WALCHAND INSTITUTE OF TECHNOLOGY, SOLAPUR
(AN AUTONOMOUS INSTITUTE)

Affiliated to
Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Civil Engineering

CHOICE BASED CREDIT SYSTEM (CBCS)

Structure and Syllabus for
Honors Degree in
Sustainability Engineering

S.Y. B. Tech. Civil Engineering W.E.F. 2022-23
T.Y. B. Tech. Civil Engineering W.E.F. 2023-24

Dr. M. G. Kalyanshetti
Chairman, BOS in Civil Engg.
W.I.T. (Autonomous), Solapur

WALCHAND INSTITUTE OF TECHNOLOGY WIT SOLAPUR

Department of Civil Engineering

Department Vision

The Department of Civil Engineering, Walchand Institute of Technology Solapur, will 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.

Department Mission

1. 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.
2. To continually advance research through a culture of discovery, creativity and innovation to benefit humankind.
3. To serve as highly capable resources to society, the profession through professional organizations, consultancy and continuing education.

Civil Engineering
Under Graduate Program
Program Educational Objectives (PEOs)

The Program Educational Objectives for B. Tech. Civil Engineering program are designed to produce competent civil engineers who are ready to contribute effectively to the advancement of Civil Engineering and to fulfill the needs of the community. These objectives are as follows:

1. Graduate will demonstrate peer-recognized technical competency in the analysis, design and construction of Civil Engineering Structures.
2. Graduate 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.
3. Graduate will be engaged in ongoing learning and professional development through pursuance of higher education and self-study.
4. 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.

Program Outcomes (POs)

The program outcomes of B. Tech. Civil Engineering Program are summarized as following:

1. **Engineering Knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem Analysis:** Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
3. **Design/Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. **Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities, relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long Learning:** Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

Program Specific Outcomes (PSOs)

Engineering graduate in Electronics and Telecommunication Engineering Programme will be able to do-

1. Graduates will be able to survey, conduct geo-technical investigations, plan, analyze, design, estimate and construct residences, public buildings, industrial buildings, townships and infrastructural projects by adopting appropriate construction methods.
2. Graduates will be able to analyze and design the water resources systems, municipal and industrial waste treatment plants with due consideration to pollution free environment.
3. Graduates 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.

Legends used–

L	Lecture Hours/week
A	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	Humanities and Social Sciences
NPTEL	National Program on Technology Enhanced Learning
F.Y.	First Year
S.Y.	Second Year
T.Y.	Third Year
B.Tech.	Bachelor of Technology

Course Code Format for Honors:

2	1	C	E	U/P	2	H	S	1	T / L
Batch Entry Year		Program Code		U-Under Graduate, P-Post Graduate	Semester No. / Year 1/2/3/…8	Honors Code		Course Serial No. 1-9	T-Theory, L-Lab session

Program Code	
CE	Civil Engineering
Course Types	
BS	Basic Science
ES	Engineering Science
HU	Humanities & Social Science
MC	Mandatory Course
CC	Core Compulsory Course
SN*	Self-Learning N* indicates the serial number of electives offered in the respective category
EN*	EN* Core Elective N* indicates the serial number of electives offered in the respective category
SK	SK Skill-Based Course
SM	Seminar
MP	Mini project
PR	Project
IN	Internship

Program Code	
CE	Civil Engineering
Honors Code	
HS	Honors in Sustainability Engineering

Sample Course Code:

21CEU4HS1T	Environmental Laws and Impact Assessment

Walchand Institute of Technology, Solapur
Civil Engineering
Honors in Sustainability Engineering

Structure of S. Y. B. Tech. Civil Engineering
(W.E.F. 2022-2023)

Semester- IV

Course Code	Course Name	Engagement Hours			Credits	FA	SA		
		L	T	P		ESE	ISE	ICA	Total
21CEU4HS1T	Environmental Laws and Impact Assessment	3	-	-	3	60	40	-	100
21CEU4HS1A	Environmental Laws and Impact Assessment Tutorial	-	1	-	1	-	-	25	25
	Grand Total	**3**	**1**		**4**	**60**	**40**	**25**	**125**

Note: -These courses are to be completed by the student in addition to the courses of B. Tech Civil Engineering.

