# Walchand College of Engineering

(Government Aided Autonomous Institute)

**Vishrambag, Sangli. 416 415**

**Credit System for**

**Final Year B.Tech. (Civil Engineering)**

**Sem.-VII and VIII**

## Applicable to AY 2024-25 and AY 2025 -26

# Walchand College of Engineering

(Government Aided Autonomous Institute)

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

## Applicable to AY 2024-25 and AY 2025 -26

| Sr. No. | Category | Course Code | Course Name | L | T | P | Hrs | Cr | MSE/ LA1 | ISE/L A2 | ESE | Ext |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Professional Core (Theory)** | | | | | | | | | | | | |
| 01 | PC | 6CV401 | Construction Methods and Equipment | 3 | 0 | 0 | 3 | 3 | 30 | 20 | 50 | |
| 02 | PC | 6CV402 | Reinforced and Prestressed Concrete Design | 3 | 0 | 0 | 3 | 3 | 30 | 20 | 50 | |
| **Professional Core (Lab)** | | | | | | | | | | | | |
| 03 | PC | 6CV445 | Mini-Project-4: Construction Project Management | 0 | 0 | 2 | 2 | 1 | 30 | 30 | 40 | OE |
| 04 | PC | 6CV446 | Mini-Project-5: Design and Drawings of RC Structures | 0 | 0 | 2 | 2 | 1 | 30 | 30 | 40 | OE |
| 05 | PR | 6CV491 | Project-I | 0 | 0 | 6 | 6 | 3 | 30 | 30 | 40 | OE |
| 06 | PC | 6CV453 | Techno-Socio Activity/Summer Internship | 0 | 2 | 0 | 2 | 2 | 30 | 30 | 40 | |
| 07 | PC | 6CV454 | Problem-Based Lab | 0 | 0 | 4 | 4 | 2 | 30 | 30 | 40 | |
| **Professional Elective (Theory)** | | | | | | | | | | | | |
| 08 | PE | Refer List | Elective- 3 | 3 | 0 | 0 | 3 | 3 | 30 | 20 | 50 | |
| 09 | PE | Refer List | Elective- 4 | 3 | 0 | 0 | 3 | 3 | 30 | 20 | 50 | |
| **Open Elective** | | | | | | | | | | | | |
| 10 | OE | Refer List | Open Elective-3 | 3 | 0 | 0 | 3 | 3 | 30 | 20 | 50 | |
| | | | | | | | | | | | | |
| 11 | MC | 6IC401 | Constitution of India | 2 | 0 | 0 | 2 | 0 | 30 | 20 | 50 | |
| | | | **Total** | **17** | **2** | **14** | **33** | **24** | | | | |

**Notes:**

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

For Lab courses: There shall be continuous assessment (LA1, LA2, ESE). The ESE is a separate head of passing. The POE/OE indicates an external component for ESE.

A minimum of two AICTE mandatory courses need to be completed for the award of the degree.

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

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

Dr. A. K. Mali
Department Academic Coordinator

Dr. G. R. Munavalli
Head, Department of Civil Engineering

Dr. A. K. Kokane
Dean Academics

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## Applicable to AY 2024-25 and AY 2025 -26

| Sr. No. | Track | Course Code | Course Name |
|---|---|---|---|
| **Professional Elective-3** | | | |
| 01 | Environmental Engineering | 6CV411 | Urban Drainage Management |
| 02 | Infrastructure Engineering | 6CV412 | Building Information Modelling |
| 03 | Transportation Engineering | 6CV413 | Traffic Engineering and Management |
| 04 | Structural Engineering | 6CV414 | Analysis of Statically Indeterminate Structures |
| 05 | Transportation Engineering | 6CV415 | Tunnel, Dock and Harbour Engineering |
| **Professional Elective-4** | | | |
| 01 | Environmental Engineering | 6CV416 | Integrated Waste Management for a Smart City |
| 02 | Hydraulics and Water Resources Engineering | 6CV417 | Design of Hydraulic Structure |
| 03 | Transportation Engineering | 6CV418 | Highway Construction and Pavement Design |
| 04 | Infrastructure Engineering | 6CV419 | Maintenance and Rehabilitation of Structures |
| 05 | Structural Engineering | 6CV420 | Computer Applications in Structural Engineering |

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

## Applicable to AY 2024-25 and AY 2025 -26

| Sr. No. | Category | Course Code | Course Name | L | T | P | Hrs | Cr | MSE/ LA1 | ISE/ LA2 | ESE | Ext |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Professional Core (Theory)** | | | | | | | | | | | | |
| 01 | PC | 6CV421 | Sustainable and Energy Efficient Building Technologies | 2 | 0 | 0 | 2 | 2 | 30 | 20 | 50 | |
| **Professional Core (Lab)** | | | | | | | | | | | | |
| 02 | PR | 6CV492 | Project-II | 0 | 0 | 12 | 12 | 6 | 30 | 30 | 40 | OE |
| **Professional Elective (Theory)** | | | | | | | | | | | | |
| 03 | PE | Refer List | Elective-5 | 3 | 0 | 0 | 3 | 3 | 30 | 20 | 50 | |
| 04 | PE | Refer List | Elective-6 | 3 | 0 | 0 | 3 | 3 | 30 | 20 | 50 | |
| **Humanities** | | | | | | | | | | | | |
| 05 | HS | 6HS401 | Humanities 3: Accounting and Finance for Engineers | 2 | 0 | 0 | 2 | 2 | 30 | 20 | 50 | |
| | | | Total | **10** | **0** | **12** | **22** | **16** | | | | |

**Notes:**

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

For Lab courses: There shall be continuous assessment (LA1, LA2, ESE). The ESE is a separate head of passing. The POE/OE indicates an external component for ESE.

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

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

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

## Applicable to AY 2024-25 and AY 2025 -26

| Sr. No. | Track | Course Code | Course Name |
|---|---|---|---|
| **Professional Elective-5** | | | |
| 01 | Structural Engineering | 6CV431 | Structural Health Monitoring |
| 02 | Environmental Engineering | 6CV432 | Industrial Wastewater Treatment |
| 03 | Geotechnical Engg | 6CV433 | Geosynthetics and Reinforced Soil Structures |
| 04 | Structural Engineering | 6CV434 | Advanced Structural Design |
| 05 | Structural Engineering | 6CV435 | Earthquake Engineering |
| **Professional Elective-6** | | | |
| 01 | Hydraulics and Water Resources Engineering | 6CV436 | Decentralized Water and Wastewater Treatment |
| 02 | Environmental Engineering/Geotechnical Engg | 6CV437 | Geo-Environmental Engineering |
| 03 | Infrastructure Engineering | 6CV438 | Contract Management |
| 04 | Structural Engineering | 6CV439 | Finite Element Method |
| 05 | Structural Engineering | 6CV440 | Design of Concrete Bridges |

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# Walchand College of Engineering, Sangli

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**AY 2024-25**

**Course Information**

| | |
|---|---|
| **Programme** | B. Tech. (Civil Engineering) |
| **Class, Semester** | Final Year B. Tech. VII |
| **Course Code** | 6CV401 |
| **Course Name** | Construction Methods and Equipment |
| **Desired Requisites:** | Building planning and Design |

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

**Course Objectives**

| | |
|---|---|
| 1 | To provide students with comprehensive knowledge and skills in modern construction methods and equipment. |
| 2 | To focus on understanding prefabricated structures, advanced construction techniques, equipment economics, and practical applications in earthwork, compaction, excavation, and concrete operations. |
| 3 | To integrate theoretical knowledge with practical insights, thereby enhancing construction efficiency, quality, and safety in contemporary construction projects. |

**Course Outcomes (CO)**

| CO | Description | Blooms Taxonomy | |
|---|---|---|---|
| | | Descriptor | Level |
| CO1 | **Apply** the concepts of equipment economics in real-world scenarios, including cost analysis and decision-making for equipment replacement, rent, and lease. | Applying | III |
| CO2 | **Demonstrate** knowledge of excavation in hard rock using rippers, jackhammers, drills, compressors, pneumatic equipment, blasting techniques and methods and equipment for pile-driving operations. | Applying | III |
| CO3 | **Analyse** different types of formwork and scaffolding, assessing their requirements, loads, and suitability for various construction projects. | Analysing | IV |
| CO4 | **Demonstrate** knowledge of Modern Construction Techniques | Analysing | IV |

| **Module** | **Module Contents** | **Hours** |
|---|---|---|
| I | **Construction Equipment Economics:**<br>Equipment records, Cost of Capital, Elements of ownership Cost, Operating Cost, Replacement Decisions, Rent and Lease Considerations. Planning for Earthwork Construction: Planning, Earthwork Quantities, Mass Diagram, Pricing Earthwork Operations.<br>Compaction and Stabilization Equipment: Compaction of Soil and rock, Types of Compacting Equipment, Dynamic Compaction, Stabilizing soils with Lime, Cement Soil Stabilization | 8 |
| II | **Dozers, Scrapers, Excavators:** Introduction, Performance Characteristics of Dozers, Pushing Material, Land Clearing, Scraper types, operation, Performance Charts, Production cycle, Hydraulic Excavators, Shovels, Hoes.<br>**Trucks and Hauling Equipment:** Finishing Equipment: Trucks, productivity, Performance Calculations, Graders, Trimmers.<br>**Drilling & Blasting**<br>Excavation in hard rock: Rippers, jack hammers, drills, compressors and pneumatic equipment, Blasting explosives, detonators, fuses. | 8 |
| III | **Formwork:** Requirements of Formwork, Loads carried by Formwork, Types of Formworks, Timber, Steel, Modular shuttering, Slip forms, Scaffolding, Deep excavation methods | 5 |

| | | |
|---|---|---|
| IV | **Modern Construction Techniques in Construction Projects.**<br>Diaphragm Walls: Purpose and Construction methods, trenchless technology<br>Steel Construction: Planning for field operations, selection of equipment and erection tools | 5 |
| V | **Prefabricated Structures:** Introduction to Prefabricated structures, Planning for pre-casting, Selection of equipment for fabrication, Transport and erection of prefabricated components, Quality measures, Design considerations of precast elements, Safety measure during erection | 4 |
| VI | **Plants for construction works and Pile-Driving Equipment:**<br>RMC plant layout and applications, Asphalt mixing and batching plant (Hot mix plant), Sensor Paver for rigid roads, Aggregate crushing plants, Batching Concrete Materials, Mixing<br>**Pile Construction**<br>Driving Piles, Pile Hammers, Supporting and Positioning Piles During Driving, Spudding and Preaugering., Pile driving equipment- Types, pile driving hammers, single acting and double acting, differential acting hammers, hydraulic and diesel hammers, vibratory drivers. | 9 |

| **Text Books** | |
|---|---|
| 1 | Peurifoy, R. L., Schexnayder, C. J., Schmitt, R. Construction planning, equipment, and methods, McGraw-Hill Education, 9th Edition2018. |
| 2 | Varma M, "Construction Equipment and its Planning and Applications", 5th Edition, Metropolitan Book Co. Publishers, 2005. |
| 3 | Zha K. N., "Construction Project Management", Pearson India Education, 2nd edition, 2015. |

| **References** | |
|---|---|
| 1 | Sharma S.C., Construction Equipment and Management, Khanna Publishers New Delhi, 1st Edition,2019. |

| **Useful Links** | |
|---|---|
| 1 | https://archive.nptel.ac.in/courses/105/103/105103206/ |

**CO-PO Mapping**

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

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

**Assessment**

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

Prepared by AAM DAC/BoS Secretary Head/BoS Chairman

# Walchand College of Engineering, Sangli

*(Government Aided Autonomous Institute)*

**AY 2024-25**

**Course Information**

| | |
|---|---|
| **Programme** | B. Tech. (Civil Engineering) |
| **Class, Semester** | Final Year B. Tech., Semester VII |
| **Course Code** | 6CV402 |
| **Course Name** | Reinforced and Prestressed Concrete Design |
| **Desired Requisites:** | Solid Mechanics, Concrete Technology, Structural Analysis |

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

**Course Objectives**

| | |
|---|---|
| 1 | To provide the fundamental concepts of reinforced and prestressed concrete, including material properties, design principles, and behaviour under various loading conditions. |
| 2 | To develop the ability to design reinforced and prestressed concrete structural elements, such as beams, slabs, columns, and foundations, according to relevant standards and codes. |
| 3 | To enhance analytical skills in evaluating and optimizing structural designs, considering factors such as load distribution, stress analysis, and deflection criteria. |

**Course Outcomes (CO)**

| CO | Description | Blooms Taxonomy | |
|---|---|---|---|
| | | Descriptor | Level |
| CO1 | Demonstrate a thorough understanding of the material properties of concrete and reinforcing steel, and their behaviour under different loading conditions. | Understanding | II |
| CO2 | Explain the principles and methodologies of reinforced and prestressed concrete design, including working stress, ultimate load, and limit state design concepts. | Applying | III |
| CO3 | Design reinforced concrete structural elements such as beams, slabs, columns, and footings, ensuring compliance with relevant codes and standards. | Creating | VI |
| CO4 | Design prestressed concrete elements, including beams and slabs, taking into account factors such as prestress losses, cracking, and deflection criteria. | Creating | VI |

| Module | Module Contents | Hours |
|---|---|---|
| I | **Water tank**<br>Importance and necessity, Types of water tanks-underground, ground-level, and elevated tanks., Factors affecting the design of water tanks, Design of circular and rectangular water tank resting on ground using<br>approximate and IS Code method. | 7 |
| II | **Foundation**<br>Introduction to combined footing, Design principles and considerations, Structural design and reinforcement detailing, Design of combined footing (Slab type, slab beam type) and raft foundation | 6 |
| III | **Retaining wall –**<br>Importance and functions of retaining walls, Types of retaining walls: gravity, cantilever, counterfort, anchored, Introduction and components of a cantilever retaining wall, Structural design and reinforcement detailing of cantilever & counterfort retaining wall. | 7 |
| IV | **Introduction to Prestressed Concrete**<br>Basics of Prestressing: Concepts, types of prestressing, and materials used.<br>Prestressing Systems: Pretensioning and post-tensioning methods, advantages and limitations.<br>Losses in Prestress: Short-term and long-term losses, factors affecting prestress loss. | 4 |

| | | |
|---|---|---|
| V | **Design of Prestressed Concrete Elements**<br>Prestressed Beams: Design for flexure, shear, and deflection criteria.<br>Slabs and Floors: Design of prestressed concrete slabs, considerations for large-span floors. | 7 |
| VI | **Analysis of Prestressed Concrete Structures**<br>Analysis of rectangular and Symmetrical I section, thrust line, cable profiles. Design of rectangular and Symmetrical I section, kern distances & efficiency of section. End Block | 8 |

| **Text Books** | |
|---|---|
| 1 | Punmia, B. C., Jain A. K., Limit state design of reinforced concrete, Laxmi Publication, 4th Edition, 2016. |
| 2 | Shah, V. and Karve, S., Limit state theory and design of reinforced concrete, Structures Publications, 8th Edition, 2017. |
| 3 | N. Krishna Raju "Prestressed Concrete", Tata McGraw Hill Education, 6th Edition, 2018. |

| **References** | |
|---|---|
| 1 | IS 456:2000 (Reaffirmed in 2021) – Code of practice for plain and reinforced concrete, BIS and SP 34-1987 – Handbook on concrete reinforcement and detailing. |
| 2 | Ramamruthm, S., Design of reinforced concrete structures (confirming to IS 456), Dhanpat Rai Publishing, 18th Edition, 2011. |
| 3 | T.Y. Lin "Prestressed Concrete", John Wiley & sons Inc. New York, 3rd Edition, 1981. |

| **Useful Links** | |
|---|---|
| 1 | https://onlinecourses.nptel.ac.in/noc23ce79/preview |
| 2 | https://nptel.ac.in/courses/105108069 |
| 3 | https://nptel.ac.in/courses/105106117 |

**CO-PO Mapping**

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

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

**Assessment**

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

# Walchand College of Engineering, Sangli

*(Government Aided Autonomous Institute)*

**AY 2024-25**

## Course Information

| | |
|---|---|
| **Programme** | B. Tech. (Civil Engineering) |
| **Class, Semester** | Final Year B. Tech., Sem VII |
| **Course Code** | 6CV445 |
| **Course Name** | Mini Project 4: Construction Project Management |
| **Desired Requisites:** | Building Planning Design, Estimating and Costing |

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

## Course Objectives

| | |
|---|---|
| **1** | The objective of the Construction Project Management Lab course is to provide students with hands-on experience in managing a construction project from inception to completion. Through practical exercises and the use of contemporary project management software |
| **2** | To develop amongst students, the necessary analytical & managerial skills to systematically analyze the scope of work on construction sites and evaluate the relation between time and money during the planning phase of construction projects to achieve better productivity |
| **3** | To understand the practical complexities involved during the planning and execution of various phases/activities of construction projects and learn the various tools and techniques to manage the resources namely time, money, material, equipment & labour, thereby facilitating to become productive managers. |

