



Walchand Institute of Technology, Solapur
(An Autonomous Institute)

Affiliated to
Punyashlok Ahilyadevi Holkar Solapur University,
Solapur

Choice-Based Credit System (CBCS)
Structure and Syllabus

For
Honors Degree in
Infrastructure Engineering
For Final Year. B.Tech. Civil Engineering

W.E.F. 2025-26

Department of Civil Engineering

Vision

- To excel and lead in education, research, and innovation, contributing to the advancement of design, construction, and maintenance of infrastructure, to enhance the quality of life for humanity in a sustainable way.

Mission

- **M1:** To provide an outstanding learning experience through a rigorous curriculum of theory and practice that develops students' technical and professional skills to succeed in a wide range of careers.
- **M2:** To continually advance research through a culture of discovery, creativity, and innovation to benefit humankind.
- **M3:** To serve as highly capable resources to society, and the profession through professional organizations, consultancy, and continuing education.



Department of Civil Engineering

Program Educational Objectives (PEOs)

- Graduate will demonstrate peer-recognized technical competency in the analysis, design and construction of Civil Engineering Structures.
- Graduates will demonstrate leadership and initiative to advance professional and organizational goals with a commitment to ethical standards of profession, teamwork and respect for diverse cultural backgrounds.
- Graduates will be engaged in ongoing learning and professional development through pursuance of higher education and self-study.
- Graduates will be committed to create practice of engineering and other professions in a responsible manner contributing to the socio-economic development of the society.

Knowledge and Attitude Profile (WK)

WK1	A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences.
WK2	Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline.
WK3	A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.
WK4	Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.
WK5	Knowledge, including efficient resource use, environmental impacts, whole-life cost, re-use of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area.
WK6	Knowledge of engineering practice (technology) in the practice areas in the engineering discipline.
WK7	Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development.



WK8	Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking, and creative approaches to evaluate emerging issues.
WK9	Ethics, inclusive behavior, and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability, etc., with mutual understanding and respect, and of inclusive attitudes.
Program Outcomes (POs)	
PO 1	Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.
PO 2	Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)
PO 3	Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)
PO 4	Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).
PO 5	Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)
PO 6	The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).
PO 7	Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)
PO 8	Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.



PO 9	Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning difference
PO 10	Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.
PO 11	Life-long Learning: Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)
Program Specific Outcomes (PSOs)	
<ul style="list-style-type: none"> • PSO 1: Students will be able to survey, conduct geotechnical investigations, plan, analyze, design, estimate, and construct residences, public buildings, industrial buildings, townships, and infrastructural projects by adopting appropriate construction methods. • PSO 2: Students will be able to analyze and design the water resources systems, and municipal and industrial waste treatment plants with due consideration to a pollution-free environment. • PSO 3: Students will be able to use appropriate application software, develop skills necessary for professional practice as a Civil Engineer, and prepare themselves for competitive examinations for higher education & for public service commissions. 	



Department of Civil Engineering

Legends Used

L	Lecture Hours / week
T	Tutorial Hours / week
P	Practical Hours / week
FA	Formative Assessment
SA	Summative Assessment
ESE	End Semester Examination
ISE	In Semester Evaluation
ICA	Internal Continuous Assessment
POE	Practical and Oral Exam
OE	Oral Exam
MOOC	Massive Open Online Course
HSS	Humanity and Social Science
NPTEL	National Programme on Technology Enhanced Learning
F.Y.	First Year
S.Y.	Second Year
T.Y.	Third Year
B. Tech.	Bachelor of Technology



Department of Civil Engineering

Course Code Format

2	1	C	E	U/P	2	C	C	1	T/L
Year of Syllabus revision	Program Code			U-Under Graduate P-Post Graduate	Semester No./ Year1/2/3/...8	Course Type		Course Serial No. 1- 9	T-Theory, L-Lab session A-Tutorial P- Programming / Design

Program Code

CE	Civil Engineering
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Course Type

BS	Basic Science
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ES	Engineering Science
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HU	Humanities & Social Science
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MC	Mandatory Course
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CC	Program Core Compulsory Course
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SN*	Self-Learning (<i>N* indicates the serial number of electives offered in the respective category</i>)
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EN*	Program Core Elective Course (<i>N* indicates the serial number of electives offered in the respective category</i>)
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SK	Skill-Based Course
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SM	Seminar
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MP	Mini project
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PR	Project
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IN	Internship
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ON*	Open Elective (<i>N* indicates the serial number of electives offered in the respective category</i>)
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MD	Multidisciplinary Minor
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EM	Entrepreneurship/Economics/Management Courses
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FP	Community Engagement Project / Field Project
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AE	Ability Enhancement Course
VE	Value Education Course
IK	Indian Knowledge System
VS	Vocational & Skill Enhancement Course
RM	Research Methodology
HN	Honors' Degree Course
HR	Honors Research

Program Code	
CE	Civil Engineering
Honors Code	
HR	Honors in Infrastructure Engineering



Department of Civil Engineering

Honors Infrastructure Engg. Final Year B.Tech. Semester VII

Course Code	Name of Course	Engagement Hours			Credits	SA		FA		Total
		L	T	P		Theory	OE/POE	ISE	ICA	
22CEU7HR1T	Bridges and Grade-Separated Structures	3	-	-	3	60	-	40	-	100
22CEU7HR1A	Bridges and Grade-Separated Structures (Tutorial)	-	1	-	1	-	-	-	25	25
	Subtotal	3	1	-	4	60	-	40	25	125
Laboratory Courses										
22CEU7HR2L	Mini Project	-	-	4	2	-	50	-	50	100
	Subtotal	-	-	4	2	-	50	-	50	100
	Grand Total	3	1	4	6	60	50	40	75	225





