

List of Experiments / Lab Activities

List of Experiments:

1. Density of Cement
2. Particle Size Analysis (Laser Diffraction)
3. Specific Surface area of cement (Blaine)
4. Setting time of concrete
5. Strength activity Test
6. Modified Chappelle Test
7. Marsh Cone Test
8. Mini Slump Test
9. Sorptivity of Concrete
10. Carbonation of concrete

Text Books

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

References

1	IS 4031 Part-2 (1999). ‐Methods of physical tests for hydraulic cement- part 2-Determination of fineness by blaine air permeability method.‖ Bureau of Indian Standards (BIS), New Delhi, India.
2	IS 16354. (2015). ‐Metakaolin for Use in Cement, Cement Mortar and Concrete Specification.‖ *Bureau of Indian Standards (BIS)*, New Delhi, India.
3	ASTM C311. (2019). ‐Standard Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use.‖ *ASTM International*, West Conshohocken, PA, United States.
Useful Links	
1	https://www.digimat.in/nptel/courses/video/105106176/L01.html
2	
3	
4	

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

Assessment				
There are three components of lab assessment, LA1, LA2, and Lab ESE IMP: Lab ESE is a separate head of passing. Lab ESE is treated as End Semester Exam and is based on all experiments/lab activities.				
Assessment	**Based on**	**Conducted by**	**Typical Schedule**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab Performance and documentation	Lab Course faculty	During Week 13 to Week 18 Marks Submission at the end of Week 18	40
Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments.				

Assessment Plan based on Bloom's Taxonomy Level				
Bloom's Taxonomy Level	**LA1**	**LA2**	**Lab ESE**	**Total**
Remember				
Understand	10	10	5	**25**
Apply	10	10	10	**30**
Analyze	5	5	15	**25**
Evaluate			10	**10**
Create				
Total	**30**	**30**	**40**	**100**

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Course Information	
Programme	B.Tech. (Civil Engineering)
Class, Semester	Elective IV - Third Year B. Tech., SEM- VI
Course Code	5CV373
Course Name	Earthquake Engineering lab
Desired Requisites:	Earthquake Engineering

Teaching Scheme		Examination Scheme (Marks)			
Lecture	-	**LA1**	**LA2**	**Lab ESE**	**Total**
Tutorial	-	30	30	60	100
Practical	2				
Interaction	-	**Credits: 1**			

Course Objectives	
1	To impart knowledge of SDOF system under various dynamic loading by solving different types of problems.
2	To illustrate behavior of MDOF system under various dynamic loading by solving different types of problems by conducting experiments
3	To provide knowledge of behavior of distributed mass model by conducting experiments.

Course Outcomes (CO)	
CO1	**Apply** principles of dynamics to solve SDOF and MDOF systems.
CO2	**Appraise** behaviour of discrete system.
CO3	**Evaluate** behaviour of continuous system and judge effect of sloshing and liquefaction.

List of Experiments / Lab Activities

LIST OF EXPERIMENTS (Any eight experiments in addition to assignments)

1. Assignments on each module of structural dynamics and earthquake engineering course
2. Dynamics of a three storied building frame subjected to harmonic base motion.
3. Dynamics of a one-storied building frame with planar asymmetry subjected to harmonic base motions.
4. Dynamics of a three storied building frame subjected to periodic (non-harmonic) base motion.
5. Vibration isolation of a secondary system.
6. Dynamics of a vibration absorber.
7. Dynamics of a four storied building frame with and without an open ground floor.
8. Dynamics of one-span and two-span beams.
9. Earthquake induced waves in rectangular water tanks
10. Dynamics of free-standing rigid bodies under base motions
11. Seismic wave amplification, liquefaction and soil-structure Interactions.

Text Books

1	Clough R. W. and Penziene J., ‑Dynamics of Structures‖, McGraw Hill Pub.
2	Craig Roy, ‑Structural Dynamics‖, John Willey & Sons.
3	Chopra A. K., ‑Dynamics of Structures- Theory & Application to Earthquake Engineering‖, Prentice Hall Pub.