Walchand Institute of Technology, Solapur
Civil Engineering
Honors in Sustainability Engineering

Structure of T. Y. B. Tech. Civil Engineering
(W.E.F. 2023-2024)

Semester- V

Course Code	Course Name	Engagement Hours			Credits	FA	SA		
		L	T	P		ESE	ISE	ICA	Total
21CEU5HS1T	Construction Materials: Sustainability and Usability	3	-	-	3	60	40	-	100
21CEU5HS1A	Construction Materials: Sustainability and Usability	-	1	-	1	-	-	25	25
	Grand Total	**3**	**1**		**4**	**60**	**40**	**25**	**125**

Structure of T. Y. B. Tech. Civil Engineering.,
(W.E.F. 2023-2024)

Semester- VI

Course Code	Course Name	Engagement Hours			Credits	FA	SA		
		L	T	P		ESE	ISE	ICA	Total
21CEU6HS1T	Sustainable Materials and Green Buildings	3	-	-	3	60	40	-	100
21CEU6HS1A	Sustainable Materials and Green Buildings	-	1	-	1	-	-	25	25
	Grand Total	**3**	**1**		**4**	**60**	**40**	**25**	**125**

Walchand Institute of Technology, Solapur
Civil Engineering
Honors in Sustainability Engineering

Structure of Final Year B. Tech. Civil Engineering
(W.E.F. 2024-2025)

Semester- VII

Course Code	Course Name	Engagement Hours			Credits	FA	SA		
		L	T	P		ESE	ISE	ICA	Total
21CEU7HS1T	Sustainable Engineering & Technology	3	-	-	3	60	40	-	100
21CEU7HS1A	Sustainable Engineering & Technology	-	1	-	1	-	-	25	25
21CEU7HS2L	Mini Project			4	2	50		50	100
	Grand Total	**3**	**1**	**4**	**6**	**110**	**40**	**75**	**225**

Note: -These courses are to be completed by the student in addition to the courses of B. Tech Civil Engineering.

Walchand Institute of Technology, Solapur

Honors in Sustainability Engineering

S.Y.B.Tech. (Civil Engineering), Semester-IV

21CEU4HS1T

ENVIRONMENTAL LAWS AND IMPACT ASSESSMENT

Teaching Scheme:	**Examination Scheme:**
Lecture: 3 hrs/week, 3 credits	ESE : 60 Marks
Tutorial: 1 hr/week, 1 credit	ISE : 40 Marks
	ICA : 25 Marks

Course Outcomes: At the end of the course, students will be able to,

1. Be familiar with the laws, policies, and institutions in the field of environment.
2. Acquire the skills needed for interpreting laws, policies, and judicial decisions in a holistic perspective.
3. Acquire the ability to evaluate the role of law and policy in the conservation and management of natural resources and prevention of pollution
4. Identify environmental attributes for the EIA study and identify methodology and prepare EIA reports.
5. Perform life cycle inventory analysis of products.
6. Develop strategies to bring energy efficiency in all stages of the product development cycle and Formulate plans for comprehensive environmental protection, in order to comply with environmental laws.

SECTION -I

Unit 1: Introduction to environmental laws in India: **[08 Hrs]**

Constitutional provisions, General principles in Environmental law: Precautionary principle; Polluter pays principle; Overview of legislations and basic concepts. Evolution and Jurisprudence of Forest and Wildlife laws; Colonial Forest policies; Forest policies after independence, statutory framework on Forests, Wildlife and Biodiversity: IFA, 1927; WLPA, 1972; FCA, 1980; Biological Diversity Act, 2002; Forest Rights Act, 2006. Strategies for conservation–Project Tiger, Elephant, Rhino, Modulew leopard.