## Course Outcomes (CO)

| **CO** | Description | Blooms Taxonomy | |
|---|---|---|---|
| | | Descriptor | Level |
| **CO1** | Create a detailed Work Breakdown Structure (WBS) for the project, identifying at least 100 distinct activities. | Applying | III |
| **CO2** | Conduct a site visit for the selected project and prepare a comprehensive site visit report, detailing observations and relevant site-specific information | Applying | III |
| **CO3** | Utilize project management software to create an accurate project schedule, incorporating all necessary elements such as activity sequencing, resource allocation, and time management | Applying | III |
| **CO4** | Demonstrate conceptual level Quality management and safety management Programme for the same project | Applying | III |

## List of Experiments / Lab Activities

**List of Experiments:**

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

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

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

| **CO-PO Mapping** | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Programme Outcomes (PO)** | | | | | | | | | | | | **PSO** | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| **CO1** | | 3 | | | 3 | | | 1 | 2 | 1 | 3 | 1 | 3 | 3 |
| **CO2** | | | | | 3 | | | 1 | 2 | 1 | 3 | 1 | 3 | 3 |
| **CO3** | | | | | | 2 | | 1 | 2 | 1 | 3 | 1 | 3 | |
| **CO4** | | 3 | | | 3 | | | 1 | 2 | 1 | 3 | 1 | 3 | 3 |
| The strength of mapping: 1:Low, 2:Medium, 3:High | | | | | | | | | | | | | | |

**Assessment**

There are three components of lab assessment, LA1, LA2, and Lab ESE
IMP: Lab ESE is a separate head of passing. Lab ESE is treated as End Semester Exam and is based on all experiments/lab activities.

| Assessment | Based on | Conducted by | Typical Schedule | Marks |
|---|---|---|---|---|
| LA1 | Lab activities, attendance, journal | Lab Course Faculty | During Week 1 to Week 6<br>Marks Submission at the end of Week 6 | 30 |
| LA2 | Lab activities, attendance, journal | Lab Course Faculty | During Week 7 to Week 12<br>Marks Submission at the end of Week 12 | 30 |
| Lab ESE | Lab Performance and documentation | Lab Course faculty | During Week 13 to Week 18<br>Marks Submission at the end of Week 18 | 40 |

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

# Walchand College of Engineering, Sangli

*(Government Aided Autonomous Institute)*

**AY 2024-25**

| **Course Information** | |
|---|---|
| **Programme** | B. Tech. (Civil Engineering) |
| **Class, Semester** | Final Year B. Tech., Semester VII |
| **Course Code** | 6CV446 |
| **Course Name** | Mini-Project-5: Design and Drawings of RC Structures |
| **Desired Requisites:** | Engineering Mechanics, Design of steel structures, Design of Concrete structures I |

| **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 expose students for holistic approach of planning, analysis and design of RCC building. |
| **2** | To enhance students' skill through usage of CAD and software tools for RC structure design. |

**Course Outcomes (CO)**

| **CO** | Description | Blooms Taxonomy |
|---|---|---|
| CO1 | Apply fundamental principles of reinforced concrete (RC) design to develop practical and effective structural solutions for real-world engineering projects. | Applying |
| CO2 | Demonstrate a thorough understanding of relevant design codes and standards, ensuring compliance in all design aspects. | Evaluating |
| CO3 | Design various RC structural elements, such as beams, slabs, columns, and foundations, ensuring structural integrity and safety. | Creating |
| CO4 | Prepare detailed structural drawings that clearly communicate design intent, including reinforcement detailing and connection details using software tools. | Creating |

**List of Experiments / Lab Activities**

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

**1. Residential G+2 storey building**

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

Note: Create a structural model and perform structural analysis of the building using software tools (e.g., ETABS, STAAD Pro).

**2. Prepare detailed design & drawing of any two of the following R. C. structures.**

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

Note:• Drawings prepared shall indicate ductility details as per the provision in IS: 13920.

**Text Books**

| | |
|---|---|
| 1 | N. C. Sinha & S. K. Roy, "Fundamentals of Reinforced Concrete" S. Chand Publishing, 4th Edition, 2013 |
| 2 | B. C. Punmia, Jain and Jain, "Comprehensive Design of R.C. Structures", Standard Book House, New Delhi, 10th Edition, 2015. |

| | |
|---|---|
| 3 | Dr. V. L. Shah and Dr. S. R. Karve, "Limit State Theory and Design", Pune Vidyarthi Griha Publication, 7th Edition, 2015. |
| **References** | |
| 1 | Sinha, "RCC Analysis and Design Vol. I and II", S. Chand and Co. New Delhi, 3rd Edition, 2014. |
| 2 | P. C. Varghese "Limit State Design of Reinforced Concrete", Prentice Hall of India, New Delhi, 1st Edition,1999. |
| 3 | P. Dayaratnram, "Limit State Analysis and Design", Wheeler Publishing company, Delhi, 5th Edition, 1996. |

**CO-PO Mapping**

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

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

**Assessment**

There are three components of lab assessment, LA1, LA2, and Lab ESE
IMP: Lab ESE is a separate head of passing. Lab ESE is treated as End Semester Exam and is based on all experiments/lab activities.

| Assessment | Based on | Conducted by | Typical Schedule | Marks |
|---|---|---|---|---|
| LA1 | Project activities, attendance, journal | Lab Course Faculty | During Week 1 to Week 6<br>Marks Submission at the end of Week 6 | 30 |
| LA2 | Project Activities,attendance, journal | Lab Course Faculty | During Week 7 to Week 12<br>Marks Submission at the end of Week 12 | 30 |
| Lab ESE | Mini-Project PoE Performance and documentation | Lab Course faculty | Marks Submission during External PoE | 40 |

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

Prepared by DAC/BoS Secretary Head/BoS Chairman

# Walchand College of Engineering, Sangli

*(Government Aided Autonomous Institute)*

**AY 2024-25**

**Course Information**

| | |
|---|---|
| **Programme** | B. Tech. (Civil Engineering) |
| **Class, Semester** | Final Year B.Tech. Sem VII |
| **Course Code** | 6CV491 |
| **Course Name** | Project-I |
| **Desired Requisites:** | |

| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | - | **MSE** | **ISE** | **ESE** | **Total** |
| **Tutorial** | - | 30 | 30 | 40 | 100 |
| **Practical** | 6 Hrs/week | | | | |
| **Interaction** | - | **Credits: 3** | | | |

**Course Objectives**

| | |
|---|---|
| 1 | To evaluate students' ability to apply the engineering knowledge for solving problems pertaining to industry and society. |
| 2 | To prepare students to work in teams for a coordinated success of the project task(s). |
| 3 | To provide opportunity to students to enhance their technical skills and knowledge by interaction with industry, institutes through projects associated with real-life problems. |

**Course Outcomes (CO)**

| **CO** | **Description** | **Blooms Taxonomy** | |
|---|---|---|---|
| | | **Descriptor** | **Level** |
| CO1 | Identify an industrial / societal / research problem related to Civil engineering. | Apply | 2 |
| CO2 | Conduct literature review, study relevant codal provision / theory and provide its brief summary. | Apply and Analyze | 3/4 |
| CO3 | Define the objectives, scope and device the methodology of the project work. | Analyze | 4 |
| CO4 | Collect the primary data / information of the parameters/materials/ methods to be used for project work through onsite/online surveys, literature review etc. | Analyse and Evaluate | 4/5 |
| CO5 | Work in team to address at least one of the objectives defined and present the progress of the work. | Evaluate | 5 |

**Module Contents**

1. The students shall select the topic in the area of their interest in consultation with the guide.
2. The literature review shall be done by the students to identify the research gaps and define the objectives of the formulated problem.
3. The students shall define the methodology, scope of the project and the rough work plan for the completion of the project.
4. The progress of the work done related to problem definition, data collection and the analytical/experimental work shall be presented to the guide and panel.
5. The students shall submit the project report of the work progress; in the given standard format.

**Text Books**

| | |
|---|---|
| 1 | Guide to Research Projects for Engineering Students: Planning, Writing, Presenting, Kenneth Keng Wee Ong, CRC Press, Taylor and Francis Publications. |

**References**

| | |
|---|---|
| 1 | R.C. Kothari, Research Methodology, New Age Publications, 2nd Edition |
| 2 | Technical Journals and Conference proceedings etc. pertaining to area of the project. |
| 3 | Dissertations of B.Tech./ M.Tech. Project work of previous students of department/institute |

| CO-PO Mapping | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Programme Outcomes (PO) | | | | | | | | | | | | PSPO | |
| COs | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| **CO1** | 3 | 3 | | | | 3 | 2 | 1 | | | 3 | 2 | 3 | |
| **CO2** | | 1 | | 1 | 1 | | | | | | | 1 | 3 | |
| **CO3** | | | | 2 | | | | | | 1 | 2 | | | |
| **CO4** | | | | | 1 | 2 | | 1 | 1 | 1 | 1 | 1 | 1 | |
| **CO5** | | | | | 1 | | | 3 | 3 | 2 | | 1 | 3 | |
| The strength of mapping: - 1: Low, 2: Medium, 3: High | | | | | | | | | | | | | | |

| Assessment | | | | |
|---|---|---|---|---|
| The Project work will be evaluated in three stages LA1, LA2 and ESE as given below: | | | | |
| **Assessment** | **Activity Related to** | **Conducted by** | **Typical Schedule** | **Marks** |
| LA1 | CO1 and CO2 | Guide and Internal panel | During Week 1 to Week 6<br>Marks Submission at the end of Week 6 | 30 |
| LA2 | CO1, CO2 and CO3 | Guide and Internal panel | During Week 6 to Week 12<br>Marks Submission at the end of Week 12 | 30 |
| Lab ESE | CO3, CO4, and CO5 | Guide and External examiner | During Week 12 to Week 18<br>Marks Submission at the end of Week 18 | 40 |
| The assessment of the students will be done individually by the respective supervisor/guide and in a group by the panel using the defined rubrics. | | | | |

Prepared by DAC/BoS Secretary Head/BoS Chairman

# Walchand College of Engineering, Sangli

*(Government Aided Autonomous Institute)*

**AY 2024-25**

**Course Information**

| | |
|---|---|
| **Programme** | B. Tech. (Civil Engineering) |
| **Class, Semester** | Final Year B.Tech. |
| **Course Code** | 6CV453 |
| **Course Name** | Techno-Socio activity |
| **Desired Requisites:** | Nil |

| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | - | **MSE** | **ISE** | **ESE** | **Total** |
| **Tutorial** | 1 Hr/week | 30 | 30 | 40 | 100 |
| **Practical** | - | | | | |
| **Interaction** | - | **Credits: 1** | | | |

**Course Objectives**

| | |
|---|---|
| 1 | To motivate the students to participate in co-curricular and extra-curricular activities. |
| 2 | To develop the student's ability to provide creative technical solutions to local and societal problems. |
| 3 | To encourage students to work in teams and connect with the society. |

**Course Outcomes (CO)**

| CO | Description | Blooms Taxonomy | |
|---|---|---|---|
| | | Descriptor | Level |
| CO1 | To analyse the real-life problems in the society. | Analysing | 2 |
| CO2 | Apply the technical knowledge and develop a structured action plan to provide innovative solutions to problems faced by the local community/ Society. | Applying, Developing | 3 and 6 |
| CO3 | To exhibit social awareness and communications skills and excel at the technical completions. | Understanding and Evaluating | 2 and 5 |
| CO4 | To illustrate the capability of self-learning. | Analyse | 4 |
| CO5 | To work in teams, collaborate with local residents and authorities and work in teams to provide a solution to a techno-socio problem(s). | Creating | 6 |

**Contents**

Open to students. Student can undertake any three techno-socio activity as listed below but not limited to it**:**

1. The students shall form groups and organize techno-socio activity for the students / community in rural areas, backward areas (**CO2, CO3**)
2. A student or a group of students shall participate in any social activity like "Swach Bharat Abhiyan", "Blood Donation Camp", or any social activity announced by Govt. / Corporation / Panchayat. (**CO2**)
3. A student or a group of students shall participate in University, State or National level technical events / competitions. (**CO3**)
4. A student shall complete online course(s) on topics beyond syllabus from Coursera, Udemy, Sky-fi lab or courses offered by CSIR / IIRS or Outreach Programmes by AICTE such as ATAL Course or courses on SWAYAM by NPTEL(**CO4**)
5. A student shall develop any innovative Patent /Gadget / Solution / System and transfer in the interest of Nation / Society / Institute (WCE). (**CO2**)
6. An Awards / Recognitions received in any techno-socio activity can be submitted as an achievement. (**CO4**)
7. A student shall publish paper (s) in National / International conferences / journals (**CO4**)
8. A student shall work as a Volunteer/ Co-ordinator in the students' organizations / clubs within/outside the institute (**CO3**)
9. A student shall contribute to the departmental development programs such as Laboratory development, NBA/NAAC preparation.

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

| Useful Links | |
|---|---|
| 1 | (https://www.asce.org/pdf/ethics_manual.pdf) |
| 2 | https://www.aicte-india.org/atal |
| 3 | https://nptel.ac.in/ |
| 4 | https://swayam.gov.in/ |

**CO-PO Mapping**

| | Programme Outcomes (PO) | | | | | | | | | | | | PSPO | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **COs** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| **CO1** | 2 | 2 | | | | 3 | | | | | | | 2 | |
| **CO2** | 2 | 2 | 2 | 2 | | 3 | | | | | | | 2 | |
| **CO3** | | | | | | 3 | | 3 | | 3 | | 3 | | |
| **CO4** | | | 2 | | | 3 | | | 2 | | | 3 | 2 | |
| **CO5** | | | | 2 | | 3 | 2 | 2 | 2 | 2 | 1 | | 3 | |

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

**Assessment**

There are three components of lab assessment, LA1, LA2 and Lab ESE.
Important: ESE is a separate head of passing. (min 40 %), LA1+LA2 should be minimum 40%

| Assessment | Based on | Marks |
|---|---|---|
| LA1 | Participations in technical competitions, volunteer and coordinator for technical/non-technical events, organization of events, Awards and recognitions etc. | 30 |
| LA2 | Online courses, Paper publishing Patent. Product/ gadget creation or Publication, contribution to department development, Participation, organization in social activity etc. | 30 |
| ESE | Group activity for providing technical solution to local, societal problem. | 40 |

| Prepared by | DAC/BoS Secretary | Head/BoS Chairman |
|---|---|---|

# Walchand College of Engineering, Sangli

*(Government Aided Autonomous Institute)*

**AY 2024-25**

**Course Information**

| | |
|---|---|
| **Programme** | B. Tech. (Civil Engineering) |
| **Class, Semester** | Final Year B. Tech., Semester-I |
| **Course Code** | 6CV411 |
| **Course Name** | Professional Elective 3: Urban Drainage Management |
| **Desired Requisites:** | Basic courses on hydraulics and sewerage |

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

**Course Objectives**

| | |
|---|---|
| 1 | To provide in depth knowledge on urban drainage and its infrastructure requirements. |
| 2 | To introduce the concept on design of urban drainage system and its components. |
| 3 | To provide modelling concepts on sanitary and storm sewage system |