References

1	Mukhopadhyay. ‑Dynamics of Structures‖, Ane books pvt ltd, 2nd edition 2010.
2	Paz Mario, ‑Structural Dynamics‖, CBS Publishers and Distributers, 5 th edition 2003.
3	Jaikrishna A. R. and Chandra Brijesh, ‑Elements of Earthquake Engineering‖, South Asian Publishers Private Limited, 2nd Edition, 2000.

Useful Links	
1	https://www.nicee.org/
2	https://bis.gov.in/other/quake.htm
3	https://www.eeri.org/
4	https://eq.iitr.ac.in/

CO-PO Mapping

	Programme Outcomes (PO)												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2	1										1		
CO2	2	1	1										1		
CO3	2	1	1										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. LA1, LA2 together is treated as In-Semester Evaluation.

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

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

Assessment Plan based on Bloom's Taxonomy Level

Bloom's Taxonomy Level	LA1	LA2	Lab ESE	Total
Remember				
Understand	5	5	10	**20**
Apply	10	10	15	**35**
Analyze	15	15	15	**45**
Evaluate				
Create				
Total	**30**	**30**	**40**	**100**

Walchand College of Engineering, Sangli
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Course Information

Programme	B.Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Sem. VI
Course Code	5CV374
Course Name	Municipal Solid Waste Management lab
Desired Requisites:	Municipal Solid Waste management.

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

Course Objectives

1	To provide hands on practice to analyse quality of ambient air, noise levels, stack emissions and MSW.
2	To provide knowledge to analyse environmental condition.

Course Outcomes (CO)

CO1	***Recognize*** and ***explain*** use of instrumentation for air, and noise monitoring and MSW Characterization.
CO2	***Use*** instrumentation for air, and noise monitoring and MSW Characterization.
CO3	***Assess*** environmental condition by using results obtained through experimentation.

List of Experiments / Lab Activities

List of Experiments:

Group A: (Laboratory Activity)

1. Sampling of Municipal Solid Waste (MSW).
2. Proximate analysis of Municipal Solid Waste (MSW).
3. Ultimate analysis of Municipal Solid Waste (MSW).

Group B: (Field Activity)

1: Municipal Solid Waste collection route for small locality /society / colony / village.
2: Municipal Solid Waste processing units for small locality /society / colony / village.
3: Municipal Solid Waste disposal units for small locality /society / colony / village.

Text Books

1	Wayne T. D., Air Pollution Engineering Manual, John Wiley & Sons, 2000.
2	Rao C. S., Environmental Pollution Control Engineering, New Age Int. Pubs, 2005.
3	‒Manual for wet and dry depositing‖, CPCB Methods, Central Lab test methods, 2001.

References

1	Sincero A. P. and Sincero G, A, ‒Environmental Engineering A Design approach‖, PHI learning Private limited, 2004.
2	Nathanson J. A. ‒Basic Environmental technology for water supply, waste management and Pollution control‖, PHI Publishing Company, 5th Edition, 2009.
3	Wark K. and Warner C.F., ‒Air Pollution‖, C.F., H.R. Publication, 1st Edition, 1978.

Useful Links

1	https://www.youtube.com/watch?v=pX5RKJCuKWE
2	https://www.youtube.com/watch?v=t0FfR6Gv2aE

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										

Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.				
Assessment	**Based on**	**Conducted by**	**Typical Schedule (for 26-week Sem.)**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab activities, attendance, journal	Lab Course Faculty	During Week 15 to Week 18 Marks Submission at the end of Week 18	40
Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments.				