Unit 2: National Water Policy and some state policies [07 Hrs]

National Water Policy and some state policies Laws relating to the prevention of pollution, access and management of water, and institutional mechanism: Water Act, 1974; Water Cess Act, 1977, EPA, 1986. Pollution Control Boards, Groundwater and law, judicial remedies and procedures, Marine laws of India; Coastal zone regulations. Legal framework on Air pollution: Air Act, 1981; EPA, 1986, Legal framework: EPA and rules made thereunder; PLI Act, 199, Principles of strict and absolute liability, Legal framework on environment protection-Environment Protection Act as the framework legislation–strength and weaknesses

Unity 3: Introduction [09 Hrs]

Introduction: The Need for EIA, Indian Policies Requiring EIA, EIA Cycle and Procedures, and EIA Report, Public Hearing, Decision Making, Monitoring the Clearance Conditions, Components of EIA, and Roles in the EIA Process. List of projects requiring Environmental clearance, and international agreements. Identifying The Key Issues: Key Elements of an Initial Project Description and Scoping, EIA Methodologies, Methods-Adhoc methods, Checklists methods, Matrices methods, Networks methods, Overlays methods

SECTION -II

Unit 4: Environmental Index using Factor Analysis [07 Hrs]

Environmental index using factor analysis, Cost/benefit analysis, and Predictive or Simulation methods. Rapid assessment of Pollution sources method, predictive models for impact assessment, Applications for RS and GIS. Reviewing, EIA Report: Scope, Baseline Conditions, Site and Process alternatives, public hearing. Construction Stage Impacts, Project Resource Requirements, and Related Impacts, Prediction of Environmental Media Quality, Socio-economic Impacts, Ecological Impacts, Occupational Health Impact, Major Hazard/ Risk Assessment, Impact on Transport System, Integrated Impact

Unit 5: Introduction, Life Cycle Assessment concepts [08 Hrs]

Introduction, Life Cycle Assessment concepts, A brief history of Life-cycle Inventory analysis, an overview of the methodology, three components, Identifying and setting boundaries for life-cycle stages, issues that apply to all stages, Applications of inventory analysis, Procedural framework of Life-cycle inventory: Introduction, define the purpose and scope of inventory

Unit 6: General issues in Inventory analysis: [06 Hrs]

Introduction, Using Templates, Data issues, special case boundary issues, Issues Applicable to specific life cycle stages: Introduction, Raw Material acquisition stage, Manufacturing stage, Use/Reuse/Maintenance stage, Recycle/Waste Management stage.

INTERNAL CONTINUOUS ASSESSMENT (ICA):

Internal Continuous Assessment (ICA) submission shall consist of the following –

1. Case study of the implications of environmental laws in a developed and developing country (Any Two).
2. Case study of EIA and LCA for and material/product (Any Two)
3. Assignments (One Assignment on each unit)

TEXT BOOKS:

1. Divan S. and Rosencranz A. (2005) *Environmental Law and Policy in India*, 2nd ed., Oxford, New Delhi
2. Leelakrishnan P. (2008) *Environmental Law in India*, 3rd ed., Lexis Nexis, India.
3. Canter, L.W., *Environmental Impact Assessment*, McGraw Hill Pub. Co., 1997
4. David P. Lawrence, *Environmental Impact Assessment: Practical Solutions to Recurrent Problems*, John Wiley & Sons, 2003
5. Hosetti, B. B., Kumar A, Eds, *Environmental Impact Assessment & Management*, Daya Publishing House, 1998
6. Ciambrone , D.F., *Environmental Life Cycle Analysis*, CRC Press, 1997

REFERENCE BOOKS:

1. Birnie P. (2009) *et al., International Law and the Environment*, 3rd ed., Oxford.
2. Desai A. (2002) *Environmental Jurisprudence***,** 2nd ed., Modern Law House**,** Allahabad.
3. *G*adgil M. and Guha R. (1995) *Ecology and Equity***,** Oxford, New Delhi.
4. Gadgil M. and Guha R. (1997) *This Fissured Land*, Oxford, New Delhi.
5. Guha R. (2000) *Environmentalism: A Global History*, Oxford, New Delhi.
6. Kamala S. and Singh U.K. (eds.) (2008) *Towards Legal Literacy: An Introduction to Law in India*, Oxford, New Delhi.
7. Leelakrishnan P. (2006) *Environmental Law Case Book*, 2nd ed, Lexis Nexis, India.
8. Sands P. (2002) *Principles of International Environmental Law*, 2nd ed, Cambridge.
9. Singh C. (1986) *Common Property and Common Poverty*, Oxford, New Delhi.

10. Upadhyay S. and Upadhyay V. (2002) *Hand Book on Environmental Law- Forest Laws, Wildlife Laws and the Environment*; Vols. I, II and III, Lexis Nexis- Butterworths-India, New Delhi.
11. UNESCO, Methodological Guidelines for the Integrated Environmental Evaluation of Water Resources Development, UNESCO/UNEP, Paris, 1987
12. Anjaneyulu.Y., and Manickam. V., Environmental Impact Assessment Methodologies, B.S. Publications, Hyderabad, 2007
13. Wathern.P., Environmental Impact Assessment- Theory and Practice, Routledge Publishers, London, 2004
14. Handbook on Life Cycle Assessment: Operational guide to the ISO standards, Kluwer Academic Publishers, 2004.

Walchand Institute of Technology, Solapur

Honors in Sustainability Engineering

T.Y.B.Tech. (Civil Engineering), Semester-V

21CEU5HS1T

CONSTRUCTION MATERIALS: SUSTAINABILITY AND USABILITY

Teaching Scheme:	**Examination Scheme:**
Lecture: 3 hrs/week, 3 credits	ESE : 60 Marks
Practical : 1 hrs/week, 1 credit	ISE : 40 Marks
	ICA : 25 Marks

Course Outcomes: At the end of the course, students will be able to,

1. Predict the use of sustainable building materials.
2. Categorize material indices and select the best materials (with optimum mechanical, durability, and eco-performance) for a project.
3. Apply the knowledge of eco-materials in the civil engineering field
4. Outline efficient cross sections for structural members, and explain various techniques for designing green concrete materials.

SECTION - I

Unit 1: Introduction to sustainable building materials **[10 Hrs]**

Introduction to sustainable building materials, qualities, use, examples - Natural building materials, locally available and locally manufactured materials, biomaterials - Salvaged and recycled materials - Nontoxic materials: low VOC paints, coating, and adhesives.

Unit 2: Concept of Embodied Energy and Carbon Footprint **[10 Hrs]**

The idea of embodied energy - Development of the concept, factors to be considered, calculation techniques for embodied energy - Data sets available for calculation of embodied energy - Case studies of embodied energy calculations - Sample embodied energy calculations for a material - Concept of embodied carbon or carbon footprint of material, calculation techniques, methods to off-set high embodied energy - Cradle to cradle material, whole life cycle and life cycle costing analysis techniques.

Unit 3: Sustainable construction techniques [10 Hrs]

Alternative construction techniques such as SMB, CSEB, steam cured blocks, composite beam and panel, funicular shells, filler slabs, reinforced concrete masonry, vaulted roofs, Ferro-cement walls, etc., - Case studies

SECTION - II

Unit 4: Innovative use of materials [10 Hrs]

Use of waste materials such as paper, glass bottles, tires, and shipping containers - Use of post-consumer and industrial waste such as fly ash, bags, and building demolition waste – use of salvaged materials from flooring, columns, beams, timber, glass, etc.