**Course Outcomes (CO)**

| CO | Description | Blooms Taxonomy | |
|---|---|---|---|
| | | Descriptor | Level |
| CO1 | ***Explain*** concepts related to sewerage, storm drainage and rainfall modelling | Understanding | II |
| CO2 | ***Develop*** sewerage network | Analysing | IV |
| CO3 | ***Analyse*** the urban drainage system | Analysing | VI |
| CO4 | ***Design*** sanitary and storm drainage system | Analysing | IV<br>VI |

| Module | Module Contents | Hours |
|---|---|---|
| I | **Sanitary Sewerage System**<br>Purpose, types, system components.<br>Review of sewer hydraulics: Velocity of flow, Hydraulic formulae, Gradient.<br>Design of sanitary sewerage system: Estimation of design discharge, Design considerations, Procedure, Hydraulic design of sanitary sewerage system. | 8 |
| II | **Storm water Drainage System: System Components and Rainfall Modeling**<br>Need and design objectives of storm water conveyance system, Hydrologic and Hydraulic Components, Basic Rainfall Characteristics, Obtaining Rainfall Data, Types of Rainfall Data, Rainfall Requirements for Modeling Runoff | 6 |
| III | **Storm water Drainage System: Modeling Runoff and Design**<br>Rainfall Abstractions, Determination of Effective Precipitation (Runoff), Basin Response Time, Peak flow estimation by various methods.<br>Initial and Final Pipe System Design, Outfall Design and Energy Dissipation, Hydraulic analysis of roadway gutter and inlets. | 7 |
| IV | **Combined Sewerage System and Sewage Pumping Station**<br>Combined Sewerage System: Purpose, Estimation of design discharge, Hydraulic design of combined sewers<br>Sewage Pumping Station: Types of pumps, components of pumping station, Design of pumping station | 7 |

| | | |
|---|---|---|
| V | **Sewer**<br>Sewer shapes, materials, material selection criteria, Laying and testing of sewer pipes, sewer appurtenances, Maintenance of sewers | 5 |
| VI | **Rainwater harvesting**<br>Need and concept of rainwater harvesting, Systems of rainwater harvesting, Roof top harvesting of rainwater, Components, Estimation of water collection potential, Design considerations, Design of a roof top harvesting system. | 6 |

| **Text Books** | |
|---|---|
| 1 | Garg S. K., "Sewage Disposal and Air pollution Engineering", Khanna Publishers, 41st Edition, 2021. |
| 2 | Subramnaya K., "Engineering Hydrology", McGraw Hill Education, 4th Edition, 2017. |

| **References** | |
|---|---|
| 1 | "Manual on Sewerage and Sewage Treatment", CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 2013. |
| 2 | "Manual on Storm Water Drainage Systems", CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 2019. |
| 3 | Haestad-Durrans, "Storm Water Conveyance Modeling and Design", Haestad Press, 1st edition, 2003. |

| **Useful Links** | |
|---|---|
| 1 | https://www.youtube.com/channel/UCbFIgNot42PRCi-05X8aF_A |

**CO-PO Mapping**

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

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

**Assessment**

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

Prepared by: B. R. Kavathekar DAC/BoS Secretary Head/BoS Chairman

# Walchand College of Engineering, Sangli

*(Government Aided Autonomous Institute)*

**AY 2024-25**

**Course Information**

| | |
|---|---|
| **Programme** | B. Tech. (Civil Engineering) |
| **Class, Semester** | Final Year B.Tech. Sem- II |
| **Course Code** | 6CV412 |
| **Course Name** | Elective 3: Building Information Modelling |
| **Desired Requisites:** | - |

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

**Course Objectives**

| | |
|---|---|
| 1 | The objective of this course is to provide students with a comprehensive understanding of Building Information Modelling (BIM) and its application in the construction industry. |
| 2 | Students will learn the principles, processes, and tools associated with BIM, and how to use BIM for effective project planning, design, construction, and management. |
| 3 | |

**Course Outcomes (CO)**

| CO | Description | Blooms Taxonomy | |
|---|---|---|---|
| | | Descriptor | Level |
| CO1 | Explain the fundamental concepts and benefits of BIM | Understanding | 2 |
| CO2 | Apply BIM tools for creating and managing building models | Applying | 3 |
| CO3 | Analyze BIM data for project planning and decision-making | Analysing | 4 |
| CO4 | Design and implement BIM strategies for construction projects | Creating | 4 |

| **Module** | **Module Contents** | **Hours** |
|---|---|---|
| I | **BIM Fundamentals**<br>Current industry scenarios - its struggles and challenges? Need of BIM?<br>What problems do we face with 2D CAD? BIM & its benefits (BIM misconceptions, and challenges), BIM as a collaborative process, BIM workflow- preconstruction, construction, and operation stage, BIM Adoption status (global), BIM Execution Plans (global), and BIM stakeholders' roles and responsibilities. | 8 |
| II | **BIM Processes and Workflows**<br>BIM Process Overview, BIM Standards, Maturity Model, Open BIM concept and challenges, BIM tools and applications, concepts such as CDE, Digital Twin, Open BIM, Data Repository, Maturity Levels, BIM Level of Development LoD, Integrated Model, etc. BIM Dimensions, BIM Project Cases, etc. | 6 |
| III | **BIM Tools and Technologies**<br>Overview of BIM Software and Tools, Introduction to Autodesk Revit, Navisworks, and Other BIM Software, Hardware and Software Requirements for BIM, Cloud-Based BIM Platforms | 6 |

| | | |
|---|---|---|
| IV | **BIM Modelling Techniques**<br>Creating 3D BIM Models, Parametric Modelling and Object Libraries, Developing Architectural, Structural, and MEP Models, Integrating Models for Clash Detection and Coordination | 6 |
| V | **BIM in Project Lifecycle**<br>BIM in Design and Pre-Construction Phases, BIM for Construction Planning and Management, BIM in Facility Management and Operation, Case Studies on BIM Implementation | 6 |
| VI | **Advanced BIM Applications and Future Trends**<br>BIM for Sustainability and Green Building Design, BIM and GIS Integration, BIM for Infrastructure Projects (Roads, Bridges, etc.), Emerging Trends in BIM (4D/5D BIM, AI, AR/VR) | 6 |

| **Text Books** | |
|---|---|
| 1 | Sacks, R., Eastman, C., Lee, G., & Teicholz, P. (2018). BIM handbook: A guide to building information modelling for owners, designers, engineers, contractors, and facility managers. John Wiley & Sons. |
| 2 | T2. Kumar, B. (2015). A practical guide to adopting BIM in construction projects. Whittles Publishing. |
| 3 | "Building Information Modelling" by Nawari O. Nawari and Michael Kuenstle |

| **References** | |
|---|---|
| 1 | "Practical BIM: Implementing Building Information Modeling" by E. William East |
| 2 | "BIM Handbook: A Guide to Building Information Modeling for Owners, Managers, Designers, Engineers, and Contractors" by Chuck Eastman, Paul Teicholz, Rafael Sacks, and Kathleen Liston |
| 3 | |

| **Useful Links** | |
|---|---|
| 1 | |
| 2 | |
| 3 | |

**CO-PO Mapping**

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

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

**Assessment**

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

Prepared by AAM DAC/BoS Secretary Head/BoS Chairman

# Walchand College of Engineering, Sangli

*(Government Aided Autonomous Institute)*

**AY 2024-25**

**Course Information**

| | |
|---|---|
| **Programme** | B. Tech. (Civil Engineering) |
| **Class, Semester** | Final Year B.Tech. VII |
| **Course Code** | 6CV413 |
| **Course Name** | Professional Elective-3: Traffic Engineering & Management |
| **Desired Requisites:** | Transportation Engineering |

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

**Course Objectives**

| | |
|---|---|
| 1 | To give exposure to principles of Traffic Engineering and Management. |
| 2 | To comprehend traffic planning, trip distribution, traffic flow and land-use transport models. |
| 3 | To make acquainted with transport economics, public transport and intelligent transportation systems. |

**Course Outcomes (CO)**

| CO | Description | Blooms Taxonomy | |
|---|---|---|---|
| | | Descriptor | Level |
| CO1 | Articulate and demonstrate principles of intersection design, Highway capacity, Transportation Planning and Management and Trip Distribution. | Applying | II & III |
| CO2 | Perceive and apply knowledge of traffic flow and transport economics. | Applying | II & III |
| CO3 | Examine the various public transportation systems. | Applying | III |
| CO4 | Demonstrate the concepts of intelligent transportation systems. | Applying | III |

| **Module** | **Module Contents** | **Hours** |
|---|---|---|
| I | **Traffic Engineering and Control -** Review of various traffic surveys and traffic Studies; Statistical methods for traffic engineering and their applications, Distributions, sampling theory and Significance testing, Regression and Correlation<br>**Intersection design-** Principles, rotary design, mini roundabout, traffic signals, types of traffic signals, determination of optimal cycle time and signal setting, coordination of signals, area traffic control, delay at a signalized intersection. **Accident and road safety**: accident causes, recording system, analysis and preventive measures, accident cost, alternative methodologies for calculation. | 8 |
| II | **Traffic management-** various measures and their scope, relative merits and demerits.<br>**Highway capacity:** passenger car units, level of service, factor affecting capacity and level of service, influence of mixed traffic.<br>**Transportation Planning and Management -** Introduction to the process of urban transport planning. Travel demand forecasting, Trip generation analysis, trip classification, multiple regression analysis, and category analysis. | 7 |
| III | **Modal split analysis**: introduction, earlier modal split models, modal split models with behavioural basis.<br>**Trip distribution analysis-** introduction, methods of trip distribution, uniform and average factor method, Fratar method, Furness method, The Gravity model, Intervening and competing, Linear programming approach to trip distribution. | 7 |

| | | |
|---|---|---|
| IV | **Traffic Assignment-** purpose of traffic assignment, traffic flow characteristics, Assignment techniques, All or nothing assignment, Multiple route assignment, Capacity restraint assignment, Diversion curves. Rout building algorithms.<br>**Theory of traffic flow-** Scope, definitions and basic relationship, review of flow density speed studies, hydrodynamic analogies, Application of hydrodynamic analogy. | 6 |
| V | **Car-** following theory and its application to traffic engineering, a probabilistic description of traffic flow, an introduction to queuing theory as applied to traffic flow problems for study state conditions, simulation studies.<br>**Transport Economics-** Economic evaluation of highway schemes, need for economic evaluation, cost and benefits of transportation projects, basic principles of economic evaluation, Net present value method, benefit/cost ratio method, internal rate of return method. Vehicle operating costs, Value of travel time saving, Accident costs. | 6 |
| VI | **Public Transportation-** Mass transit systems: Bus and rail transit, characteristic capacities.<br>Introduction to intelligent transportation systems, Introduction to advanced computational techniques for transportation planning. | 5 |

| **Text Books** | |
|---|---|
| 1 | Pingnataro G. J., Principles of Traffic Engineering, McGraw Hill, 1970. |
| 2 | Wohl and Martin, Traffic System Analysis for Engineering and Planners, McGraw Hill, 1983 |
| 3 | Kadiyalai, L. R., "Traffic Engineering and Transport Planning", Khanna Publishers, 8th Edition 2013 |

| **References** | |
|---|---|
| 1 | Saxena S., A Course in Traffic Engineering and Design, Dhanpat Rai & Sons |
| 2 | Chakraborty P. and Das A., Principles of Transportation Engineering, Prentice Hall, India |
| 3 | Hutchinson B.G., Introduction to Urban Transport Systems, Planning, McGraw Hill,1970. |

| **Useful Links** | |
|---|---|
| 1 | |

**CO-PO Mapping**

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

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

**Assessment**

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

Prepared by DAC/BoS Secretary Head/BoS Chairman

# Walchand College of Engineering, Sangli

*(Government Aided Autonomous Institute)*

**AY 2024-25**

**Course Information**

| | |
|---|---|
| **Programme** | B. Tech. (Civil Engineering) |
| **Class, Semester** | Final Year B.Tech. VII |
| **Course Code** | 6CV414 |
| **Course Name** | Analysis of Statically Indeterminate Structures |
| **Desired Requisites:** | Solid Mechanics, Structural analysis, Structural Mechanics |

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

**Course Objectives**

| | |
|---|---|
| 1 | To impart the knowledge on analysis of its statically indeterminant structures(beam frame/ struss) by different methods. |

**Course Outcomes (CO)**

| CO | Description | Blooms Taxonomy | |
|---|---|---|---|
| | | Descriptor | Level |
| CO1 | ***Apply*** different methods for the analysis of structures. | Applying | 3 |
| CO2 | ***Calculate*** forces and displacements for structures. | Evaluating | 5 |
| CO3 | ***Evaluate*** internal forces in frames and beams. | Evaluating | 5 |
| CO4 | ***Analyze*** the continuous beams | Analyzing | 4 |

| Module | Module Contents | Hours |
|---|---|---|
| I | **Theorem of Three Moments Method**<br>Clapeyron's theorem of three moments (no derivation), Application of Clapeyron's theorem (2 span and more), for beams with uniform moment of inertia subjected to concentrated loads and uniformly distributed loads over entire span. Draw SF diagrams and BM diagrams showing point of contra flexure for continuous beams. Use of software for computation of shear force and bending moment for beams with different methods. | 8 |
| II | **Consistent Deformation Method for beams**<br>Introduction to force method- Static Indeterminacy, General Procedure, Analysis of Propped Cantilever Beams, Fixed beams, Continuous beams, | 6 |
| III | **Analysis of Indeterminate trusses and frames**<br>Pin jointed and rigid jointed frames, External and internal static indeterminacy, Principle of Superposition, Compatibility conditions, redundant trusses & frames' analysis by consistent deformation method. | 7 |
| IV | **Rotation Contribution Method**<br>Analysis of continuous beams, including support settlement, Rotation contribution method with side sway, single bay single storey and single bay two storey frames. Bending moment and shear force diagrams. Elastic curve. | 6 |
| V | **Analysis using Stiffness Method:**<br>Displacement transformation matrix using Stiffness Method, Development of global stiffness matrix for continuous beams, plane trusses and rigid plane frames (having not more than six co-ordinates – 6x6 stiffness matrix) | 6 |

| | | |
|---|---|---|
| VI | **Plastic Analysis:**<br>Plastic modulus, shear factor, plastic moment of resistance, load factor, plastic analysis of continuous beam and simple rectangular portals, Application of upper and lower bound theorems | 6 |

| **Text Books** | |
|---|---|
| 1 | Vazirani. V. N. & Ratwani M. M., "Advanced Theory of Structures", Khanna Publishers, 2008 |
| 2 | Reddy C. S., "Basic Structural Analysis", Tata McGraw Hill, 7th Edition, 1981. |
| 3 | Vijayanand M., Muthu K. U., Narendra H., Janardhana M., "Indeterminate Structural Analysis" Dream Tech Press (1 January 2019) |

| **References** | |
|---|---|
| 1 | Mcquire and Gallagher. R. H. "Matrix Structural Analysis", John Wiley, 2nd Edition, 2000 |
| 2 | Beaufit F.W et al. "Computer Methods of Structural Analysis", Prentice Hall, illustrated,1970 |
| 3 | John L. and Meek, "Matrix Structural Analysis", McGraw Hill Book Company, illustrated,1971 |

| **Useful Links** | |
|---|---|
| 1 | https://nptel.ac.in/courses/105/105/105105166/ |
| 2 | https://onlinecourses.nptel.ac.in/noc23_ce87/preview |
| 3 | http://engineeringvideolectures.com/course/281?pn=0#videolist |

**CO-PO Mapping**

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

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

**Assessment**

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

Prepared by DAC/BoS Secretary Head/BoS Chairman

# Walchand College of Engineering, Sangli

*(Government Aided Autonomous Institute)*

**AY 2024-25**

**Course Information**

| | |
|---|---|
| **Programme** | B. Tech. (Civil Engineering) |
| **Class, Semester** | Final Year B.Tech., Semester- VII |
| **Course Code** | 6CV415 |
| **Course Name** | Professional Elective 3- Tunnel, Dock and Harbour Engineering |
| **Desired Requisites:** | Transportation Engineering |

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

**Course Objectives**

| | |
|---|---|
| 1 | To discuss to the fundamentals of Tunnel and docks & harbours engineering and construction methods. |
| 2 | To introduce unit operation of drilling and blasting. |
| 3 | |