WALCHAND INSTITUTE OF TECHNOLOGY, SOLAPUR

(An Autonomous Institute)

Honors in Infrastructure Engineering

Final Year B.Tech. (Civil Engineering), Semester-VII

22CEU7HR1T: Bridges and Grade-Separated Structures

Teaching Scheme		Examination Scheme	
Lectures	3 Hours/week	ESE	60 Marks
Practical	1 Hour/week	ISE	40 Marks
Credits	4	ICA	25
Introduction:			
This course provides a thorough introduction to the bridge grade-separated structures with substructure and superstructure construction techniques. This course also introduces the construction of embankments and retaining walls. It also provides information about equipment management, time planning, cost control, and features of project work breakdown.			
Course Prerequisite:			
Basic knowledge of Transportation Engineering, Design of Structure, and Foundation Engineering.			
Course Objectives:			
<ol style="list-style-type: none">1. To make students aware of the grade-separated structures along with their structural and hydraulic requirements.2. To make students learn about the construction techniques used for the substructure.3. To make students learn about the construction techniques used for superstructures.4. To teach students techniques to implement in the construction of the Embankment, Retaining wall, and Breast wall in Hill Road.5. To make students learn about equipment management, cost control, time planning work schedules, and project work breakdown.			
Course Outcomes:			
After completing the course, students will be able to <ol style="list-style-type: none">1. Evaluate structural and hydraulic needs of grade-separated structures.2. Assess sub-structure construction methods and justify appropriate techniques.3. Analyze superstructure construction processes and recommend optimal methods.4. Design construction approaches for embankments, retaining walls, and breast walls in hilly regions.5. Develop project plans integrating cost control, equipment management, scheduling, and relevant software tools.			



Unit – I	Introduction to Bridges	8 Hours
Basic Elements of a Bridge. Types of bridges and grade-separated structures for highways, standard specifications for road bridges, and grade-separated structures to fulfill traffic, structural, and Hydraulic design requirements		
Unit – II	Sub-Structure Construction	7 Hours
Techniques of Box jacking – pipe jacking, underwater construction of diaphragm walls and basements, tunneling techniques, piling techniques, dewatering, and standby plant equipment for underground open excavation.		
Unit – III	Superstructure Construction	8 Hours
Launching girders, bridge decks, and offshore platforms – Material handling - erecting lightweight components on tall structures - Erection of articulated structures - Fabrication and erection of steel trusses and frames. Bridge testing for safe carrying capacity, strengthening of bridges, and aesthetic treatments. Bridge bearings, joints, approaches, and construction and maintenance aspects.		
Unit – IV	Construction of Embankment & Retaining Wall	8 Hours
Embankment Construction - Ground improvement techniques, Retaining and Breast walls on the hill road, wing walls and approaches, and cofferdams.		
Unit – V	Equipment Management	7 Hours
Factors affecting selection of equipment and methods –Planning - Equipment Management in Projects - Maintenance Management – Replacement - Cost Control of Equipment – Depreciation Analysis, Methods of calculation of depreciation- Safety Management.		
Unit – VI	Time planning – project work breakdown	7 Hours
Time planning – project work breakdown, determining activities involved, assessment of duration, CPM / PERT network analysis, work scheduling, methods of work scheduling, factors affecting work scheduling, and Problems. Planning Control System – resource production, project cost, project time, codification and project management, information system, use of software.		
INTERNAL CONTINUOUS ASSESSMENT:		
Internal Continuous Assessment (ICA) shall consist of a minimum of six assignments based on the entire curriculum		
Text Books		
<ol style="list-style-type: none"> 1. D. Johnson Victor, “Essentials of Bridge Engineering”- Oxford, IBH Publishing Company. 2. Ponnuswamy, “Bridge Engineering”-McGraw-Hill Publication, 1989. 		



3. K.K. Chitkara. “Construction Project Management Planning, Scheduling and Controlling”- Tata McGraw-Hill publications
4. S.C. Sharma “Construction Equipment and its Management”- Khanna Publishers

Reference Books

1. Vazirani Ratwani & M. G. Aswani, “Design of Concrete Bridges”- Khanna Publishers, New Delhi
2. “Design of Bridges”- Dr. Krishna Raju, Oxford & IBH Publishing Company Limited.
3. “Analysis and design of Bridges”- M. A. Jayaram, Sapna Publishers, Bangalore.
4. Peurifoy, R.L., and Clifford, J.S “Construction Planning Equipment and Method”- McGraw-Hill Book Co. Inc
5. Relevant IRC & ASTM Standards





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Final Year B.Tech. (Civil Engineering), Semester-VII

22CEU7HR2L: Mini Project

Teaching Scheme		Examination Scheme	
Practical	4 Hours/week	OE	50 Marks
Credits	2	ICA	50

Student/s shall carry out a 'Mini Project' in any one of the following subjects:

1. Highway Construction
2. Highway Planning and Management
3. Quality Assurance and Quality Control
4. Bridge and Flyover Construction
5. Environmental Impact Assessment of Highway Project
6. Traffic Management of Highway Project
7. Safety in Road Construction
8. Sustainable materials
9. Pavement Design, etc.

The project shall consist of Prototype design, working models, Laboratory experiments, Process modification/development, Simulation, Software development, Data analysis, Survey, etc.

The student is required to submit a 'Project Report' based on the work. The Mini project shall be assessed by the domain subject teachers for ICA.