Unit 5: Eco-audits and eco-audit tools [10 Hrs]

Eco auditing of Reusable and disposable cups, Grocery bags, and Family cars - comparing material energy with the use of energy Legal framework, the material selection strategy: choosing a car, Principles of materials selection, Selection criteria and property charts, using indices for scaling, Resolving conflicting objectives: trade-off methods, seven useful charts, Computer-aided selection

Unit 6: Eco-informed materials selection [10 Hrs]

Eco-informed materials selection introduction, Selection per unit of function, Systematic eco-selection: carbonated water bottles, Structural materials for buildings, Initial and recurring embodied energy of buildings, Transportation -introduction, crash barriers—matching material to purpose, materials for lightweight structures, material substitution for the eco-efficient design

INTERNAL CONTINUOUS ASSESSMENT (ICA):

Internal Continuous Assessment (ICA) submission shall consist of the following –

Assignments (One Assignment on each unit)

TEXT BOOKS:

1. M.F. Ashby (2012) "Materials and the Environment: Eco-Informed Material Choice", 2nd Ed., Elsevier, Burlington.
2. M.F. Ashby (2011) "Materials Selection in Mechanical Design", 4th Ed., Elsevier, Burlington
3. A New Era of Sustainable Technology Development 2nd edition, M.M. Khan, Scrivener Publishing LLC.

REFERENCE BOOKS:

1. William McDonough, Michael Braungart, "Cradle to Cradle: Remaking the way we make things", North Point Press, 2002.
2. Lawrence D.P., Environmental Impact Assessment – Practical solutions to recurrent problems, Wiley-Interscience, New Jersey, 2003
3. Environmental Assessment Source book-Vol. III: Guidelines for environmental assessment of energy and industry projects, World Bank,1998
4. Petts J., Handbook of Environmental Impact Assessment, Vol., I and II, Blackwell Science, London, 1999
5. Canter L.W., Environmental Impact Assessment, McGraw Hill, New York. 1996
6. Nick Harvey, Beverley Clarke, Environmental Impact Assessment: Procedures and Practices, Oxford University Press, USA, 2012
7. Gursharan Singh Kainth, Climate Change, Sustainable Development and India, LAP Lambert, 2011
8. Janis Birkeland, Positive Development: From Vicious Circles to Virtuous Cycles through Built Environment Design, Routledge, 2008
9. Sustainable Building - Design Manual: sustainable building design practices- TERI 2004
10. Ross Spiegel, Green Building Materials: A Guide to Product Selection and Specification, 3rd Edition, John Wiley & Sons, 2010
11. K.S. Jagadish, Alternative building materials and technologies, New Age International, 2013
12. The Barefoot Architect: A Handbook for Green Building, Shelter Publication, 2007

Walchand Institute of Technology, Solapur

Honors in Sustainability Engineering

T.Y.B.Tech. (Civil Engineering), Semester-VI

21CEU6HS1T

SUSTAINABLE MATERIALS AND GREEN BUILDINGS

Teaching Scheme:	**Examination Scheme:**
Lecture: 3 hrs/week, 3 credits	ESE : 60 Marks
Tutorial : 1 hrs/week, 1 credit	ISE : 40 Marks
	ICA : 25 Marks

Course Outcomes: At the end of this course, students will be able to,

1. Appraise the appropriateness and sustainability of materials for construction projects.
2. Explain innovative sustainable systems in construction.
3. Examine the green building rating systems and its contribution to sustainability.
4. Select sustainable technologies based on international standard practices and certification.

SECTION-I

Unit 1: Sustainability **[10 Hrs]**

Definition of Sustainability, Dimension of Sustainability, Three Pillars of Sustainability, Principles of Sustainability - 5R- case studies of urban areas and industrial areas, Construction Materials Resource Efficiency and operational Reuses Of The Construction Materials, Sustainability Goals for Construction Industry and green building - Energy and water, Construction and Demolition Waste, Building Stock Management.

Unit 2: Various green construction materials: **[10 hrs]**

Natural and manmade, CLC Blocks (Cellular Light Weight Concrete), Fly ash Bricks, AAC blocks, Cement Fiberboards, chemicals/admixtures.