**Course Outcomes (CO)**

| CO | Description | Blooms Taxonomy | |
|---|---|---|---|
| | | Descriptor | Level |
| CO1 | Explain the fundamentals tunnel and docks & harbours engineering. | Understand | I |
| CO2 | Explain and analyse the various aspects of the design of the tunnel and docks & harbours. | Understand, Analyze, | II, IV |
| CO3 | Design the various elements of tunnel and docks & harbours. | Create | VI |
| CO4 | Appraise and apply various techniques used in the construction of tunnels and docks & harbours. | Understand, Evaluate | II, V |

| **Module** | **Module Contents** | **Hours** |
|---|---|---|
| I | **Introduction of Tunnel Engineering**<br>General aspects, economic considerations, Selection of route, Classification of Tunnel, shapes and sizes, historical development of tunnel, advantages and disadvantages of tunnels, Geotechnical Investigation for Tunnel, Tunnel alignment and profile, transfer of CL on surface, Tunnel Cross-sections, Tunnel Lining, Methods of lining. | 6 |
| II | **Tunnel Construction Methods**<br>Tunnelling Methods: Types and purpose of tunnels; factors affecting the choice of excavation technique; Methods – soft ground tunnelling, hard rock tunnelling, shallow tunnelling, deep tunnelling; Shallow tunnels – cut and cover, cover and cut, pipe jacking, jacked box excavation techniques, methods of muck disposal, supporting, problems encountered in tunnelling and remedial measures.<br>Tunnel Boring Machines (TBM) | 6 |
| III | **Tunnelling by Drilling and Blasting**<br>Unit operations in conventional tunnelling; Drilling – drilling principles, drilling equipment, drilling tools, drill selection, rock drill ability factors; Blasting – explosives, initiators, blasting mechanics, blast hole nomenclature; types of cuts- fan, wedge and others; blast design, tunnel blast performance – powder factor, parameters influencing, models for prediction; mucking and transportation equipment selection.<br>**Tunnel Support System**<br>Temporary and Permanent support system, Initial Support, Primary support, secondary support, Specialized support system, Grouting and ground stabilization, Monitoring and Maintenance.Tunnel Ventilation and Lighting, Methods of Ventilation , Dust Control | 7 |

| | | |
|---|---|---|
| IV | **Introduction of Dock & Harbour Engineering**<br>Docks and Harbour Engineering - Sea and tides, hydrographic surveys, wind, waves and cyclones, siltation and erosion, investigations, traffic forecasting. Advantages and Disadvantages of Water Transportation, Elements of Water Transportation, Classification of Harbours, Ports Development in India, Port Authorities, Bodies and Association.<br>**Harbour Planning**<br>Site selection, Planning of Harbours, Ship Characteristics, Characteristics of Good Harbour, Size of Harbour, Harbour layout, channel, basin and berths, shore protection works, dry docks and slipways, Dredging and Coastal Protection: Classification, types of dredgers, choice of dredger, uses of dredged materials, coastal erosion and protection, sea wall, revetment, bulkhead, aprons, transit shades and warehouses, cargo handling equipment. | 7 |
| V | **Marine Structure**<br>General Design Aspects, Breakwaters - Function, Types General Design Principles, Wharves, Jetties, Piers, Dolphin, Fenders, Mooring Accessories.<br>**Navigational Aids**<br>Navigational Aids: Requirements of signals, fixed navigation structures, necessity of navigational aids, light houses, beacon lights, floating navigational aids, light ships, buoys, radar. | 7 |
| VI | **Port Facilities**<br>Port development, port planning, port building facilities, transit sheds, warehouses, cargo handling facilities, container handling terminal facilities, shipping terminals, inland port facilities. Inland waterways, Inland water transportation in India, classification of waterways, economics of inland waterways transportation, national waterways.<br>**Environmental Impact assessment**<br>Environmental consideration in dock and harbour projects, baseline assessment, Monitoring Assessment of impact, Mitigation measure.Case studies in India. | 7 |

| **Text Books** | |
|---|---|
| 1 | Saxena S.C., Tunnel Engineering, Dhanpat Rai & Sons, New Delhi, 1st Edition, 1984. |
| 2 | Srinivasan R., Harbour, Dock And Tunnel Engineering, Charotar Publishing, 30th Edition 2022 |

| **References** | |
|---|---|
| 1 | Megaw T. M. and Bartlett J., Tunnels Planning, Design, Construction, EHJW, 1st Edition 1981 |
| 2 | B. Maidi, M.Thews and U.Maidi, Handbook of Tunnel Engineering, Volume 1 |
| 3 | Jarvis A., Port and Harbour Engineering, Ashgate, 1st Edition, 1998 |

| **Useful Links** | |
|---|---|
| 1 | https://www.youtube.com/watch?v=MfkIm7qBiPk |
| 2 | https://www.youtube.com/watch?v=VE_xMqMp0k&list=PLSsfsY90RszGPQ1lCN4qpV5HvcYvgOqFs |

**CO-PO Mapping**

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

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

**Assessment**

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

# Walchand College of Engineering, Sangli

*(Government Aided Autonomous Institute)*

**AY 2024-25**

| **Course Information** | |
|---|---|
| **Programme** | B. Tech. (Civil Engineering) |
| **Class, Semester** | Final Year, B. Tech. VII |
| **Course Code** | 6CV416 |
| **Course Name** | Integrated Waste Management for Smart City |
| **Desired Requisites:** | Waste Management and Pollution Control |

| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | 03 Hrs/week | **MSE** | **ISE** | **ESE** | **Total** |
| **Tutorial** | - | 30 | 20 | 50 | 100 |
| **Practical** | - | | | | |
| **Interaction** | - | **Credits: 03** | | | |

**Course Objectives**

| | |
|---|---|
| 1 | To provide the knowledge about fundamental components, and concept of circular economy for solid waste management. |
| 2 | To choose appropriate technologies and strategies regarding collection and transport of solid waste to the context of smart cities. |
| 3 | To appraise various treatment and disposal methods and technologies for solid waste. |
| 4 | To discuss policies, rules and regulations regarding solid waste management. |

**Course Outcomes (CO)**

| CO | Description | Blooms Taxonomy | |
|---|---|---|---|
| | | Descriptor | Level |
| CO1 | Explain the fundamental components and concept of a circular economy for solid waste management. | Understanding | II |
| CO2 | Choose appropriate technologies and strategies regarding the collection and transport of solid waste in the context of smart cities. | Applying | III |
| CO3 | Evaluate various treatment and disposal methods and technologies for solid waste. | Analysing | IV |
| CO4 | Explain policies, rules and regulations regarding solid waste management. | Understanding | II |

| **Module** | **Module Contents** | **Hours** |
|---|---|---|
| I | **Introduction to Solid Waste Management in Smart Cities:**<br>overview of solid waste management, functional elements of solid waste management, Importance of integrated waste management in smart cities<br>Challenges and opportunities in managing solid waste in urban areas<br>Role of technology and innovation in smart waste management | 7 |
| II | **Waste Generation and Composition Analysis:**<br>factors influencing waste generation in urban areas, Methods for waste characterization and composition analysis, Understanding the types and quantities of waste generated in smart cities, case studies on waste composition analysis in different urban settings | 6 |
| III | **Collection and Transportation Systems:**<br>different waste collection and transport systems, design and planning parameters of efficient waste collection systems, technologies for optimizing waste collection routes, IoT and GPS for real-time monitoring of waste collection vehicles<br>best practices in waste transportation and transfer stations | 6 |

| | | |
|---|---|---|
| IV | **Treatment and Disposal Technologies:** overview of waste treatment technologies (e.g., composting, anaerobic digestion, recycling, waste-to-energy), selection criteria for appropriate treatment technologies in smart cities, case studies on successful waste treatment and disposal projects, environmental and economic considerations in waste treatment and disposal | 7 |
| V | **Resource Recovery and Circular Economy:** concept of resource recovery and circular economy in waste management, strategies for recovering valuable resources from waste streams, implementation of waste-to-resource initiatives in smart cities, role of stakeholders in promoting circular economy principles | 6 |
| VI | **Policy, Regulations, and Public Participation:** regulatory frameworks and policies governing solid waste management in smart cities, importance of public participation and community engagement in waste management, case studies on successful waste management policies and regulations, strategies for promoting public awareness and behaviour change towards sustainable waste management practices | 6 |

| **Text Books** | |
|---|---|
| 1 | George Tchobanoglous, Hilary Theisen, and Samuel Vigil, "Integrated Solid Waste Management: Engineering Principles and Management Issues", Mc Graw Hill publications, Edition 2014. |
| 2 | Sunil Kumar, "Municipal Solid Waste Management in Developing Countries", CRC Press publications, 1st Edition 2016. |

| **References** | |
|---|---|
| 1 | George Tchobanoglous, Frank Kreith, and Marcia E. Williams, "Handbook of Solid Waste Management", Mc Graw Hill publications, 2nd Edition. 2002. |
| 2 | "Solid Waste Engineering: A Global Perspective", CL Engineering publications, 3rd edition, 2016 |

| **Useful Links** | |
|---|---|
| 1 | https://www.youtube.com/watch?v=jZhEe4q2GzE&list=PLwdnzlV3ogoXAap_BHeApkcF7M8nt13hv&index=4 |
| 2 | https://www.youtube.com/watch?v=mnontR8NKqk&list=PLwdnzlV3ogoXAap_BHeApkcF7M8nt13hv&index=11 |
| 3 | https://www.youtube.com/watch?v=yTYm5IuO6gg&list=PLwdnzlV3ogoXAap_BHeApkcF7M8nt13hv&index=18 |

**CO-PO Mapping**

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

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

**Assessment**

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

Prepared by DAC/BoS Secretary Head/BoS Chairman

# Walchand College of Engineering, Sangli

*(Government Aided Autonomous Institute)*

**AY 2024-25**

## Course Information

| | |
|---|---|
| **Programme** | B. Tech. (Civil Engineering) |
| **Class, Semester** | Final Year B. Tech., Sem VII |
| **Course Code** | 6CV418 |
| **Course Name** | Professional Elective 4: Highway Construction & Pavement Design |
| **Desired Requisites:** | Highway Engineering, Soil Mechanics |

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

## Course Objectives

| | |
|---|---|
| **1** | To introduce highway pavements, design concepts and material properties. |
| **2** | To enable students to carry out the design of bituminous mixes, analyse and design flexible and rigid highway pavements. |
| **3** | To introduce the concepts of pavement evaluation and rehabilitation. |

## Course Outcomes (CO) with Bloom's Taxonomy Level

| **CO** | Description | Blooms Taxonomy | |
|---|---|---|---|
| | | Descriptor | Descriptor |
| **CO1** | Perceive and apply the knowledge of the pavement components and design bituminous mixes. | Understanding | II & III |
| **CO2** | Articulate and apply concepts of flexible and rigid pavements. | Understanding | II & III |
| **CO3** | Analyze and design flexible and rigid pavements. | Analyzing and creating | IV & VI |
| **CO4** | Evaluate the structural condition of the pavement. | Evaluating | V |

| **Module** | **Module Contents** | **Hours** |
|---|---|---|
| I | Introduction to highway pavements, Types and component parts of pavements, Factors affecting design and performance of pavements, Functions and significance of sub-grade properties, Various methods of assessment of sub-grade soil strength for pavement design, Mix design procedures in mechanical stabilization of soils, Design of bituminous mixes by Marshall, Hubbard - field and Hveem's methods | 7 |
| II | Introduction to analysis and design of flexible pavements, Stresses and deflections in homogeneous masses, Burmister's 2-layer and 3-layer theories, Wheel load stresses, ESWL of multiple wheels, Repeated loads and EWL factors | 8 |
| III | Empirical, semi-empirical and theoretical approaches for flexible pavement design, Group index, CBR, Triaxial, Mcleod and Burmister layered system methods | 7 |
| IV | Introduction to analysis and design of rigid pavements, Types of stresses and causes, Factors influencing stresses, General conditions in rigid pavement analysis, Warping stresses, Frictional stresses, Combined stresses | 6 |
| V | Joints in cement concrete pavements, Joint spacings, Design of slab thickness, Design and detailing of longitudinal, contraction and expansion joints, IRC methods of Design | 6 |
| VI | Introduction to pavement evaluation, Structural and functional requirements of flexible and rigid pavements, Quality control tests for highway pavements, Evaluation of pavement structural condition by Benkelman beam, rebound deflection and plate load | 6 |

| | | |
|---|---|---|
| | tests, Introduction to design of pavement overlays and the use of geosynthetics | |
| | | |
| **Text Books** | | |
| 1 | Yoder and Witezak, Principles of Pavement design, John Wiley and sons, second edition,1975. | |
| 2 | Yang, Design of functional pavements, McGraw- Hill,1972. | |
| 3 | Khanna S. K. & Justo C. E. G., Highway Engineering, Nemchand & Bros, 9e. | |
| 4 | Hass & Hudson, 'Pavement Management System', McGraw Hill Book Co, 1978. | |
| | | |
| **References** | | |
| 1 | IRC: 37 - 2001, 'Guidelines for the Design of Flexible Pavements'. | |
| 2 | IRC: 58 – 2002, 'Guidelines for the Design of Rigid Pavements'. | |
| 3 | IRC: 37-2012, 'Tentative Guidelines for the Design of Flexible Pavements'. | |
| 4 | IRC: 58-2011, Guidelines for Design of Plain Jointed Rigid Pavements for Highways. | |
| | | |
| **Useful Links** | | |
| 1 | https://civildigital.com/pavement-design-road-construction-design-parameters/ | |
| 2 | https://www.civil.iitb.ac.in/tvm/1100_LnTse/401_lnTse/plain/plain.html | |
| 3 | https://nptel.ac.in/courses/105/104/105104098/ | |
| 4 | https://www.youtube.com/watch?v=3oNa9Z94Hiw | |
| 5 | https://www.youtube.com/watch?v=-qYRWWbIcCI | |
| 6 | https://nptel.ac.in/content/storage2/courses/105101087/downloads/Lec-28.pdf | |

**CO-PO Mapping**

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

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

**Assessment**

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

Prepared by DAC/BoS Secretary Head/BoS Chairman

# Walchand College of Engineering, Sangli

*(Government Aided Autonomous Institute)*

**AY 2024-25**

**Course Information**

| | |
|---|---|
| **Programme** | B. Tech. (Civil Engineering) |
| **Class, Semester** | Final Year B. Tech., Sem VII |
| **Course Code** | 6CV419 |
| **Course Name** | Professional Elective 4: Maintenance and Rehabilitation of Structures |
| **Desired Requisites:** | Strength of Materials, Building Materials and Construction |

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

**Course Objectives**

| | |
|---|---|
| 1 | To enable students to inspect and identify the damages in civil engineering structures. |
| 2 | To make students conversant with the techniques for repair, strengthening and retrofitting of structures. |
| 3 | Prepare the estimate of maintenance, repairs rehabilitation and strengthening of the structure. |

**Course Outcomes (CO)**

| CO | Description | Bloom's Taxonomy | |
|---|---|---|---|
| | | Descriptor | Level |
| CO1 | Understand different causes of damage and decide the appropriate technique of repair. | Understanding | 2 |
| CO2 | Identify the causes of failure of masonry buildings and R.C.C. buildings. | Remembering | 1 |
| CO3 | Distinguish between strengthening and retrofitting and employ the appropriate techniques accordingly. | Understanding | 2 |
| CO4 | Compute strength and age of building, and prepare estimates and tenders for maintenance and repair of structures. | Applying | 3 |

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

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

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

| **References** | |
|---|---|
| 1 | Shrikhande and Agrawal, "Earthquake resistant Design of Structures", 1st edition, PHI Learning Pvt. Ltd., 2006. |
| 2 | S. K. Duggal, "Earthquake Resistant Design of Structures" 3ed Edition, Oxford UniversityPress, 2007. |

| **Useful Links** | | |
|---|---|---|
| 1 | https://archive.nptel.ac.in/courses/105/105/105105213/ | (IIT Kharagpur) |
| 2 | https://archive.nptel.ac.in/courses/105/106/105106202/ | (IIT Madras) |

| CO-PO Mapping | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Programme Outcomes (PO) | | | | | | | | | | | | PSO | |
| COs | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| CO1 | | | 1 | | 1 | | | | | | | | | 2 |
| CO2 | | | | 2 | | | | | | | | | | 2 |
| CO3 | | | 2 | | 2 | | | | | | | | | 2 |
| CO4 | | | 2 | | 2 | | | | | | | | | 2 |
| The strength of mapping: - 1: Low, 2: Medium, 3: High | | | | | | | | | | | | | | |

**Assessment**

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

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

# Walchand College of Engineering, Sangli

*(Government Aided Autonomous Institute)*

**AY 2024-25**

**Course Information**

| | |
|---|---|
| **Programme** | B. Tech. (Civil Engineering) |
| **Class, Semester** | Final Year B.Tech. VII |
| **Course Code** | 6CV420 |
| **Course Name** | PE 4: Computer Applications in Structural Engineering |
| **Desired Requisites:** | Strength of Materials, Structural Analysis, RCC |

| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | 3 Hrs/week | **MSE** | **ISE** | **ESE** | **Total** |
| **Tutorial** | - | 30 | 30 | 40 | 100 |
| **Practical** | - | | | | |
| **Interaction** | - | **Credits: 3** | | | |

**Course Objectives**

| | |
|---|---|
| 1 | To provide knowledge of numerical approaches and the significance of analysis by computers |
| 2 | To provide the necessary knowledge of numerical tools required for analysing and solving problems in structural design and analysis. |
| 3 | To train the students in the basic use of commercial software in structural analysis and design. |
| 4 | To enhance students' programming skills through the writing of programs for structural applications. |