Assessment Plan based on Bloom's Taxonomy Level				
Bloom's Taxonomy Level	**LA1**	**LA2**	**Lab ESE**	**Total**
Remember				
Understand	15	10	10	**35**
Apply	15	10	10	**35**
Analyze				
Evaluate		10	20	**30**
Create				
Total	**30**	**30**	**40**	**100**

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Course Information	
Programme	B. Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Semester VI
Course Code	5CV347
Course Name	Civil Engineering Software Laboratory
Desired Requisites:	

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

Course Objectives	
1	To provide the students hands-on practice of various Civil Engineering software

Course Outcomes (CO)	
CO1	***Explain*** the basic concepts related to various Civil Engineering related software.
CO2	***Analyze*** building and infrastructure facilities using Civil Engineering related software
CO3	***Design*** building and infrastructure facilities using Civil Engineering related software

List of Experiments / Lab Activities

At least one of following software

List of Projects:

a. Preparation of building drawings in 2D and 3D using AutoCAD
b. Structural analysis and design of buildings using STAAD-PRO
c. Analysis and design of Water Distribution Systems (WDS) using EPANET/WaterGEMS
d. Analysis and design of sewerage systems using SewerGEMS
e. Analysis and design of storm water management systems using SewerGEMS/StormCAD

Text Books

1	Water Infrastructure Division, US EPA, EPANET 2.2 User Manual, 2020.
2	Autodesk, An Introduction to AutoCAD for beginners, 2020
3	SewerGEMS V8i User Guide, Bentley Systems, 2020

References

1	Shih R., AutoCAD 2021 Tutorial, 2021
2	Walski T., _Advanced Water Distribution Modeling‘, Haestad Press, 1st Edition, 2003.
3	_Stormwater Conveyance Modeling and Design‘, Haestad Press, 1st Edition, 2007

Useful Links

1	https://www.youtube.com/channel/UCbFIgNot42PRCi-05X8aF_A

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									

Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.				
Assessment	**Based on**	**Conducted by**	**Typical Schedule (for 26-week Sem.)**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab activities, attendance, journal	Lab Course Faculty	During Week 15 to Week 18 Marks Submission at the end of Week 18	40
Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments.				

Assessment Plan based on Bloom's Taxonomy Level				
Bloom's Taxonomy Level	**LA1**	**LA2**	**Lab ESE**	**Total**
Remember				
Understand	5	5	10	**20**
Apply	10	10	15	**35**
Analyze	15	15	15	**45**
Evaluate				
Create				
Total	**30**	**30**	**40**	**100**

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Course Information	
Programme	B.Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	5CV376
Course Name	Design of Hydraulic Structures Lab
Desired Requisites:	Fluid Mechanics , Water Resources Engineering and Design of Hydraulics Structures

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

Course Objectives	
1	Use the knowledge and skills studied previously, especially, on fluid mechanics, hydraulics and hydrology into this lab course.
2	To recognize the different types of hydraulic structures
3	To understand its purpose and function to select the most appropriate structure and location for a specific problem.
4	To design and analyse the hydraulic structure for safety and economical.

Course Outcomes (CO)	
CO1	Use and integrate the fundamental and basics studied towards the goal of selecting, analyzing and designing of hydraulic structures.
CO2	Cope with decision making and satisfy competing objectives.
CO3	Design, analyse and proof that the hydraulic structure is safe and economical.
CO4	Work in a team and learn successful group interaction for a project.

List of Experiments / Lab Activities

List of Experiments:

1. Determination of height of dam, demand / storage reservoir calculation.
2. Design of gravity dam for elementary and practical profile with stability calculations.
3. Design and development of earth dam section by using slip circle method.
4. Design of spillway and energy dissipation arrangements.
5. Design of Arch dam with its layout of constant angle and constant radius.
6. Design of the weir on permeable foundation
7. Design of the canal for alluvial soil and un-alluvial soil
8. Study the characteristics of flow under sluice gate
9. Study the characteristics of flow due to channel transitions.
10. Report based on Field visits to Irrigation and Water Power Engineering Projects

Text Books	
1	Irrigation Engineering, S.K. Gerg , Khanna publisher, Delhi
2	Water Recourses Engineering and Water Power Engineering, Dr. P.N Modi
3	Irrigation Water Power Engineering, Dr. B.C Punmia, Dr. Pande.

