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
Sustainability Engineering
For Final Year. B.Tech. Civil Engineering

W.E.F. 2025-26

HEAD,
Department of Civil Engineering
Walchand Institute of Technology,
SOLAPUR-413006.

Dr. Mrs. M. A. Nirgude
Dean Academics

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)

- **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
Course Type	
BS	Basic Science
ES	Engineering Science
HU	Humanities & Social Science
MC	Mandatory Course
CC	Program Core Compulsory Course
SN*	Self-Learning (**N*** *indicates the serial number of electives offered in the respective category)*
EN*	Program Core Elective Course (**N*** *indicates the serial number of electives offered in the respective category)*
SK	Skill-Based Course
SM	Seminar
MP	Mini project
PR	Project
IN	Internship
ON*	Open Elective (**N*** *indicates the serial number of electives offered in the respective category)*
MD	Multidisciplinary Minor
EM	Entrepreneurship/Economics/Management Courses
FP	Community Engagement Project / Field Project

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	
HS	Honors in Sustainability Engineering

Sample Course Code:

22CEU4HS1T	Environmental Laws and Impact Assessment

Department of Civil Engineering

Honors -Sustainability 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	
22CEU7HS1T	Sustainable Engineering & Technology	3	-	-	3	60	-	40	-	100
22CEU7HS1A	Sustainable Engineering & Technology (Tutorial)	-	1	-	1	-	-	-	25	25
	Subtotal	3	1	-	4	60	-	40	25	125
Laboratory Courses										
22CEU7HS2L	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

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Honors in Sustainability Engineering

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

22CEU7HS1T: Sustainable Engineering & Technology

Teaching Scheme		**Examination Scheme**	
Lectures	3 Hours/week	**ESE**	60 Marks
Practical	1 Hour/week	**ISE**	40 Marks
Credits	4	**ICA**	25 Marks

Introduction:

The course explores the intersection of engineering practices with environmental stewardship and resource conservation. The subject focuses on integrating sustainable principles into engineering processes and technologies to mitigate environmental impacts and promote long-term viability. It covers topics such as renewable energy systems, green manufacturing techniques, waste reduction strategies, and lifecycle assessments of products and processes.

Course Prerequisite:

Environmental Laws and their impact assessment, Construction Materials: Sustainability & Usability, Sustainable Materials & Green Buildings of Civil Engineering

Course Objectives:

1. To educate students on the principles of sustainability as they apply to engineering and technology.
2. To make students understand sustainable design methodologies and techniques, such as life cycle assessment and eco-design principles.
3. To make students explore renewable energy systems, green manufacturing processes, and other sustainable technologies.
4. To make students develop skills in assessing the economic feasibility and environmental impacts of engineering projects and technologies.

Course Outcomes:

After completing the course, students will be able to

1. Figure out the relevance and the concept of sustainability and the global initiatives in this Direction.
2. Aquent and explain different types of environmental pollution problems and their sustainable Solutions.
3. Apply the environmental regulations and standards.
4. Observe and incorporate the concepts related to conventional and non-conventional energy.
5. Implement the broad perspective of sustainable practices by utilizing engineering knowledge and principles.

Unit – I	**Sustainability:**	**6 Hours**
Sustainability: Introduction, concept, the evolution of the concept; Social, environmental, and economic sustainability concepts; Sustainable development, Nexus between Technology and Sustainable development; Millennium Development Goals (MDGs) and Sustainable Development Goals (SDGs), Clean Development Mechanism (CDM).		
Unit – II	**Environmental Pollution:**	**6 Hours**
Environmental Pollution: Air Pollution and its effects, Water pollution and its sources, Zero waste concept and 5R concepts in solid waste management; case studies, Greenhouse effect, Global warming.		
Unit – III	**Climate Change:**	**6 Hours**
Climate change, Ozone layer depletion, Carbon credits, Carbon trading, and Carbon footprint, Legal provisions for environmental protection.		
Unit – IV	**Environmental management standards:**	**6 Hours**
Environmental management standards: ISO 14001:2015 framework and benefits, Scope and goal of Life Cycle Analysis (LCA), Circular economy, Bio-mimicking, Environment Impact Assessment (EIA), Industrial ecology, and industrial symbiosis.		
Unit – V	**Resources and its utilization:**	**8 Hours**
Resources and its utilization: Basic concepts of Conventional and non-conventional energy, General ideas about solar energy, Fuel cells, Wind energy, Small hydro plants, bio-fuels, Energy derived from oceans, and Geothermal energy.		
Unit – VI	**Sustainability Practices:**	**8 Hours**
Sustainability practices: Basic concept of sustainable habitat, Methods for increasing energy efficiency in buildings, Green Engineering, Sustainable Urbanization, Sustainable cities, Sustainable transport.		
Internal Continuous Assessment (ICA) submission shall consist of assignments on each unit based on the syllabus.		
Text Books		
1. Allen, D. T. and Shonnard, D. R., Sustainability Engineering: Concepts, Design and Case Studies, Prentice Hall. 2. Bradley. A.S; Adebayo, A.O., Maria, P. Engineering applications in sustainable design and development, Cengage learning 3. Mackenthun, K.M., Basic Concepts in Environmental Management, Lewis Publication, London, 1998.		

Reference Books
1. Environment Impact Assessment Guidelines, Notification of Government of India, 2006. 2. ECBC Code 2007, Bureau of Energy Efficiency, New Delhi Bureau of Energy Efficiency Publications-Rating System, TERI Publications - GRIHA Rating System 3. Ni bin Chang, Systems Analysis for Sustainable Engineering: Theory and Applications, McGraw-Hill Professional. 4. Twidell, J. W. and Weir, A. D., Renewable Energy Resources, English Language Book Society (ELBS). 5. Purohit, S. S., Green Technology - An approach for sustainable environment, Agrobios Publication.
e-Resources
NPTEL course: "Sustainable Engineering Concepts and Life Cycle Analysis"

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

22CEU7HS2L: Mini Project

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

Introduction:

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

1. Sustainable materials
2. Green Buildings
3. Applications of SDGs
4. Sustainable systems
5. Engineering materials for Sustainability
6. EIA
7. LCA
8. Impact of Environmental Policies, etc.

The project shall consist of Sustainable Engineering 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.