**Course Outcomes (CO)**

| CO | Description | Blooms Taxonomy | |
|---|---|---|---|
| | | Descriptor | Level |
| CO1 | Explain the use of different softwares and their basic capabilities in Structural engineering. | Explain | nl |
| CO2 | Design and analysis of RCC structural members using MS Excel or softwares such as STAAD.pro, ETABS etc. | Analysing | 4 |
| CO3 | Development of a subroutine functions and small program for analysis of a structural members. | Creating | 6 |
| CO4 | Development of Finite Element model of 2D and Continuum structures in software. | Creating | 6 |

| **Module** | **Module Contents** | **Hours** |
|---|---|---|
| I | **Introduction to Computer Applications in Structural Engineering:** Reasons for Computer-based design and analysis of structures, Computer tools in structural analysis and design, Introduction to software such as ETABS, SAP200-and STAAD.Pro, ABAQUS, ANSYS etc., Comparison and applications of different softwares | 6 |
| I | **Application of MS Excel in Structural Design:** Review of IS codes for RCC design (IS 456:2000, IS 875 parts I-V, IS 13920:2016) Illustration of design of various structural elements like, Slabs, Beams, Columns using Microsoft Excel | 7 |
| III | **Analysis and design of 2D structures using softwares:** Review of basics of structural analysis, User-interface capabilities of STAAD.pro, SFD and BMD of beams, columns and rigid frames using STAAD.pro, Interpreting and handling results from software output. Review of basics of RCC design, Design steps in softwares such as STAAD.pro, ETABS, Illustration of design of beams, columns, Interpretation of software outputs | 7 |
| IV | **Use of Programming Language for analysis of Beam:** Review of matrix methods of analysis, Introduction to MATLAB, Syntax and commands in MATLAB, Stiffness, Loading, Boundary condition arrays, | 6 |

| | | |
|---|---|---|
| V | **Analysis of Beam using stiffness method in MATLAB:**<br>Creating input file, calling inputs, Creating Function for joints, member properties, Loading, Stiffness Matrix, Illustration of analysis of 2D beam with different loads using the Program | 6 |
| VI | **Finite element modelling in software:**<br>Fundamentals of Finite Element analysis, Steps in finite element modelling, Types of elements, Introduction to ABAQUS/ ANSYS, Steps for FE modelling of structures in ABAQUS/ANSYS, Analysis of 2D beam in ABAQUS/ANSYS | 6 |

**Text Books**

| | |
|---|---|
| 1 | Devdas Menon, and S. Pillai, Reinforced Concrete Design - The MC Graw Hill company Third Ed–2009 |
| 2 | Pandit and Gupta "Structural Analysis", Tata MC Graw Hill Book company |
| 3 | Chapman, “MATLAB programming for Engineers”, Cengage Learning, |

**References**

| | |
|---|---|
| 1 | Steven Chapra and Raymond Canale, “Numerical methods for Engineers:” McGrew Hill Publication, 7th Edition 2015. |

**CO-PO Mapping**

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

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

**Assessment**

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

Prepared by DAC/BoS Secretary Head/BoS Chairman

# Walchand College of Engineering, Sangli

*(Government Aided Autonomous Institute)*

**AY 2024-25**

| **Course Information** | |
|---|---|
| **Programme** | B. Tech. (Civil Engineering) |
| **Class, Semester** | Final Year B. Tech., Semester VII |
| **Course Code** | 6CV454 |
| **Course Name** | Problem-Based Laboratory |
| **Desired Requisites:** | |

| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | - | **LA1** | **LA2** | **ESE** | **Total** |
| **Tutorial** | - | 30 | 30 | 40 | 100 |
| **Practical** | 4 hrs./week | | | | |
| **Interaction** | - | **Credits: 2** | | | |

**Course Objectives**

| | |
|---|---|
| **1** | To inculcate problem-solving attitude in students. |
| **2** | To provide the students with hands-on practice of various Civil Engineering software |

**Course Outcomes (CO)**

| **CO** | **Description** | **Blooms Taxonomy** | |
|---|---|---|---|
| | | **Descriptor** | **Level** |
| **CO1** | ***Identify*** societal/engineering problems. | Remember | I |
| **CO2** | ***Collect*** the data required for field-based/analytical problem identified for the study | Create | VI |
| **CO3** | ***Design/decide*** the methodology for experimental/analytical work | Evaluate<br>Create | V<br>VI |
| **CO4** | ***Study*** the problem and ***recommend*** alternative methods/measures to solve the problem using suitable software/tools. | Apply<br>Analyze | III<br>IV |

**List of Experiments / Lab Activities**

**Students are expected to select any societal/engineering problem and provide a solution to it preferably using a software/tool.** Process given below shall be followed:

1. **Identification of problem (field-based or analytical)**
2. **Data collection**
   a. For field-based problems:
      Site visits
      Observations
      Sample collection
      Interaction
   b. For analytical problem:
      Selection of tool/software
      Use of tool/software
3. **Methodology**
   a. Design/finalize the experiment
   b. Finalize and document the procedure/process of experimentation
4. **Actual work**
   a. Experimental work
   b. Simulation/modelling/design/analysis

5. **Remedial measures/solution**
   a. Alternatives methods/measures to solve the problem
   **b.** Discussion on an alternative scenario
6. **Conclusion**

| **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 | | | | 1 | | | 1 | | | | | |
| **CO2** | | | 2 | 3 | | | | | 1 | | | | | |
| **CO3** | | | 2 | 3 | | 1 | | | 1 | | | | | |
| **CO4** | | | 3 | | 3 | 1 | 1 | | 1 | | | | 2 | |

| **Assessment** | | | | |
|---|---|---|---|---|
| Students are expected to work in groups of 3-5 for this laboratory<br>There are three components of lab assessment, LA1, LA2 and ESE.<br>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<br>Marks Submission at the end of Week 5 | 30 |
| LA2 | Lab activities, attendance, journal | Lab Course Faculty | During Week 5 to Week 8<br>Marks Submission at the end of Week 9 | 30 |
| ESE | Lab activities, attendance, journal | Lab Course Faculty | During Week 10 to Week 14<br>Marks Submission at the end of Week 14 | 40 |
| Week 1 indicates starting week of Semester.<br>Lab activities/Lab performance will include presentations, drawings, programming and other suitable activities, as per the nature and requirement of the project selected. | | | | |

| Prepared by | DAC/BoS Secretary | Head/BoS Chairman |
|---|---|---|

# Walchand College of Engineering, Sangli

*(Government Aided Autonomous Institute)*

**AY 2024-25**

**Course Information**

| | |
|---|---|
| **Programme** | B. Tech. (Other than Civil Engineering) |
| **Class, Semester** | Final Year B. Tech., Sem. VII |
| **Course Code** | |
| **Course Name** | Open Elective 3: Environmental Management Systems |
| **Desired Requisites:** | - |

| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | 03 Hrs/week | **MSE** | **ISE** | **ESE** | **Total** |
| **Tutorial** | - | 30 | 20 | 50 | 100 |
| **Practical** | - | | | | |
| **Interaction** | - | **Credits: 03** | | | |

**Course Objectives**

| | |
|---|---|
| 1 | To provide knowledge of ecological aspects, ethics legislation and certifications pertaining to environment |
| 2 | To familiarize students with auditing and impact assessment tools |

**Course Outcomes (CO)**

| CO | Description | Blooms Taxonomy | |
|---|---|---|---|
| | | Descriptor | Level |
| CO1 | ***Explain*** ecological aspects and effects due to various types of pollution | Understanding | II |
| CO2 | ***Perceive*** environmental ethics and legislation. | Understanding | II |
| CO3 | ***Choose*** appropriate methodology for EIA and auditing and assess the impacts. | Applying | III |
| CO4 | Explain benefits and processes of different certifications. | Understanding | II |
| CO5 | ***Implement*** EMS and Environmental Management Plan for infrastructural facilities. | Applying | IV |

| **Module** | **Module Contents** | **Hours** |
|---|---|---|
| I | **Ecological Aspects and types of Pollution**<br>Ecological aspects: Salient features of major Ecosystems, Energy Transfer, Population Dynamics, Ecological imbalance, Preservation of Biodiversity. Land Pollution, Water Pollution due to sewage, industrial effluents and leachate, Pollution due to Nuclear Power Plants, Radioactive Waste, Thermal pollution, causes and control.<br>Noise Pollution: Decibel Levels, Monitoring, Hazards, Control measures. | 7 |
| II | **Environmental Ethics and Legislation**<br>Environmental Ethics: Ethics in society, Environmental consequences, Responsibility for environmental degradation, Ethical theories and codes of Ethics, Changing attitudes, Sustainable development.<br>Environmental Legislation: Water (prevention and control of pollution) act 1974, The environmental act 1986, The Noise Pollution (Regulation and Control) Rules, 2000. Environmental economics. | 7 |
| III | **Environmental Impact Assessment (EIA)**<br>Definitions and Concept, Scope, Objectives, Types of impacts, Elements of EIA, Baseline studies. Methodologies of EIA, Prediction of impacts and its methodology, Uncertainties in EIA, Status of EIAs in India. | 6 |

| | | |
|---|---|---|
| IV | **Environmental Auditing**<br>Definitions and concepts, Scope and Objectives, Types of audit, Accounts audit, Environmental audit statement, Qualities of environment auditor. Environmental Impact Statement (EIS). | 6 |
| V | **ISO Standards**<br>ISO and ISO 14000 Series: Introduction, Areas covered in the series of standards, Necessity of ISO certification.<br>Environmental management system: Evolution, Need, Elements, Benefits, ISO 14001 requirements, Steps in ISO 14001 certification, ISO 14001 and sustainable development, Integration with other systems (ISO 9000, TQM, Six Sigma), Benefits of integration. | 6 |
| VI | **Environmental Management Plan**<br>Definition, Importance, Development, Structuring, Monitoring, Cost aspects. Strategy for siting of Industries, Eco-Labelling, Life-Cycle Assessment. | 6 |

**Text Books**

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

**References**

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

**Useful Links**

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

**CO-PO Mapping**

| | **Programme Outcomes (PO)** | | | | | | | | | | | | **PSPO** | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COs | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| **CO1** | 3 | | | | | | 2 | | | | | | 1 | |
| **CO2** | 3 | | | | | | 2 | | | | | | 1 | |
| **CO3** | 3 | | | | | | 2 | | | | | | 1 | |
| **CO4** | 3 | | | | | | 2 | | | | | | 1 | |
| **CO5** | 3 | | | | | | 2 | | | | | | 1 | |

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

**Assessment**

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

| Prepared by | DAC/BoS Secretary | Head/BoS Chairman |
|---|---|---|

# Walchand College of Engineering, Sangli

*(Government Aided Autonomous Institute)*

**AY 2022-23**

| **Course Information** | |
|---|---|
| **Programme** | B. Tech. (All Branch) |
| **Class, Semester** | Final Year B. Tech., Sem I & II |
| **Course Code** | |
| **Course Name** | Constitution of India |
| **Desired Requisites:** | |

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

| **Course Objectives** | |
|---|---|
| **1** | To review and create awareness on various provisions in the constitution of India. |

**Course Outcomes (CO) with Bloom's Taxonomy Level**

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

| | | |
|---|---|---|
| **CO1** | Explain the premises informing the twin themes of liberty and freedom from a civil rights perspective. | understand |
| **CO2** | Address the growth of Indian opinion regarding modern Indian intellectuals constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism | understand |
| **CO3** | Address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution | understand |

| **Module** | **Module Contents** | **Hours** |
|---|---|---|
| I | History of Making of the Indian Constitution Drafting Committee, (Composition & Working | 4 |
| II | **Philosophy of the Indian Constitution :** Preamble, Salient Feature | 4 |
| III | **Contours of Constitutional Rights:** Fundamental Rights; Right to Equality; Right to Freedom; Right against Exploitation; Right to Freedom of Religion; Cultural and Educational Rights; Right to Constitutional Remedies; Directive Principles of State Policy; Fundamental Duties. | 5 |
| IV | **Organs of Governance:** Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions | 5 |

| **CO-PO Mapping** | |
|---|---|
| | **Programme Outcomes (PO)** |

| | | |
|---|---|---|
| V | **Local Administration:** District"s Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Pachayati raj: Introduction, PRI: Zila Pachayat. Elected officials and their roles, CEO ZilaPachayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of<br>Elected and Appointed officials, Importance of grass root democracy | 5 |
| VI | **Election Commission:**<br>Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning.<br>Institute and Bodies for the welfare of SC/ST/OBC and women. | 5 |

| | | |
|---|---|---|
| **Text Books** | | |
| 1 | Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015. | |
| 2 | M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014 | |
| 3 | D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015 | |
| | | |
| **References** | | |
| 1 | The Constitution of India, 1950 (Bare Act), Government Publication | |
| | | |
| **Useful Links** | | |
| 1 | https://en.wikipedia.org/wiki/Constituent_Assembly_of_India | |
| 2 | https://nptel.ac.in/courses/129/106/129106003/ | |
| 3 | https://nptel.ac.in/noc/courses/noc20/SEM2/noc20-lw02/ | |
| 4 | https://eci.gov.in/about/about-eci/the-functions-electoral-system-of-india-r2/ | |

| **Assessment** |
|---|
| The assessment is based on 2 in-semester examinations in the form of MSE 30 and ISE of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 50 marks. MSE shall be typically on modules 1 and 2, ISE 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 (Marks) For Theory Course** | | | | | |
|---|---|---|---|---|---|
| **Bloom's Taxonomy Level** | | **MSE** | **ISE** | **ESE** | **Total** |
| 1 | Remember | | | | |
| 2 | Understand | | | | |
| 3 | Apply | 30 | 20 | 50 | **100** |
| 4 | Analyze | | | | |
| 5 | Evaluate | | | | |
| 6 | Create | | | | |
| **Total** | | **30** | **20** | **50** | **100** |

# Walchand College of Engineering, Sangli

*(Government Aided Autonomous Institute)*

**AY 2024-25**

**Course Information**

| | |
|---|---|
| **Programme** | B. Tech. (Civil Engineering) |
| **Class, Semester** | Final Year B.Tech. |
| **Course Code** | 6CV421 |
| **Course Name** | Sustainable and Energy Efficient Building Technologies |
| **Desired Requisites:** | Building Materials and Construction, Building Planning and Design |

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

**Course Objectives:** The course is designed to

| | |
|---|---|
| 1 | Introduce the class the scientific and engineering principles of energy and usstainable energy alternatives. |
| 2 | impress upon the integration of modern materials and traditional techniques to bring about cost effectiveness, energy efficiency and environmental friendly technologies in construction industry. |
| 3 | meet the objectives of green building concepts during the construction phase and operational phase. |

**Course Outcomes (CO)**

| CO | Description | Blooms Taxonomy | |
|---|---|---|---|
| | | Descriptor | Level |
| CO1 | Perceive and explain concepts in the language of energy, and express the relevance of environment and energy efficiency in context to construction industry | Understand | 2 |
| CO2 | Calculate and assign the energy contribution of various materials and components in buildings. | Apply | 2 |
| CO3 | Ability to apply alternative/environmental friendly/ energy efficient building systems using conventional/modern/waste materials leading to better efficiency in context to embodied energy and thermal comfort. | Apply | 2 |
| CO4 | Apply the concept of heat exchange in buildings and adopt passive and active design strategies for human comfort in buildings. | Apply | 2 |

| Module | Module Contents | Hours |
|---|---|---|
| I | **Module 1: Energy and Environment**<br>Energy, planning & urban form, Global warming, causes, energy considerations, energy conservation and energy efficiency, energy systems and spatial structures, Classification of energy, primary and secondary energy, commercial and non-commercial energy, renewable and non-renewable energy, Global primary energy reserves and consumption, energy distribution, Units of Energy with examples. | 5 |
| II | **Module 2: Energy and Environmental issues in Building Materials**<br>General facts, energy resources and their impacts on environment, energy in context to built environment, Sustainable buildings, Objectives of Green buildings, planning aspects of sustainable buildings, energy consumption and efficiency in buildings, Design strategies, Material strategies, Parametric assessment, Env. Issues related to buildings materials, Green Rating Standards (Griha and ECBC). | 6 |
| III | **Module 3: Conventional Materials and Techniques in Buildings**<br>Constraints in Choice of building systems, Pre & post construction performance, Properties of materials, Types of Physical, Mechanical, Chemical and Thermal characteristics, Introduction to structural and physical aspects of buildings, Conventional materials used in construction, Case studies of various building materials, Energy consumption in various building materials, Sustainability considerations. | 6 |

| | | |
|---|---|---|
| IV | **Module 4: Sustainable Materials and Techniques for Masonry**<br>Felt requirements and real objectives of Green towns, Energy scenario in pre and post independent India, Need and approach to sustainability, Green building materials, Design constraints,<br>Appropriate materials and techniques in construction: Relevance of building blocks, mortars. Stabilized mud blocks, FAL-G blocks, Hollow concrete blocks, Calcium silicate bricks, Hourdi blocks, Energy comparison in building blocks, Structural relevance of combination mortars for masonry, Building Materials from Agro and Industrial waste, Biomass resources, treated thatch, Industrial wastes, | *6* |
| V | **Module 5: Roofing concepts in Green Buildings**<br>Structural inefficiencies in Conventional roofing systems, Concepts in roofing alternatives, Thatch roofs, Filler slab roofs, Filler materials, Composite beam-panel roofs / floors, hollow hourdi/concrete block roofs / floors, Ferrocement roofing systems, Masonry Domes and Vaults, Comparison of Energy consumption in roofing systems, Energy Embodied energy in buildings. | *6* |
| VI | **Module 6: Energy systems in Building Maintenance**<br>Elements of climate, Factors influencing climate, Climate and human comfort, Orientation of buildings, Comfort criteria, Heat exchange in buildings, Design for heat loss and heat gain in buildings, Concepts of Active and Passive Energy systems in Buildings, Use of modern gadgets leading to energy efficiency, Influence of Building materials and components on thermal comfort, Green Cover, Introduction to Rain water harvesting. | *6* |

| **Text Books** | |
|---|---|
| 1 | Alternative Building materials and Technologies by K.S. Jagadish, B.V.Venkatarama Reddy, K. S. Nanjunda Rao, New Age International, 2017, 2nd Ed. |
| 2 | Manual of tropical Housing and Building- Climatic Design by Koenigsberger, Ingersoll, Mayhew, Szokolay, Universities Press (India) Pvt. Ltd., 2012 |
| 3 | Passive and Low Energy Building Design for Tropical Island Climates- by N. V. Baker, Published by Commonwealth Secretraiat Publications, copyright May 1987. |

| **References** | |
|---|---|
| 1 | Building with Earth, John Norton, Intermediate Technology Pub., 1997. |

| **Useful Links** | |
|---|---|
| 1 | |

**CO-PO Mapping**

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

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

**Assessment**

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

| Prepared by Dr. K. S. Gumaste | DAC/BoS Secretary | Head/BoS Chairman |
|---|---|---|