References	
1	Irrigation Engineering, G.S Birdie, and Das, Dhanpatrai and Sons, Delhi
2	Hydrology and Water Recourses, R.K Sharma, , Dhanpatrai and sons Delhi
3	Theory Design of Irrigation Structures‖, Varshney, Gupta Vol. I, II, III, Nemechand and brothers

Useful Links

CO-PO Mapping															
	Programme Outcomes (PO)												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1				2									2	2	
CO2				2											
CO3				2									2		
CO4				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, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab activities, attendance, journal	Lab Course Faculty	During Week 15 to Week 18 Marks Submission at the end of Week 18	40
Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments.				

Assessment Plan based on Bloom's Taxonomy Level				
Bloom's Taxonomy Level	**LA1**	**LA2**	**Lab ESE**	**Total**
Remember				
Understand	5	5	10	**20**
Apply	10	10	15	**35**
Analyze	15	15	15	**45**
Evaluate				
Create				
Total	**30**	**30**	**40**	**100**

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Course Information

Programme	B. Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Semester VI
Course Code	5CV379
Course Name	Sewerage and sewage treatment laboratory
Desired Requisites:	Engineering Chemistry Laboratory, Water Quality Analysis Laboratory and Sewage Treatment Technology

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

Course Objectives

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

Course Outcomes (CO)

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

List of Experiments / Lab Activities

List of Experiments:

11. Characteristics of sewage
    i. Bio-chemical oxygen demand (BOD)
    ii. Chemical oxygen demand
    iii. Total kjeldahl nitrogen
12. Estimation of BOD rate constant
13. Determination of mixed liquor suspended solids, mixed liquor volatile suspended solids
14. Determination of sludge volume index and sludge density index
15. Sludge characterization
    i. Moisture content
    ii. Total, fixed and volatile solids
16. Effect of sewage disposal on stream
17. Design of sewerage system for a housing colony
18. Design of sewage treatment plant for a housing colony

Text Books

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

References

1	IS 3025 (Relevant parts), Bureau of Indian Standards.
2	Standard Methods for the Examination of Water and Wastewater, APHA, 23rd Revised Edition, 2017.

Useful Links

1	https://ee1-nitk.vlabs.ac.in/exp/determination-of-biological-oxygen/

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

Assessment

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

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

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

Assessment Plan based on Bloom's Taxonomy Level

Bloom's Taxonomy Level	LA1	LA2	Lab ESE	Total
Remember				
Understand				
Apply				
Analyze				
Evaluate				
Create				
Total	**30**	**30**	**40**	**100**

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Course Information	
Programme	B.Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	5CV378
Course Name	Foundation Engineering Laboratory
Desired Requisites:	Soil Mechanics, Soil Mechanics Laboratory

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

The students are expected to get an experience of analysing and designing basic geotechnical structures with help of spreadsheet software using knowledge gained in the parallel theory course. Few laboratory tests that were not part of soil mechanics laboratory would also be covered.

Course Outcomes (CO)

CO1	**Explain** soil investigation practices. **Perform** laboratory experiments to determine swelling properties and CBR of earthen materials.
CO2	**Analyse** stability of earth retaining structures, slopes and foundations.
CO3	**Employ** spreadsheet software for data analysis and presentation.

Laboratory tests

1. Measurement of swelling pressure of soils
2. Free Swell Index test
3. Laboratory determination of California Bearing Ratio (CBR).

Numerical Assignments list

Students are expected to work on following assignments using spreadsheet software / coding for detailed calculations and data presentation purposes.

