KOLHAPUR INSTITUTE
OF TECHNOLOGY'S
COLLEGE OF
ENGINEERING
(AUTONOMOUS),
KOLHAPUR

Structure for

B. Tech. Emerging Minor in Civil and Environmental Engineering with Specialization in Sustainability Engineering

Department of Civil and Environmental Engineering

Kolhapur Institute of Technology's
College of Engineering (Autonomous), Kolhapur,
Maharashtra, INDIA

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Teaching and Evaluation Scheme for

B. Tech. (Emerging Minor) in Civil and Environmental Engineering with Specialization in Sustainability Engineering

Course Code	Course Name	Semester	Hours/Week				Evaluation Scheme		
			L	T	P	Credits	Component	Marks	
								Max	Min for Passing
UCEMNC0361	Sustainable Materials	III	3	1	-	**4**	ESE	100	40
UCEMNC0461	Clean Energy Engineering	IV	3	1	-	**4**	ESE	100	40
UCEMNC0561	Climate Change and Sustainable Development	V	3	1	-	**4**	ESE	100	40
UCEMNC0661	Sustainable Infrastructure Engineering	VI	3	1	-	**4**	ESE	100	40
UCEMNC0761	Environmental Management	VII	2	-	-	**2**	ESE	100	40
			12	**4**	**-**	**18**	**500**		

Total Credits - 18, Total Contact hours – 18

Class: S. Y. B. Tech Civil & Environmental Engineering-Emerging Minor **Title of the Course:** Sustainable Materials **Course Code:** UCEMNC0361	**L**	**T**	**P**	**Credit**
	03	-	-	3

Course Pre-Requisite:

Students shall have the knowledge of:

- Basic Civil Engineering
- Engineering Chemistry

Course Description:

- The course comprises of engineering properties of various construction materials
- The course includes details of sustainable materials
- The course also deals with various application of sustainable materials

Course Learning Objectives:

- Aware the student with a wide range of sustainable building materials, their properties and its use in architectural design and construction.
- Aware the student about impact of materials.
- To develop a practical approach in choosing architectural and construction materials based on use, desired results, durability, availability and cost.

Course Outcomes:

COs	**After the completion of the course the students will be able to**	**Bloom's Cognitive Descriptor**
CO.1	Recall key concepts and definitions related to sustainable materials.	Remember (L1)
CO.2	Illustrate importance of concrete & its ingredients in sustainable development.	Understanding (L2)
CO.3	Identify the factors affecting Indoor air quality in building	Apply (L3)
CO.4	Select waste material to be used in construction for sustainability.	Apply (L3)

CO-PO Mapping:

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO.1	1	1	1				3					
CO.2	1	1	1				3					2
CO.3	1	1	1				3					
CO.4		1	1				3					1

COs	**PSO1**	**PSO2**
CO.1	-	2
CO.2	-	2
CO.3	-	3
CO.4	-	3

Assessments :

Assessment	**Weightage (Marks)**
ESE	100

- **ESE:** Assessment is based on 100% course content covered before MSE and 70% weightage for course content covered after MSE.

Course Contents:

Unit 1: **Introduction**: Introduction to sustainability, Embodied energy, Operational energy in	**08 Hrs.**

Building and Life cycle energy. Ecological footprint, Bio-capacity and calculation of planet equivalent. Operational energy in building, role of materials and thermal conductivity.	
Unit 2: **Role of Material:** Carbon from Cement, alternative cements and cementitious material, Alternative fuel for cements for reduction in carbon emission. Sustainability issues for concrete	**07 Hrs.**
Unit 3: **Sustainable concrete:** Role of quality, minimization of natural resource utilization, High volume fly ash concrete, geo-polymer concrete etc. concrete with alternative material for sustainability, : Reduction in water consumption in concrete, Recycled aggregate, Energy for grinding crushing of cement aggregate etc. and reduction.	**08 Hrs.**
Unit 4: **Finishing materials :**Paints, Adhesive and sealants for use in building, Volatile organic content (VOC), emission issues and indoor air quality for Sustainability and Health hazard	**06 Hrs.**
Unit 5: **Indoor Environment Quality:** Introduction; Low emitting materials; Building and material reuse; Construction waste management; Regional materials; Life cycle cost assessment of building materials and products; Factors affecting indoor environment quality; Ventilation and filtration, Indoor Environment quality best practice	**08 Hrs.**
Unit 6: **Alternate construction materials:** Use of recycled materials in construction, Waste minimization and its importance in construction, Use of bamboo in construction and its advantages. Use of industrial waste in construction and its importance. Cost of sustainable materials.	**08 Hrs.**