# Walchand College of Engineering, Sangli

*(Government Aided Autonomous Institute)*

**AY 2024-25**

## Course Information

| | |
|---|---|
| **Programme** | B. Tech. (Civil Engineering) |
| **Class, Semester** | Final Year B.Tech., Sem VIII |
| **Course Code** | 6CV492 |
| **Course Name** | Project-II |
| **Desired Requisites:** | |

| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | - | **MSE** | **ISE** | **ESE** | **Total** |
| **Tutorial** | - | 30 | 30 | 40 | 100 |
| **Practical** | 12 Hrs/week | | | | |
| **Interaction** | - | **Credits: 6** | | | |

## Course Objectives

| | |
|---|---|
| 1 | To impart knowledge to the students to analyze the real-world problems and provide designs/solution. |
| 2 | To make students work in a team, follow professional ethics, and develop leadership and presentation skills. |

## Course Outcomes (CO)

| CO | Description | Blooms Taxonomy | |
|---|---|---|---|
| | | Descriptor | Level |
| CO1 | Conduct the necessary analytical/experimental work to provide a solution / develop parametric relation/ design, as per the designed objectives of the project. | Analyze/ Evaluate/ Create | 4/5/6 |
| CO2 | Develop expertise in using modern tools/laboratory instruments to produce experimental results for the defined objectives. | Analyze /Evaluate | 4//5 |
| CO3 | Exhibit adequate skills as an individual/team to analyze, evaluate and arrive at conclusions of the studies conducted, and communicate effectively. | Analyze/ Evaluate | 4/5 |
| CO4 | Work in a team to complete the objectives of the project work and present it to the evaluation committee. | Evaluate | 5 |
| CO5 | Preparation of a project report for the work done, including Problem Statement, Methodology, Results, Discussions and Conclusions. | Create | 6 |

## Module Contents

1. The students shall conduct experimental/analytical work in the institute or outside depending on the topic of their study.
2. The project work shall be carried out in the respective laboratories using the equipment necessary for the execution of the defined objectives of the work.
3. The results obtained shall be analyzed through the appropriate mathematical and statistical tools and techniques, and the results shall be compared with the literature.
4. The appropriate discussions on the obtained results and conclusions shall be documented in the report.
5. The students shall give Presentations on their project work to the internal and external evaluation committee and submit of the detailed project report of the work done.

## Text Books

| | |
|---|---|
| 1 | Guide to Research Projects for Engineering Students: Planning, Writing, Presenting, Kenneth Keng Wee Ong, CRC Press, Taylor and Francis Publications. |

## References

| | |
|---|---|
| 1 | R.C. Kothari, Research Methodology, New Age Publications, 2nd Edition |
| 2 | Technical Journals and Conference proceedings etc. pertaining to area of the project. |
| 3 | Dissertations of B.Tech./ M.Tech. Project work of previous students of department/institute |

| CO-PO Mapping | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Programme Outcomes (PO) | | | | | | | | | | | | PSPO | |
| COs | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| **CO1** | 3 | 3 | | | | 3 | 2 | 1 | | | 3 | 2 | 3 | |
| **CO2** | | 1 | | 1 | 1 | | | | | | | 1 | 3 | |
| **CO3** | | | | | 1 | | | 3 | 3 | 2 | | 1 | 3 | |
| **CO4** | | 2 | | 3 | | | | | 3 | | | | | |
| **CO5** | | | | | | | | | | 3 | | 3 | | |
| The strength of mapping: - 1: Low, 2: Medium, 3: High | | | | | | | | | | | | | | |

| Assessment | | | | |
|---|---|---|---|---|
| The Project work will be evaluated in three stages LA1, LA2 and ESE as given below: | | | | |
| **Assessment** | **Activity Related to** | **Conducted by** | **Typical Schedule** | **Marks** |
| LA1 | CO1, CO2 | Guide and Internal panel | During Week 1 to Week 6<br>Marks Submission at the end of Week 6 | 30 |
| LA2 | CO2, CO3 | Guide and Internal panel | During Week 6 to Week 12<br>Marks Submission at the end of Week 12 | 30 |
| Lab ESE | CO1, CO2, CO3, CO4 and CO5 | Guide and External examiner | During Week 12 to Week 18<br>Marks Submission at the end of Week 18 | 40 |
| The assessment of the students will be done individually by the respective supervisor/guide and in a group by the panel using the defined rubrics. | | | | |

| Prepared by | DAC/BoS Secretary | Head/BoS Chairman |
|---|---|---|

# Walchand College of Engineering, Sangli

*(Government Aided Autonomous Institute)*

**AY 2024-25**

**Course Information**

| | |
|---|---|
| **Programme** | B. Tech. (Civil Engineering) |
| **Class, Semester** | Final Year B. Tech., Semester VIII |
| **Course Code** | 6CV431 |
| **Course Name** | Professional Elective 5: Structural Health Monitoring |
| **Desired Requisites:** | Solid Mechanics, Concrete Technology, Structural Analysis |

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

**Course Objectives**

| | |
|---|---|
| 1 | To develop proficiency in the use of various SHM technologies and tools for assessing the condition and performance of structures. |
| 2 | To enhance skills in data collection, analysis, and interpretation for making informed decisions regarding structural integrity and maintenance. |
| 3 | To apply SHM techniques to real-world problems, ensuring the safety, reliability, and longevity of civil engineering structures. |

**Course Outcomes (CO)**

| CO | Description | Blooms Taxonomy | |
|---|---|---|---|
| | | Descriptor | Level |
| CO1 | Demonstrate a comprehensive understanding of the principles and techniques of structural health monitoring (SHM) and their importance in civil engineering. | Applying | 3 |
| CO2 | Analyze the need and challenges of Structural Health Monitoring. | Applying | 3 |
| CO3 | Describe various methods of damage detection. | Analysing | 4 |
| CO4 | Apply the Structural Health Monitoring technique for the building. | Applying | 3 |

| **Module** | **Module Contents** | **Hours** |
|---|---|---|
| I | **Introduction to Structural Health Monitoring**<br>Concepts and Definitions: Understanding the need for SHM, key concepts, and terminology. | 6 |
| II | **Importance and Application**<br>Benefits and applications of SHM in civil engineering, including safety, maintenance, and lifecycle management.<br>Historical Perspective: Evolution of SHM techniques and technologies. | 6 |
| III | **SHM Techniques and Technologies**<br>Non-Destructive Testing (NDT): Overview of NDT methods such as ultrasonic testing, radiography, magnetic particle testing, and eddy current testing.<br>Sensors and Instrumentation: Types of sensors used in SHM (e.g., strain gauges, accelerometers, displacement sensors), sensor placement, and data acquisition systems. | 8 |
| IV | **Structural Health Assessment and Damage Detection**<br>Damage Identification Methods: Techniques for detecting and locating damage, including static and dynamic methods.<br>Health Index Development: Creating health indices for evaluating the condition of structures. | 7 |
| V | **Health Monitoring of Bridges:**<br>Measurement of Parameters, Sensors/Transducers technologies, Measurement & Health<br>monitoring Techniques: Vibration signal analysis, Strain gage based Instrumentation, Destructive & Non-destructive testing, Load Test, etc | 6 |

| | | |
|---|---|---|
| VI | **Advanced SHM Techniques**<br>Fiber Optic Sensors: Principles and applications of fibre optic sensing in SHM.<br>Wireless Sensor Networks: Use of wireless sensor networks for distributed monitoring of structures. | 5 |

| | |
|---|---|
| **Text Books** | |
| 1 | Charles R Farrar, and Keith Worden, Structural Health Monitoring: A Machine Learning Perspective, John Wiley &Sons, first edition, 2012-2013. |
| 2 | Nagayama, T. and Spencer Jr, B.F., 2007, Structural health monitoring using smart sensors, Newmark Structural Engineering Laboratory. University of Illinois at Urbana-Champaign. |
| **References** | |
| 1 | Glisic, B. and Inaudi, D., 2008, Fibre optic methods for structural health monitoring, John Wiley &Sons |
| 2 | Do, R., 2014, Passive and active sensing technologies for structural health monitoring, University of California, San Diego. |
| **Useful Links** | |
| 1 | https://youtu.be/Y_-OrF8lmio?si=46zyTMiut68gWBWk |
| 2 | https://youtu.be/7mbejkAPbgg?si=fR20wkLqGtFMjQBS |

**CO-PO Mapping**

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

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

**Assessment**

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

| Prepared by | DAC/BoS Secretary | Head/BoS Chairman |
|---|---|---|

# Walchand College of Engineering, Sangli

*(Government Aided Autonomous Institute)*

**AY 2024-25**

**Course Information**

| | |
|---|---|
| **Programme** | B. Tech. (Civil Engineering) |
| **Class, Semester** | Final Year B. Tech., Semester VIII |
| **Course Code** | 6CV432 |
| **Course Name** | Professional Elective 5: Industrial Wastewater Treatment |
| **Desired Requisites:** | Sewerage and Sewage Treatment |

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

**Course Objectives**

| | |
|---|---|
| 1 | To Provide in-depth knowledge of manufacturing processes, wastewater generation and treatment. |
| 2 | To enhance the technical competency and apply the acquired knowledge for research and development, industry, and consultancy activities. |

**Course Outcomes (CO)**

| CO | Description | Blooms Taxonomy | |
|---|---|---|---|
| | | Descriptor | Level |
| CO1 | ***Explain*** classification of industries and concept related to common effluent treatment plant. | Understand | II |
| CO2 | ***Apply*** concepts of waste minimization for reduction, reuse and by-product recovery from industrial wastewater. | Apply | III |
| CO3 | ***Study*** and ***Recommend*** effluent treatment technologies for agro-based, chemical and engineering industries. | Analyze | IV |
| CO4 | ***Design*** units for treatment of industrial wastewater. | Create | VI |

| **Module** | **Module Contents** | **Hours** |
|---|---|---|
| I | **Classification of Industries and Waste Minimization Techniques**<br>Classification of Industries as per Central Pollution Control Board (CPCB), Concept of waste minimization, Techniques of volume and strength reduction, Equalization: Process, Flow and quality, Location, Volume requirement, Design considerations, Reuse and recycling concepts, Objectives and Methods of Neutralization and Proportioning. | 6 |
| II | **Agro Based Industries – A**<br>Manufacturing processes, Water usage, Sources, Quantities and characteristics of effluents (process stream and combined), Pollution effects, Waste Reduction/Reclamation/By-product recovery, Utilization, Alternative methods of treatment and disposal for Agro-based industries: Sugar and Distillery. | 7 |
| III | **Agro Based Industries – B**<br>Manufacturing processes, Water usage, Sources, Quantities and characteristics of effluents (process stream and combined), Pollution effects, Waste Reduction/Reclamation/By-product recovery, Utilization, Alternative methods of treatment and disposal for Agro-based industries: Dairy, Pulp and paper mill and Textile. | 7 |
| IV | **Chemical Industries**<br>Manufacturing processes, Water usage, Sources, Quantities and characteristics of effluents (process stream and combined), Pollution effects, Waste Reduction/Reclamation/By-product recovery, Utilization, Alternative methods of treatment and disposal for Chemical industries: Pharmaceutical, Petroleum and refineries, Fertilizer and Tannery. | 8 |

| | | |
|---|---|---|
| V | **Engineering Industries**<br>Manufacturing processes, Water usage, Sources, Quantities and characteristics of effluents (process stream and combined), Pollution effects, Waste Reduction/Reclamation/By-product recovery, Utilization, Alternative methods of treatment and disposal for Engineering industries: Electroplating and Thermal power plants. | 6 |
| VI | **Common Effluent Treatment Plant**<br>Concept, Objectives, Methodology, Cost benefit analysis, Design, Operation and maintenance. | 5 |

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

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

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

**CO-PO Mapping**

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

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

**Assessment**

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

| Prepared by | DAC/BoS Secretary | Head/BoS Chairman |
|---|---|---|

# Walchand College of Engineering, Sangli

*(Government Aided Autonomous Institute)*

**AY 2024-25**

**Course Information**

| | |
|---|---|
| **Programme** | B. Tech. (Civil Engineering) |
| **Class, Semester** | Final Year B. Tech., Sem VIII |
| **Course Code** | 6CV433 |
| **Course Name** | Professional Elective 5: Geosynthetics and Reinforced Soil Structures |
| **Desired Requisites:** | Soil Mechanics, Foundation Engineering |

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

**Course Objectives**

| | |
|---|---|
| 1 | To familiarize with different ground improvement techniques. |
| 2 | To impart knowledge of types, functions and applications of geosynthtics. |
| 3 | To explain the philosophy for analysis and design of Reinforced Earth Retaining Walls. |

**Course Outcomes (CO)**

| CO | Description | Bloom's Taxonomy | |
|---|---|---|---|
| | | Descriptor | Level |
| CO1 | Realize the need and demand for the use of geosynthetic materials in the field of civil engineering. | Understanding | 2 |
| CO2 | Design the Geosynthetics for the functions of separation, reinforcement, stabilization,filtration, drainage and moisture barriers. | Applying | 3 |
| CO3 | Understand and describe various manufacturing methods and quality control tests for Geosynthetics. | Understanding | 2 |
| CO4 | Understand types, functions and applications of natural geotextiles | Understanding | 2 |

| **Module** | **Module Contents** | **Hours** |
|---|---|---|
| I | **Introduction**<br>Ground Improvement Techniques, Introduction to Geosynthetics - Basic description - Polymeric materials – Uses and Applications. Properties of Geotextiles, Geogrids Geomembranes, Geocomposites. | 7 |
| II | **Geotextiles, Geogrids and Gabions**<br>Geotextiles: Design criteria for Separation – Reinforcement – Stabilization - Filtration - Drainage and Moisture barriers. Geogrids: Designing for Reinforcement - Stabilization – Gabions: Design - Construction methods. | 6 |
| III | **Use of Geosynthetics in Roads**<br>Geosynthetics in road ways – applications - role of subgrade conditions - design criteria – survivability - application in paved roads. | 6 |
| IV | **Reinforced Earth Retaining Walls**<br>Components - External stability - Internal stability - Design of reinforced earth walls with strip, sheet and grid reinforcement. | 7 |
| V | **Geomembranes**<br>Pond Liners - Covers for Reservoirs - Canal Liners - Landfill Liners - Caps and closures, moisture barriers. Geocomposites: An added advantage - Geocomposites in Separation - Reinforcement - Filtration - Geocomposites as Geowebs and Geocells. | 7 |

| | | |
|---|---|---|
| VI | **Natural Geotextiles**<br>Natural fibres as geotextiles - factors governing the use - juts fibres - coir geotextiles - bamboo/timber - combination of geotextiles. | 6 |

| **Text Books** | |
|---|---|
| 1 | Shukla Sanjay Kumar (2016), *"An introduction to geosynthetic engineering",* CRC Press. |
| 2 | Shukla Sanjay Kumar (2002), *"Geosynthetics and their applications",* Thomas Telford |
| 3 | Peter G Nicholson (2015), *"Soil improvement and ground modification methods",* Butterworth-Heinemann, , Elsevier Inc. |

| **References** | |
|---|---|
| 1 | R. W. Sarsby (2006), *"Geosynthetics in Civil Engineering",* 1st Edition, Woodhead Publishing |
| 2 | Robert M Koerner (2005), "Designing with Geosynthetics", 5th Edition, Pearson Prentic Hall. |
| 3 | Wu Jonathan T. H. (2019) ,"Geosynthetic reinforced soil (GRS) walls ", Wiley. |
| 4 | FHWA-NHI-10-024 (2009), "*Design and Construction of Mechanically Stabilized Earth Walls and Reinforced Soil Slopes -Volume I* ", NHI. |
| 5 | Jie Han (2015), " *Principles and Practices of Ground Improvement*", Wiley. |

| **Useful Links** | |
|---|---|
| 1 | https://archive.nptel.ac.in/courses/105/106/105106052/ ( IIT Madras) |
| 2 | https://igrip.iitgn.ac.in/geosynthetics-lectures/ (IIT Gandhinagar) |
| 3 | https://nptel.ac.in/courses/105101143 (IIT Bombay) |