1. Determination of earth pressure distribution on earth retaining structures
2. Shallow foundation design problems
3. Deep foundation design problems
4. Slope stability analysis problems

Text Books

1	Gopal Ranjan and A.S.R. Rao (2016),‖Basic and Applied Soil Mechanics‖,New Age International Publishers, 3rd Edition
2	Murthy, V. N. S.(2018), ― Textbook of Soil Mechanics and Foundation Engineering Geotechnical Engineering Series ‖, CBS publishing; 1st edition
3	B.M.Das,‖Principles of Geotechnical Engineering‖,Cengage Learning, 7th Edition

References

1	Beauro of Indian Standards, I.S.2720 (Various sections / parts)
2	Couduto, Donald P.(2017), ‖Geotechnical Engineering – Principles and Practices‖, Prentice-Hall.,2nd Edition
3	Muni Budhu(2011),‖Soil Mechanics and Foundations‖, John Wiley & Sons, Inc,3rd Edition

Useful Links	
1	https://www.youtube.com/watch?v=Lng0hVDvsu0&list=PLOzRYVm0a65dtbpo_DP7acjsLYdmWT99r
2	https://www.youtube.com/watch?v=V1m3cB-Aqy8&list=PL940DD62E8781E147

CO-PO Mapping															
	Programme Outcomes (PO)												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1				2									1		
CO2	2	3	2										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				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.				
Assessment	**Based on**	**Conducted by**	**Typical Schedule (for 26-week Sem)**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab activities, attendance, journal	Lab Course Faculty	During Week 15 to Week 18 Marks Submission at the end of Week 18	40
Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments.				

Assessment Plan based on Bloom's Taxonomy Level				
Bloom's Taxonomy Level	**LA1**	**LA2**	**Lab ESE**	**Total**
Remember				
Understand	5	5	10	**20**
Apply	10	10	15	**35**
Analyze	15	15	15	**45**
Evaluate				
Create				
Total	**30**	**30**	**40**	**100**

Open Elective 3
Courses

Walchand College of Engineering, Sangli

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Course Information

Programme	B.Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech.
Course Code	5OE322
Course Name	Physical Geology
Desired Requisites:	-

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 2**			

Course Objectives

1	Introduce students the necessary knowledge and concepts in physical geology.
2	Introduce the natural phenomenon of weathering and geological work of agents modifying surface of the earth.
3	Introduce continental drift, plate tectonics and seismology.

Course Outcomes (CO) with Bloom's Taxonomy Level

CO1	Identify and describe the fundamentals of geology, mineralogy, petrology and structural geology.	Remembering
CO2	Explain the process of weathering and geological work of agents like river, wind, glacier and groundwater.	Understanding
CO3	Explain the phenomenon of continental drift, seismicity, volcanism collectively with the theory of plate tectonics.	Understanding

Module	**Module Contents**	**Hours**
I	**Introduction** Introduction to geology, branches and scope, recent theories related to origin and age of the earth, introduction to minerals, rocks and geological structures.	4
II	**Weathering** Mechanical and chemical weathering of rocks, soil formation and types. Geological work of river-Hydrologic cycle, transportation of sediment, processes and typrs of river erosion, erosional features, deposion and deposional features, rejuvenation of river.	4
III	**Wind, glacier and sea** Geological work of wind, glacier and ocean with respect to erosion, erosional features, transportation and deposition of sediments, deposional features.	4
IV	**Groundwater** Sources of groundwater, water table, groundwater zones, rocks as aquifuge, aquitard, aquiclude, aquifer,Types of aquifer, artisian condition, porosity, permeability, movement of groundwater, work of groundwater, Darcy's law, cone of depression, saline water incursion in coastal areas, wells, springs, hot springs and geysers,	4
V	**Continental drift and plate tectonics** Interior of the earth, principle of isostasy and evidences, continental drift, evidences for Gondwana land and Laurasia, plate tectonics, crustal plates and plate boundaries, events associated with plate margins, opening and closing of oceans, convection current hypothesis, seafloor spreading, volcanoes-types and products of volcano, distribution of volcanos.	4