Textbooks:

1. Sam Kubba, "Hand book of Green building Design and construction", Elsevier Architecture Press.
2. Abe Kruger and Carl Seville, "Green building: principals and practice in residential construction", Cengage Learning.
3. IGBC Green New building rating system (Version 3.0), March 2015. GRIHA Manual Volume-1: Introduction to National Rating System by Ministry of New and

References:

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.

Class: S. Y. B. Tech Environmental Engineering (Emerging Minor in Sustainability Engineering) **Title of the Course: Clean Energy Engineering** **Course No.:** UCEMNC0461	**L**	**T**	**P**	**Credit**
	03 hours per week	01	-	4

Course Pre-Requisite:

Students shall have the knowledge of:

- Basic Mathematics
- Basic Physics
- Basic Chemistry

Course Description:

This course provides an introduction to the principles, technologies, and practices involved in the generation and utilization of clean energy. Students will explore various renewable energy sources, including solar, wind, hydro, and biomass, and examine their potential for sustainable development. The course will cover energy conversion processes, efficiency improvements, environmental impacts of clean energy systems and a comprehensive understanding of clean energy technologies and their role in mitigating climate change and promoting environmental sustainability.

Course Learning Objectives:

1. To explain the fundamental principles of clean energy generation and utilization
2. To Interpret various renewable energy sources including solar, wind, hydro, biomass etc. and their potential for sustainable energy production.
3. To Analyse the efficiency, environmental impact, and economic feasibility of different clean energy technologies.
4. To Examine the role of clean energy in reducing greenhouse gas emissions and addressing climate change.

Course Outcomes:

COs	**After the completion of the course the students will be able to**	**Bloom's Cognitive Descriptor**
CO.1	Explain the fundamental principles of clean energy generation and utilization.	Cognitive (Understanding) L2
CO.2	Interpret various renewable energy sources including solar, wind, hydro, biomass etc. and their potential for sustainable energy production.	Cognitive (Understanding) L2
CO.3	Analyse the efficiency, environmental impact, and economic feasibility of different clean energy technologies.	Cognitive (Analysing) L4
CO.4	Examine the role of clean energy in reducing greenhouse gas emissions and addressing climate change.	Cognitive (Analysing) L4

CO-PO Mapping:

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO.1	3	-	3	1	-	1	2	-	-	1	-	3
CO.2	3	-	3	1	-	1	2	-	-	1	-	3
CO.3	3	3	2	2	-	2	3	-	-	-	2	1
CO.4	3	3	2	2	-	2	3	-	-	-	2	1

COs	**PSO1**	**PSO2**
CO.1	1	1
CO.2	1	1
CO.3	3	3
CO.4	3	3

Assessments :

Assessment	Weightage (Marks)
ESE	100

- **ESE:** Assessment is based on 100% course content.

Course Contents:

Unit 1: Overview of conventional & renewable energy sources Need & development of renewable energy sources, types of renewable energy systems, Future of Energy Use, Global and Indian Energy scenario, Renewable and Non-renewable Energy sources, Energy for sustainable development, Potential of renewable energy sources, renewable electricity and key elements, Global climate change, CO2 reduction potential of renewable energy- concept of Hybrid systems, Energy and its environmental impacts.	**08 Hrs.**
Unit 2: Solar Energy Heat transfer, estimation and physical conversion, Instruments for measurement. Energy collection and analysis: Flat Plate Collector FPC, Evacuated tube collector ETC, concentrating collectors. Solar energy application: Direct and indirect. Solar photovoltaic technology: Conversion, Systems components, integrations and applications.	**07 Hrs.**
Unit 3:Biomass Energy Properties of biogas (Calorific value and composition), biogas plant technology and status, Bio energy system, design and constructional features. Biomass resources and their classification, Biomass conversion processes, Thermo chemical conversion, direct combustion, biomass gasification, pyrolysis and liquefaction, biochemical conversion, anaerobic digestion, types of biogas Plants, applications, alcohol production from biomass, bio diesel production, Urban waste to energy conversion, Biomass energy programme in India	**08 Hrs.**
Unit 4: Biofuels Edible, Petro crops – Analysis of Indian nonedible oil sources – Example of biodiesel crop – Jatropha curcas – Tree description – Jatropha curcas for rural development – environmental protection – Bio ethanol – production from conventional as well as unconventional sources. - Bio diesel – Technology for production of bio diesel - Transesterification – Process – Usage of Methanol – Glycerine – Storage and Characterisation of biodiesel – Biodiesel engine development – modification – Environmental and health effects of biodiesel – R&D in biodiesel – disposal of cake – value addition of byproducts	**07 Hrs.**
Unit 5: Wind Energy Wind Energy Conversion, Potential, Wind energy potential measurement, Site selection, Types of wind turbines, Wind farms, wind Generation and Control. Nature of the wind, power in the wind, factors influencing wind, wind data and energy estimation, wind speed monitoring, classification of wind, characteristics, applications of wind turbines, offshore wind energy – Hybrid systems, wind resource assessment, Betz limit, site selection, wind energy conversion devices. Wind mill component design, economics and demand side management, energy wheeling, and energy banking concepts. Safety and environmental aspects, wind energy potential and installation in India.	**07 Hrs.**
Unit 6: Hydro energy, Geothermal energy and Ocean Energy Small hydro - Tidal energy, Wave energy, Open and closed OTEC Cycles Limitations, Geothermal energy, Geothermal energy sources - Types of geothermal power plants, Applications - Environmental impact. Ocean Energy: Ocean wave energy conversion, principle of Ocean Thermal Energy Conversion (OTEC), ocean thermal power plants, tidal energy conversion, Tidal and wave energy its scope and development, Scheme of development of tidal energy.	**08 Hrs.**

Textbooks:

1. Renewable Energy Sources I Twidell & Weir - Taylor and Francis - 2nd Special Indian Edition.
2. Non- conventional Energy Sources - G.D. Rai - Dhanpat Ral and Sons.
3. Renewable Energy Resources I Tiwari and Ghosal I Narosa.

4. Non-Conventional Energy Sources by G.D Rai
5. Twidell, J.W. and Weir, A., Renewable Energy Sources, EFN Spon Ltd., 1986.
6. Kishore VVN, Renewable Energy Engineering and Technology, Teri Press, New Delhi,2012
7. Godfrey Boyle, Renewable Energy, Power for a Sustainable Future, Oxford University Press, U.K, 1996.

Reference Books:

1. Energy Resources Utilization and Technologies -Anjaneyulu & Francis- BS Publications 2012.
2. Principles of Solar Energy - Frank Krieth & John F Kreider - Hemisphere Publications.
3. Non-Conventional Energy - Ashok V Desai I Wiley Eastern.
4. Non-Conventional Energy Systems - K Mittal and Wheeler.
5. Renewable Energy Technologies I Ramesh & Kumar - Narosa.
6. Renewable Energy Resources - Tiwari&Ghosal - Narosa Publisher
7. Principles of Solar Energy – Frank Krieth and John K
8. Non-Conventional Energy – Ashok V Desai

Unit wise Measurable Students Learning Outcomes:

Unit Learning Objectives:

1. To study the summary of conventional & renewable energy sources.
2. To explore Solar energy as clean energy source and its potential for sustainable energy production.
3. To explore Biogas energy as clean energy source and its potential for sustainable energy production.
4. To explore Biofuel energy as clean energy source and its potential for sustainable energy production.
5. To explore Wind energy as clean energy source and its potential for sustainable energy production.
6. To explore Hydro energy, Geothermal energy and Ocean Energy as clean energy source and its potential for sustainable energy production.