CO-PO Mapping

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

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

**Assessment**

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

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

# Walchand College of Engineering, Sangli

*(Government Aided Autonomous Institute)*

**AY 2024-25**

**Course Information**

| | |
|---|---|
| **Programme** | B. Tech. (Civil Engineering) |
| **Class, Semester** | Final Year B.Tech. |
| **Course Code** | 6CV434 |
| **Course Name** | Professional Elective 5: Advanced Structural Design |
| **Desired Requisites:** | Design of Concrete structures I & Design of Concrete structures II |

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

**Course Objectives**

| | |
|---|---|
| 1 | To provide details of analysis and design methods for structural elements viz deep beam, shear wall, flat slab, deep foundation and earth retaining structures |

**Course Outcomes (CO)**

| CO | Description | Blooms Taxonomy | |
|---|---|---|---|
| | | Descriptor | Level |
| CO1 | Design shear walls, flat slabs, foundations and earth-retaining structures | Creating | 6 |
| CO2 | Analyze shear wall two-span continuous beam rafted deep foundations | Analyzing | 4 |
| CO3 | Solove problems pertaining to fixed beam propped cantilever and continuous beam | Applying | 3 |
| CO4 | Create the reinforcement detailing of the flat slab | Creating | 6 |

| **Module** | **Module Contents** | **Hours** |
|---|---|---|
| I | **Elevated rectangular water reservoir**<br>Design of elevated water reservoir rectangular RCC water tank with staging, Using Provisions of IS 3370. | 6 |
| II | **Elevated circular water reservoir**<br>Design of elevated water reservoir a) Circular Flat Bottom- flat Top, b) RCC water tank with staging, Using Provisions of IS 3370. | 6 |
| III | **Flat slabs**<br>Elements of flat slabs, Design of Flat Slabs using Direct Design Method - Equivalent Frame Method - Reinforcement detailing as per SP 34: 1987. | 7 |
| IV | **Design of two span continuous beams**<br>Analysis and Design of two span continuous beams by limit state method, with redistribution of moments by using elastic envelop method, problems of fixed beam, propped cantilever, two span continuous beam. | 7 |
| V | **Design of foundations**<br>Analysis and Design of raft foundations. Analysis and design of Deep foundations: pile foundations, pile cap. | 7 |
| VI | **Earth retaining Structures**<br>Analysis and Design Earth retaining Structures: RCC cantilever and counterfort retaining walls. | 6 |

**Text Books**

| | |
|---|---|
| 1 | N. Krishna Raju and R. N. Pranesh, “Reinforced concrete design” New Age International Publishers, New Delhi. 2003. |
| 2 | Devdas Menon and S. Pillai “Reinforced Concrete Design” - Third Edition McGraw Hill Education; 3rd edition (1 July 2017) |

| | |
|---|---|
| 3 | S N Sinha “Reinforced Concrete Design” Second Revised Edition McGraw-Hill Education (India) Pvt Limited, 2002 |
| | |
| **References** | |
| 1 | P.C. Varghese , “Limit State Design of Reinforced Concrete”, Prentice Hall of India, New Delhi 2nd Edition, 2006. |
| 2 | N.C. Sinha & S.K. Roy, “Fundamentals of Reinforced Concrete” S. Chand Publishing, 2013. |
| 3 | “Handbook of Reinforced Concrete SP-34” |
| | |
| **Useful Links** | |
| 1 | https://www.youtube.com/watch?v=undsd92MM8w |
| 2 | https://www.youtube.com/watch?v=BNZp9121cms |
| 3 | https://www.youtube.com/watch?v=uyuPmBGX32g |

**CO-PO Mapping**

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

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

**Assessment**

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

| Prepared by | DAC/BoS Secretary | Head/BoS Chairman |
|---|---|---|

# Walchand College of Engineering, Sangli

*(Government Aided Autonomous Institute)*

**AY 2024-25**

**Course Information**

| | |
|---|---|
| **Programme** | B. Tech. (Civil Engineering) |
| **Class, Semester** | Final Year B. Tech., Sem VIII |
| **Course Code** | 6CV435 |
| **Course Name** | Professional Elective 5: Earthquake Engineering |
| **Desired Requisites:** | Strength of Materials, Soil Mechanics, Engineering Mathematics |

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

**Course Objectives**

| | |
|---|---|
| 1 | To make students aware of the mechanism involved in the generation of earthquake and its consequences. |
| 2 | To obtain the governing equations for the single degree of freedom systems. |
| 3 | To impart knowledge regarding computation of lateral load and earthquake resistant design of buildings. |

**Course Outcomes (CO)**

| CO | Description | Bloom's Taxonomy | |
|---|---|---|---|
| | | Descriptor | Level |
| CO1 | Understand the mechanism involved in the generation of the earthquake. | Understanding | 2 |
| CO2 | Compute the response of the various single degree of freedom systems. | Applying | 3 |
| CO3 | Interpret/Understand the behavior of the structures during the earthquake. | Applying/ Understanding | 3/2 |
| CO4 | Study the earthquake resistant design and modern earthquake resistant techniques | Analysing/ Understanding | 4/2 |

| **Module** | **Module Contents** | **Hours** |
|---|---|---|
| I | **Seismology and Earthquakes**<br>Internal structure of the earth, plate tectonics, plate boundaries, Faults: Fault geometry, Fault movement, Elastic rebound theory, other sources of seismic activity, Location of earthquakes, Size of earthquakes: Earthquake Intensity, Earthquake Magnitude, Earthquake Energy, Seismographs, Ground motion Parameters: Amplitude parameters, frequency content parameters, duration. | 7 |
| II | **Dynamics of Discrete Systems**<br>Basic terminologies: period, cycle, frequency, natural frequency, forced vibrations, degree of freedom, resonance, principal modes of vibrations, Normal mode of vibrations; properties of harmonic motion, vibrating systems, single degree of freedom systems (SDOF), equation of motion for SDOF system, Response of Linear SDOF systems: undamped free vibrations, damped free vibrations, undamped forced vibrations, damped forced vibrations, damping. | 7 |
| III | **Response Spectrum**<br>Response spectrum concept, tripartite spectrum, construction of design response spectrum, effect of foundation soil and structural damping on design spectrum, evaluation of lateral loads due to earthquakes on multistorey building as per IS 1893-2016-part I. | 6 |

| | | |
|---|---|---|
| IV | **Behavior of Structures During Earthquakes**<br>Response of brick masonry structures: Walls, Box action effect, different types of bands; response of stone masonry structures, response of reinforced concrete structures: Reversal of Stresses, Importance of Beam Column Joints, Effect of Short Column, Effect of Soft Storey, Improper Detailing, Effect of Masonry Infill Walls, Effect of Eccentricity, Effect of Pounding, Effect of Floating Columns, Effect of Flexibility, Effects of Setbacks. | 8 |
| V | **Earthquake Resistant Design**<br>Earthquake resistant design philosophy, Planning aspects, load path, stiffness and strength distribution, ductility, ductile detailing of RCC beam column as per IS13920 | 6 |
| VI | **Earthquake Resistant Techniques**<br>Base Isolation: Elastomeric, Sliding, Combined; Dampers: Friction dampers, Tuned Mass Dampers, Visco-elastic dampers | 5 |

**Text Books**

| | |
|---|---|
| 1 | Duggal S. K. (2013), *Earthquake Resistance Design of Structures*; Oxford University Press, New Delhi |
| 2 | Pankaj Agarwal & Manish Shrikhande (2011), *Earthquake Resistant Design of Structures*, PHI Publications |

**References**

| | |
|---|---|
| 1 | Chopra A K (2007); *Dynamics of Structures*, Pearson, New Delhi. |
| 2 | Kramer S L (1996), *Geotechnical Earthquake Engineering*, Prentice Hall, New Jersy. |
| 3 | IS: 1893 (Part-I) (2016), Criteria for Earthquake Resistant Design General Provision to Building. |
| 4 | IS: 13920 (2016), Code of Practice for Ductile Detailing of RC Structure. |
| 5 | ITK-BMTPC, Earthquake Tips "Learning Earthquake Design and Construction" by C.V.R.Murthy, Building Material and Technology Promotion Council. |

**Useful Links**

| | |
|---|---|
| 1 | https://archive.nptel.ac.in/courses/105/101/105101004/ IIT Bombay |
| 2 | https://archive.nptel.ac.in/courses/105/101/105101134/ IIT Bombay |

CO-PO Mapping

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

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

**Assessment**

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

# Walchand College of Engineering, Sangli

*(Government Aided Autonomous Institute)*

**AY 2024-25**

## Course Information

| | |
|---|---|
| **Programme** | B. Tech. (Civil Engineering) |
| **Class, Semester** | Final Year B.Tech., Semester-II |
| **Course Code** | 6CV436 |
| **Course Name** | Professional Elective 6: Decentralized Water and Wastewater Treatment |
| **Desired Requisites:** | |

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

## Course Objectives

| | |
|---|---|
| 1 | To Provide in-depth knowledge of treatment systems and their applications. |
| 2 | To introduce design concepts on the decentralized treatment system |

## Course Outcomes (CO)

| CO | Description | Blooms Taxonomy | |
|---|---|---|---|
| | | Descriptor | Level |
| CO1 | ***Explain*** the concepts and types of decentralized treatment of water and wastewater. | Understanding | II |
| CO2 | ***Apply*** decentralized treatment for various cases | Applying | III |
| CO3 | ***Analyze*** and ***evaluate*** the physical, chemical and biological systems for the decentralized treatment of water and wastewater. | Analyzing<br>Evaluating | IV<br>V |
| CO4 | ***Design*** the decentralized water and wastewater treatment systems and systems for storm water storage and treatment | Creating | VI |

| Module | Module Contents | Hours |
|---|---|---|
| I | **Introduction to Decentralized Water and Wastewater Treatment**<br>Review of basics of water and wastewater treatment systems, quantification and characterization, Need, Advantages and types of DeWATS, Concept of sustainability in water and wastewater treatment | 6 |
| II | **Decentralized Water Treatment**<br>Introduction to Point of Use (POU) water treatment systems, Types, Treatment units in POU water treatment systems, Design of POU water treatment systems for residential, commercial and industrial purpose, Operation and Maintenance of POU water treatment systems, Packaged water treatment systems, Types, Design philosophy | 7 |
| III | **Decentralized Wastewater Treatment Systems (DeWATS): Primary Treatment**<br>Primary Treatment alternatives, advantages and disadvantages, design of screens, Grit chamber, Septic Tank, Imhoff tank, Biogas settler and Anaerobic baffled reactor | 7 |
| IV | **DeWATS: Secondary and Tertiary Treatment**<br>Secondary treatment alternatives, advantages and disadvantages, design of Waste Stabilisation Ponds, Up-flow Anaerobic Sludge Blanket Reactor (UASB), Activated Sludge Treatment, Sequencing Batch Reactor, Membrane Bio-reactor, Constructed Wetland (horizontal and vertical flow), Bio-rack Wetland and Aerated Ponds<br>Tertiary treatment alternatives, chlorination and ozonation | 7 |

| | | |
|---|---|---|
| V | **DeWATS: On-site Containment and Treatment**<br>On-site treatment systems, Greywater treatment, Design of anaerobic upflow filter, Urine diversion and composting toilet, Deep row entrenchment and Soak pit | 6 |
| VI | **Decentralized Stormwater Storage and Treatment Systems**<br>Need of stormwater storage and treatments, Concept of low impact development (LID) techniques, Management of stormwater using decentralized storage systems, Design of green roofs, vegetated swales, pocket wetlands, cisterns, rain gardens | 6 |

| **Text Books** | |
|---|---|
| 1 | Peavy H, S, Rowe D, R, and Tchobanoglous G, "Environmental Engineering", McGraw-Hill Book Company, Indian edition 2017. |
| 2 | Hammer M. J. and Hammer M. J., "Water and Wastewater Technology", PHI learning private limited, 6th Edition, 2008. |
| 3 | 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 | Gutterer B., Sasse L., Panzerbieter T. and Reckerzügel T., "Decentralised Wastewater Treatment Systems (DEWATS) and Sanitation in Developing Countries: A Practical Guide," Water, Engineering and Development Centre (WEDC) UK, 2009. |

| **Useful Links** | |
|---|---|
| 1 | https://www.youtube.com/watch?v=courErfW-cs |
| 2 | https://www.youtube.com/watch?v=CCso1LgJ3yg |

**CO-PO Mapping**

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

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

**Assessment**

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

# Walchand College of Engineering, Sangli

*(Government Aided Autonomous Institute)*

**AY 2024-25**

**Course Information**

| | |
|---|---|
| **Programme** | B. Tech. (Civil Engineering) |
| **Class, Semester** | Final Year B.Tech., Sem VIII |
| **Course Code** | 6CV437 |
| **Course Name** | Professional Elective 6: Geoenvironmental Engineering |
| **Desired Requisites:** | Soil Mechanics, Foundation Engineering, Environmental Engineering |

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

**Course Objectives**

| | |
|---|---|
| 1 | To introduce the concept of geoenvironmental engineering. |
| 2 | To impart knowledge of soil contamination and contaminant transport in soil. |
| 3 | To acquaint with different approaches of solid waste containment. |
| 4 | To make aware of possible geotechnical reuse of waste material. |

**Course Outcomes (CO)**

| CO | Description | Bloom's Taxonomy | |
|---|---|---|---|
| | | Descriptor | Level |
| CO1 | **Describe** and **differentiate** various engineering properties of soils, available geosynthetic materials, their properties and suitability. | Understanding/ Analyzing | 2/4 |
| CO2 | **Calculate** area requirement of landfill site. | Applying | 2 |
| CO3 | **Evaluate** compaction quality using field tests. | Evaluating | 5 |
| CO4 | **Analyze** stability of landfill embankments, liner and covers. | Analyzing | 4 |

| **Module** | **Module Contents** | **Hours** |
|---|---|---|
| I | **Introduction to Geoenvironmental Engineering**<br>Introduction, overview of pollution, control and remediation, case histories on geoenvironmental engineering, Soil: phased system, soil classification, various soils with important engineering properties and their suitability for intended purpose, clay mineralogy. | 7 |
| II | **Contaminant Transport in Soil**<br>Soil-water-contaminant interaction, contaminant transport, geotechnical attenuation and attenuation capacity of soils, zones of contaminant plume, introduction to detection of polluted zones and monitoring designed system. | 5 |
| III | **Introduction to Geosynthetic Materials**<br>Types of geosynthetic materials: geotextile, geomembrane, geonet, geogrid, geosynthetic clay liners, geocell, geofoam; applications of geosynthetic materials for various engineering functions, properties of geosynthetic materials, use of geosynthetics in waste containment, concerns about use. | 6 |
| IV | **Solid Waste Containment**<br>Site selection, typical cross sections of landfills, merits and demerits. Area calculation of landfill site, EPA (MOEF and CPCB) Guidelines.<br>CCL, GCL and composite liners, compaction quality control for CC liners. Stability analysis of landfills: conventional slope stability analysis by method of slices, stability number concept. Stability against sliding of geomembrane over clay (liner stability) and sliding of soil over geomembrane (cover stability). Assessment of anchorage requirement of GM. | 12 |

| | | |
|---|---|---|
| V | **Slurry Waste Containment**<br>*Slurry waste containment:* slurry transported wastes, pond layouts, components of pond, embankment construction, staged raising of embankment, design aspects, environmental impact and control.<br>*Vertical Barriers for Containment:* various types of cutoff walls, requirements of good vertical barriers, slurry trench walls using Bentonite and Cement-bentonite slurry, material and construction aspects. | 5 |
| VI | **Geotechnical Reuse of Waste Material**<br>Waste reduction, use of waste in geotechnical construction, waste characteristics for soil replacement, transport considerations and engineering properties of waste. | 5 |

| **Text Books** | |
|---|---|
| 1 | Sivakumar Babu G L (2006)," Soil Reinforcement and Geosynthetics", University Press (India) Pvt Ltd Hyderabad. |
| 2 | Reddi, L. N. and Inyang, H.I., "Geoenvironmental Engineering, Principles and Applications", Mracel Dekker Inc. New York, 2000. |
| 3 | Bagchi, A., " Design of landfills and integrated solid waste management " John Wiley & Sons, Inc. USA, 2004. |

| **References** | |
|---|---|
| 1 | Donald Coduto, (2002) " Geotechnical Engineering Principles and Practices", Prentice Hall of India Pvt Ltd., New Delhi. |
| 2 | Daniel, D. E., (1993) " Geotechnical Practice for Waste Disposal", Chapman and Hall. |
| 3 | Rowe R. K., " Geotechnical and Geoenvironmental Engineering Handbook" Kluwer Academic Publications, London, 2000. |

| **Useful Links** | |
|---|---|
| 1 | https://cpcb.nic.in/rules/ |
| 2 | https://nptel.ac.in/courses/105103025 |
| 3 | https://onlinecourses.nptel.ac.in/noc19_ce37/preview |
| 4 | https://archive.nptel.ac.in/courses/105/102/105102160/ |