VI	**Seismology** Definition and types of earthquakes, origin, causes and effects of earthquake, focus, epicentre, isoseismal lines, seismographs and seismic waves, MM scale of seismic intensity, locating epicenter and focus, Richter magnitude, distribution of earthquakes, prediction of earthquakes.	4
	Moodle wise Outcomes: At end of each module students will be able to 7. Remember basic concepts related to origin of the earth, minerals, rocks and geological structures. 8. Understand and explain the process of weathering and geological work of river. 9. Understand and explain geological work of wind, glacier and sea. 10. Understand and explain the concepts in groundwater studies. 11. Understand and explain continental drift and plate tectonics and volcanism. 12. Understand and explain the phenomenon of earthquake.	
Text Books		
1	Mahapatra G. B. 2018: –Textbook of Physical Geology‖, CBS Publications.	
2	Babgar K. M. 2018: –Principles of Engineering Geology‖ Standard Publishers and Distributers.	
3	Parbin Singh, 2014 –Engineering and General Geology‖, S. K. Kataria and Sons.	
References		
1	Arthur Holms 2016 : –Holme's Principles of Physical Geology‖, ELBS.	
2	A. K. Datta 2010 : –Physical Geology‖, Kalyani Publishers.	
3	P. K. Mukharjee, 2013 –Textbook of Geology‖, World Press Pvt. Ltd.	
Useful Links		
1		

CO-PO Mapping															
	Programme Outcomes (PO)												**PSO**		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3													2	
CO2		3												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 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level				
Bloom's Taxonomy Level	**T1**	**T2**	**ESE**	**Total**
Remember	10	10	30	**50**
Understand	10	10	25	**45**
Apply				
Analyze			05	**05**
Evaluate				
Create				
Total	**20**	**20**	**60**	**100**

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Course Information

Programme	B.Tech. (Civil Engineering)
Class, Semester	T. Y. B. Tech. Semester VI
Course Code	5OE323
Course Name	Disaster Management
Desired Requisites:	--

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 2**			

Course Objectives

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

Course Outcomes (CO)

CO1	***Explain*** disasters, man-made hazards and vulnerabilities.
CO2	***Apply*** approaches of Disaster Risk Reduction (DRR) and enhance awareness of institutional processes in the country
CO3	***Assess*** vulnerability and various methods of risk reduction measures as well as mitigation.

Module	**Module Contents**	**Hours**
I	**Introduction to Disasters** Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc. – Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability – Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don'ts during various types of Disasters.	4
II	Approaches to Disaster Risk Reduction (DRR) Disaster cycle – Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- non-structural measures, Roles and responsibilities of- community, Panchayat Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake-holders- Institutional Processes and Framework at State and Central Level- State Disaster Management Authority (SDMA) – Early Warning System – Advisories from Appropriate Agencies.	5

III	Inter-Relationship between Disasters and Development Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India – Relevance of indigenous knowledge, appropriate technology and local resources.	5
IV	Disaster Risk Management in India Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements, (Mitigation, Response and Preparedness, Disaster Management Act and Policy – Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.	5
V	Disaster Management: Applications Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies	5
VI	Case Studies and Field Works Land Slide, Earthquake, Drought, Storm, Flood, Forest fire, Space Based Inputs for Disaster Mitigation, Management and field works related to disaster management.	4

Text Books	
1	Singhal J.P. Disaster Management, Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423
2	Bhattacharya Tushar, Disaster Science and Management, McGraw Hill India Education Pvt. Ltd., 2012. ISBN-10: 1259007367, ISBN-13: 978-1259007361]
3	Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011

References	
1	Govt. of India: Disaster Management Act, Government of India, New Delhi, 2005.
2	Government of India, National Disaster Management Policy, 2009.

Useful Links	
1	https://www.youtube.com/watch?v=Xsg8aydKyto&list=PLFW6lRTa1g83LVbwbeGobTMtYjsviZO05&index=2
2	https://www.youtube.com/watch?v=bQ6wTFMm4Q0&list=PLFW6lRTa1g83LVbwbeGobTMtYjsviZO05&index=6

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

Assessment
The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level				
Bloom's Taxonomy Level	**T1**	**T2**	**ESE**	**Total**
Remember				
Understand	20	5	20	**45**
Apply		5	20	**25**
Analyze				
Evaluate		10	20	**30**
Create				
Total	**20**	**20**	**60**	**100**