Unit3: Special Concrete: **[10 Hrs]**

Fly ash and its use in concrete, Silica fume concrete, Self-compacting concrete, Fiber Reinforced plastics and concrete, and Lightweight concrete. High-performance concrete, Nanotechnology in cement concrete, Ferrocement Technology.

SECTION-II

Unit 4: Green Building Technologies: [10 Hrs]

Introduction- Necessity - Concept of Green building. Principles of green building, Applications of 5R in green building, Application of renewable energy resources in green building, Structure of green building.

Unit 5: Orientation of the Building: [10 Hrs]

Selection of site and Orientation of the building – usage of low energy materials – effective cooling and heating systems – effective electrical systems – effective water conservation systems.

Unit 6: Certification systems: [10 Hrs]

Certification systems, Green Rating for Integrated Habitat Assessment (GRIHA) and Leadership in Energy and Environmental Design (LEED), case studies.

INTERNAL CONTINUOUS ASSESSMENT (ICA):

Assignments on each chapter and field visit report shall be submitted by the students.

REFERENCE BOOKS:

1. The Philosophy of Sustainable Design by Jason F. McLennan, Ecotone Publishing Co., 2004.
2. Green Building Fundamentals by Mike Montoya, Pearson, 2nd edition, 2010.
3. Sustainable Construction - Green Building Design and Delivery by Charles J. Kibert, John Wiley & Sons, 2nd edition, 2008.
4. Sustainable Construction and Design by Regina Leffers, Prentice Hall, 2009.
5. Michael Bauer, Peter Mösle and Michael Schwarz “Green Building – Guidebook for Sustainable Architecture” Springer, 2010.
6. Tom Woolley, Sam Kimmins, Paul Harrison and Rob Harrison “Green Building Handbook” Volume I, Spon Press, 2001.
7. Mili Majumdar, “Energy-efficient buildings in India” Tata Energy Research Institute, 2002.
8. TERI “Sustainable Building Design Manual- Volume I & II” Tata Energy Research Institute, 2009
9. Concrete Technology by M. S. Shetty, Pub.-S. Chand & Co. Ltd.
10. Concrete Technology by A.M. Neveille, Pub.- Pearson Education Ltd.

Walchand Institute of Technology, Solapur

Honors in Sustainability Engineering

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

21CEU7HS1T

SUSTAINABLE ENGINEERING & TECHNOLOGY

Teaching Scheme:	**Examination Scheme:**
Lecture: 3 hrs/week, 3 credits	ESE : 60 Marks
Practical : 1 hrs/week, 1 credit	ISE : 40 Marks
	ICA : 25 Marks

Course Outcomes: At the end of 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

SECTION-I

Unit-1: Sustainability **[08 Hrs]**

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-2: Environmental Pollution **[06 Hrs]**

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-3: Climate Change **[06 Hrs]**

Climate change, Ozone layer depletion, Carbon credits, carbon trading and carbon footprint, legal provisions for environmental protection.

SECTION II

Unit-4: Environmental management standards **[08 Hrs]**

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-5: Resources and its utilization **[06 Hrs]**

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-6: Sustainability Practices **[06 Hrs]**

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):

Internal Continuous Assessment (ICA) submission shall consist of the following – Minimum 6 Assignments (One Assignment on each unit).

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

Walchand Institute of Technology, Solapur

Honors in Sustainability Engineering

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

21CEU7HS2L
MINI PROJECT

Teaching Scheme:
Practical: 4 hrs/week, 2 credit

Examination Scheme:
ICA: 50 Marks
ESE: 50 Marks

Student/s shall carry out a 'Mini Project' in any one of the following subjects: Sustainable materials, Green Buildings, Applications of SDGs, Sustainable systems, engineering materials for Sustainability, EIA, LCA, 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.

Dr. M. G. Kalyanshetti
Chairman, BOS in Civil Engg.
W.I.T. (Autonomous), Solapur

WALCHAND INSTITUTE OF TECHNOLOGY WIT SOLAPUR