**CO-PO Mapping**

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

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

**Assessment**

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

# Walchand College of Engineering, Sangli

*(Government Aided Autonomous Institute)*

**AY 2024-25**

**Course Information**

| | |
|---|---|
| **Programme** | B. Tech. (Civil Engineering) |
| **Class, Semester** | Final Year B.Tech., Semester-II |
| **Course Code** | 6CV438 |
| **Course Name** | Professional Elective 6: Contract Management |
| **Desired Requisites:** | |

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

**Course Objectives**

| | |
|---|---|
| 1 | To introduce the concepts and principles of contract management of engineering projects. |
| 2 | To develop proficiency with methods for civil engineering contract and dispute resolution systems. |
| 3 | To acquaint the students to formulate different contract documents |

**Course Outcomes (CO)**

| CO | Description | Blooms Taxonomy | |
|---|---|---|---|
| | | Descriptor | Level |
| CO1 | ***Explain*** provisions of Indian Contract Act | Understanding | II |
| CO2 | ***Describe*** elements of Contract Management | Understanding | II |
| CO3 | ***Appraise*** the different alternatives types of contracts and dispute resolution methods for an engineering project. | Analyzing | IV |
| CO4 | ***Formulate*** conditions of contract and contract documents | Creating | VI |

| Module | Module Contents | Hours |
|---|---|---|
| I | **Introduction to Contract Management**<br>Importance of contracts, Overview of contract management, Overview of activities in contract management, Scope of contract management, Professional ethics, Detailed project report and understanding nature, specification, scope, timeline, cost and other salient points of projects for contact drafting. | 6 |
| II | **Indian Contract Act 1872**<br>Objectives of the act, Definition of contact, Meanings of proposal, promise, reciprocal promise, consideration, valid contract, free consent, Essential requirements of legally valid contract, Offer, Acceptance, Lawful Consideration, Intention, Capacity, and Legality of subject matter, Void and voidable contracts, Breach of contract and its consequences, Damages, Mitigating the loss or damage. | 7 |
| III | **Types Civil Engineering Contracts**<br>Competitive bidding contracts, Negotiated contracts, Lump-sum contacts, Item rate contract, percentage rate contracts, cost plus types of contract, Turnkey contract, subcontract, annual maintenance contract, Supply and Installation Contracts, BOT, BOOT, BOLT, PPP, EPC, HAM, NCB, ICB etc. Pros and cons of each type. | 7 |
| IV | **Contract Formation**<br>Tender, types of tenders, Tender notice, Pretender conference, Contents of tender notice, E-tendering, Tender preparation, Tender documents, Methods of tender submission, Opening of tenders, Scrutiny of tenders, Contract award and letter, Contract documents, Contract agreement | 6 |

| | | |
|---|---|---|
| V | **Conditions of Contract**<br>Notice to proceed, Handing over the site to contractor, Rights and duties of various parties, notices to be given, Fairness of Conditions of Contract, Subjects of conditions- Bid Security, Performance Security, Contract Duration and Price, Performance parameters; Payment terms, Delays, Penalties and liquidated damages; Force majeure, Suspension and termination, Changes and variations, subcontracting etc. Important contents of each condition, Typical conditions for each subject. | 7 |
| VI | **Dispute Resolution and Integrity in Contract**<br>The "conventional" model of dispute resolution, Alternative Dispute Resolution methods (ADR), early neutral evaluation, negotiation, conciliation, mediation, and arbitration, Indian legislation for arbitration and conciliation, Integrity in Contract its significance and typical clauses. | 6 |

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

| **References** | |
|---|---|
| 1 | Prasad L., "Managing Engineering and Construction Contracts: Some Perspectives," LAP Lambert Academic Publishing, 2010 |
| 2 | Murdoch J. and Hughes W., "Construction Contracts: Law and Management, Routledge Publications, 2015. |

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

**CO-PO Mapping**

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

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

**Assessment**

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

| Prepared by: B. R. Kavathekar | DAC/BoS Secretary | Head/BoS Chairman |
|---|---|---|

# Walchand College of Engineering, Sangli

*(Government Aided Autonomous Institute)*

**AY 2024-25**

**Course Information**

| | |
|---|---|
| **Programme** | B. Tech. (Civil Engineering) |
| **Class, Semester** | Final Year B.Tech., Sem VIII |
| **Course Code** | 6CV439 |
| **Course Name** | Professional Elective 6: Finite Element Method |
| **Desired Requisites:** | Solid Mechanics, Structural Mechanics |

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

**Course Objectives**

| | |
|---|---|
| 1 | To provide knowledge of philosophy and principles of finite element method in structural engineering. |
| 2 | To impart knowledge of element stiffness matrix formulation for 1D, 2D and 3D elements. |
| 3 | To demonstrate the ability of finite element method to model and solve various continuum field problems. |

**Course Outcomes (CO)**

| CO | Description | Bloom's Taxonomy | |
|---|---|---|---|
| | | Descriptor | Level |
| CO1 | **Determine** element stiffness matrix using finite element methodology. | Understanding | 2 |
| CO2 | **Solve** for nodal degrees of freedom, strains and stresses. | Analyzing | 4 |
| CO3 | **Apply** finite element methodology to obtain solutions for various field problems. | Applying | 3 |
| CO4 | **Choose** appropriate shape function for the given finite element. | Applying | 3 |

| **Module** | **Module Contents** | **Hours** |
|---|---|---|
| I | **FEM in Skeleton Structures-I**<br>Basic concept of finite element analysis, Discretization, nodes, element connectivity, formulation of element stiffness matrices for spring, bar and plane truss elements. Solutions for unknown nodal displacements; Applications of method to spring, bar and plane truss problems. | 7 |
| II | **FEM in Skeleton Structures-II**<br>Formulation of element stiffness matrices for beam and plane portal frame element by direct method; Transformation of matrix from local to global system; Numbering of nodes; minimization of band width; force displacement relations; Solution for displacement unknowns; Applications of method to plane truss; Continuous beams and plane portal frames. | 7 |
| III | **Field Problems Idealization**<br>Elementary theory of Elasticity: Stress strain relation; Strain displacement, relations; plane stress and plane strain problems; Compatibility conditions; differential equations of equilibrium; equations for two dimensional and three dimensional problems. | 6 |
| IV | **FEM Principles and General Approach**<br>Principle of minimum potential energy; variational method; continuum problems; Two dimensional Elements; use of displacement functions; Pascal's triangle; triangular and rectangular elements; Formulation of element stiffness matrix.<br>Convergence requirements – Selection of the order of polynomial, conforming and non-conforming elements, Effect of element aspect ratio, finite representation of infinite bodies. | 7 |

| | | |
|---|---|---|
| V | **Isoparametric Formulation**<br>Shape function in Cartesian and natural co-ordinate system, Lagrange's interpolation formulae, concept of isoparametric element, relation between Cartesian and natural coordinate system, Jacobian matrix, one and two dimensional Isoparametric elements. | 6 |
| VI | **3D Elements Formulation**<br>Introduction to three-dimensional problem, various three-dimensional elements, Axisymmetric problems, formulation of stiffness matrix of three dimensional and axisymmetric elements. | 6 |

| **Text Books** | |
|---|---|
| 1 | P.N.Seshu "Finite Element Analysis", PHI learning private Lim. Delhi, 2013. |
| 2 | T. R. Chandrupatla and A.D. Belegundu,"Introduction to Finite Element in Engineering", Prentice Hall of India Private Limited, 3rd Edition, 2002. |
| 3 | C. S. Desai & J. F. Abel "Introduction to Finite Element Method", AEP, 1st Edition, 1972. |

| **References** | |
|---|---|
| 1 | Robert D. Cook, David S. Malkus, Michael E. Plesha,Robert J. Witt,"Concepts and Applications of Finite Element Analysis", 2003. |
| 2 | David. V. Hutton, " Fundamentals of finite element analysis", Tata McGraw-Hill Edition 2005. |
| 3 | J. N. Reddy. "An Introduction to the Finite Element Method" McGraw Hill, 3rd Edition, New York, 2006. |
| 4 | Zienkiewicz.O.C. &Taylor.R.L., "The Finite Element Method- Vol I &Vol II" Tata McGraw-Hill Publishing Company Limited, 6th Edition, 2005. |

| **Useful Links** | |
|---|---|
| 1 | https://onlinecourses.nptel.ac.in/noc22_me43/preview |
| 2 | https://archive.nptel.ac.in/courses/112/104/112104193/ |
| 3 | https://ocw.mit.edu/courses/2-092-finite-element-analysis-of-solids-and-fluids-i-fall-2009/download/ |

**CO-PO Mapping**

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

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

**Assessment**

- The assessment is based on MSE, ISE, and ESE.
- MSE shall be typically on modules 1 to 3.
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# Walchand College of Engineering, Sangli

*(Government Aided Autonomous Institute)*

**AY 2024-25**

**Course Information**

| | |
|---|---|
| **Programme** | B. Tech. (Civil Engineering) |
| **Class, Semester** | Final Year B.Tech. |
| **Course Code** | 6CV440 |
| **Course Name** | PE VI: Design of Concrete bridges |
| **Desired Requisites:** | Design of Concrete structures |

| **Teaching Scheme** | | **Examination Scheme (Marks)** | | | |
|---|---|---|---|---|---|
| **Lecture** | 3 Hrs/week | **MSE** | **ISE** | **ESE** | **Total** |
| **Tutorial** | - | 30 | 30 | 40 | 100 |
| **Practical** | - | | | | |
| **Interaction** | - | **Credits: 3** | | | |

**Course Objectives**

| | |
|---|---|
| 1 | To provide knowledge of loads and analysis for different types of bridges. |
| 2 | To impart knowledge for design of different types of bridges including substructures with relevant codes. |
| 3 | To provide knowledge for construction, inspection, and maintenance of bridges. |

**Course Outcomes (CO)**

| CO | Description | Blooms Taxonomy | |
|---|---|---|---|
| | | Descriptor | Level |
| CO1 | To explain different types of concrete bridges and their components. | Understanding | 2 |
| CO2 | To interpret and apply the codal provision for the design of concrete bridges. | Applying | 2/3 |
| CO3 | To design the different component of concrete bridge. | Creating | 6 |
| CO4 | To explain the construction and maintenance techniques of concrete bridges. | Understanding | 2 |

| Module | Module Contents | Hours |
|---|---|---|
| I | **Introduction to Concrete bridges:** History and significance of bridge engineering, Classification of bridges (types, materials, and spans), Basic components of a bridge, Drainage of bridges, Selection of Bridge Site | 6 |
| II | **Loads and Standards for Bridge design:** Design loads for bridges, IRC loading, Relevant codes and standards (IRC, AASHTO, Eurocode) for bridge design, Load factors and partial safety factors | 7 |
| III | **Design of Superstructure:** Design of R. C. deck slab, Design of Box culvert, Pipe Culvert and Composite Bridge | 7 |
| IV | **Design of Sub-structure:** Abutments, Piers, Approach slab, Pile and Well foundation, Pneumatic caissons | 7 |
| V | **Bearing and expansion joints:** Forces on bearings, Types of bearings, design of unreinforced & reinforced elastomeric bearings, expansion joints | 6 |
| VI | **Construction & maintenance of Bridges:** Short & long span concrete bridge, Form work and False work, Construction management, inspection, maintenance, innovative construction techniques, Lessons from bride failures | 6 |

**Text Books**

| | |
|---|---|
| 1 | Krishna Raju, "Design of Bridges," Oxford and IBH Publishing Co. Lt. New Delhi and Kolkata, 2001 |
| 2 | Jagdeesh T. R., Jayaram M. A. Design of Bridge Structures, Pentice hall of India pvt ltd., New Delhi 2003 |

| | |
|---|---|
| 3 | Johnson Victor, "Essentials of Bridge Engineering, Oxford and IBH Publishing Co. Ltd, 5th Edition 2001 |
| | |
| **References** | |
| 1 | Raina V. K. "Concrete Bridge practice" Construction, Maintenance and rehabilitation", Tata McGrew Hill Publishing Company, New Delhi |
| 2 | Raina V. K. "Concrete Bridge Practices" Analysis Design and economics", Tata McGrew Hill Publishing Company, New Delhi |
| | |
| **Useful Links** | |
| 1 | https://onlinecourses.nptel.ac.in/noc19_ce23/preview |
| 2 | https://www.classcentral.com/course/swayam-reinforced-concrete-road-bridges-14270 |
| 3 | https://www.youtube.com/playlist?list=PLYX9X4ZldqpYMaPURxSbY1i8vgfVsZfmQ |

**CO-PO Mapping**

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

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

**Assessment**

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| Prepared by | DAC/BoS Secretary | Head/BoS Chairman |
|---|---|---|

# Walchand College of Engineering, Sangli

*(Government Aided Autonomous Institute)*

**AY 2024-25**

**Course Information**

| | |
|---|---|
| **Programme** | B. Tech. (Civil Engineering) |
| **Class, Semester** | Final Year B.Tech., Semester-II |
| **Course Code** | 6HS401 |
| **Course Name** | Humanities 3: Accounting and Finance for Engineers |
| **Desired Requisites:** | |

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

**Course Objectives**

| | |
|---|---|
| 1 | To familiarize engineering students with basic concepts in accounting and finance |

**Course Outcomes (CO)**

| CO | Description | Blooms Taxonomy | |
|---|---|---|---|
| | | Descriptor | Level |
| CO1 | ***Explain*** generally accepted accounting principles and concepts in finance | Understand | II |
| CO2 | ***Summarize*** systems of accounting | Understand | II |
| CO3 | ***Apply*** concepts related to financial leverage and ratios, time value of money | Apply | III |
| CO4 | ***Calculate*** accounting and internal rate of return, net present value of asset. | Evaluate | V |

| **Module** | **Module Contents** | **Hours** |
|---|---|---|
| I | **Introduction**<br>Basic Accounting and concepts in finance; Book keeping: definitions, objectives, elements, journal and ledger. | 4 |
| II | **Accounting & Concepts in Finance I:**<br>Definitions, objectives, characteristics, limitations, basic terms; Generally Accepted Accounting Principles (GAAP) | 4 |
| III | **Accounting & Concepts in Finance II:**<br>Systems of accounting, cash book, bank book, depreciation; provisions, reserves, accounting equation, journal & ledger entries, trial balance, profit & loss; account, balance sheet, cash flow statement | 6 |
| IV | **Analysis of financial statements:**<br>Financial leverage, financial ratios, Significance and applications | 3 |
| V | **Financial planning including capital budgeting I:**<br>Definition, financial planning options and objectives, time value of money, Simple and compound interest, rule of 72, methods of capital budgeting - payback period | 5 |
| VI | **Financial planning including capital budgeting II:**<br>Accounting rate of return (ARR), net present value (NPV), internal rate of return (IRR) | 4 |

**Text Books**

| | |
|---|---|
| 1 | Theusen G.J. and Fabrycky W.J., "Engineering Economy," 9th Edition, Prentice-Hall, Inc., New Delhi, India, 2001. |
| 2 | Jha K.N., "Construction Project Management- Theory and practice," 2nd Edition, Pearson India Education Services Pvt. Ltd., 2015. |
| | |
| **References** | |
| 1 | Crundwell F.K., "Finance for Engineers-Evaluation and Funding of Capital Projects," Springer, London, UK, 2008. (ISBN 978-1-84800-032-2). |
| | |
| **Useful Links** | |
| 1 | https://www.youtube.com/watch?v=0Y74FXKTDvw&list=PLFW6lRTa1g82vN2IP78V9S32FiUaKU8X8 |
| 2 | https://www.youtube.com/playlist?list=PLqkMUh7RSUsX5S0GO8SRBa_gxHbFL_w1R |

**CO-PO Mapping**

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

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

**Assessment**

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| Prepared by: B. R. Kavathekar | DAC/BoS Secretary | Head/BoS Chairman |
|---|---|---|