

COURSE PLAN

Fr. CRCE (Mechanical)

Academic year: 2022-23

Fr. Conceicao Rodrigues College of Engineering

Father Agnel Ashram, Bandstand, Bandra-west, Mumbai-50

Department of Mechanical Engineering

B.E. (Mechanical) (Semester VII) (2022-2023)

Course Plan

Subject: Renewable Energy Sources (RES) (MEDLO732)

Credits – 03

Syllabus Mechanical Engineering

Module	Contents	Hrs
01	1.1: Introduction to Renewable Energy Sources and Solar Radiation: Global and National current energy scenarios, Prospects of renewable energy sources and renewable energies role in developing sustainable model. 1.2: Solar radiation terms, solar geometry, earth sun angles, attenuation and measurement of solar radiation on horizontal and inclined surfaces, methods of solar radiation estimation.	05
02	Solar Thermal Energy: 2.1: Introduction and working principle of flat plate collectors, thermal performance analysis of flat plate collectors, concentrating collectors, Installation and maintenance criteria of solar thermal systems. 2.2: Solar thermal devices- Solar air heater and different types of solar air heaters, solar water heater and different types of solar water heaters, solar dryers, solar pond, solar distillation, solar still, solar cooker. 2.3: Solar space heating & cooling, solar refrigerator, solar thermal energy storage systems. Case Study: Solar thermal power plant working operation.	07
03	Solar Photovoltaic Energy: 3.1: Introduction and working principle of a solar PV systems, types of solar PV cells, solar tracking systems, controls and measurement methods of solar PV systems. 3.2: Methods to improve the efficiency of PV cells, parameters which affect the efficiency and life cycle of PV cells. Case Study: Installation of 1 kW of solar PV plant.	07
04	Wind Energy: 4.1: Basic components and working principle of wind energy conversion systems, wind data and site selection considerations, various types of wind energy conversion systems, constructional features of horizontal and vertical axis wind machines, performance analysis of horizontal and vertical axis wind machines. 4.2: Estimation of power output- betz limits, Environmental impacts of wind energy.	06

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05	<p>5.1: Energy from Biomass: Introduction of bioenergy, conversion technologies, types of biogas generation plants, design and construction details of biogas plant (KVIC), site selection, digester design consideration, filling a digester for starting, maintaining biogas production, utilization of biogas.</p> <p>5.2: Hydrogen Energy: Introduction and application, General introduction to infrastructure requirement for hydrogen production, storage, dispensing & utilization.</p> <p>Principles of fuel cells, types of fuel cells, power generation by fuel cells, applications of fuel cells.</p>	07
06	<p>6.1: Geothermal Energy: Introduction to geothermal technologies and methods of extracting geothermal energy, prospects of geothermal energy in India.</p> <p>6.2: Energy from the ocean: Wave energy characteristics and wave energy conversion devices, tide energy conversion devices, Ocean Thermal Energy Conversion (OTEC) systems.</p> <p>6.3: Energy management and economics: Energy conservation, energy security, energy economics, energy audit- definition, need, types of energy audit, Energy management (audit) approach-understanding energy costs, Energy conservation in Buildings: Energy Conservation Building Codes (ECBC): Green Building, LEED rating.</p>	07

Co No.	Course Outcomes
CO1	Describe the need for renewable energy and its potential for the development of a sustainable environment.
CO2	Analyze different solar collectors using geometrical parameters and photovoltaics for generation of solar energy.
CO3	Identify and analyze various wind turbine energy harnessment techniques.
CO4	Design biogas plant for harnessing energy from organic waste.
CO5	Describe significance of hydrogen energy to fulfill present and future energy needs.
CO6	Describe the operating principle of geothermal energy and ocean energy and their role in sustainable development.

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						2	3					
CO2	3	2	3									
CO3	3	2	3									
CO4	3	2	3									
CO5	3						2					
CO6	3						3					

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CO-PSO Mapping	PSO1	PSO2
CO1		2
CO2	3	
CO3	3	
CO4	3	
CO5	3	
CO6	3	

Target = 2 for all COs

FINAL CO	=	(0.8* Direct) + (0.2* Indirect)
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Direct	CO1	(0.7*Test) +(0.3*Univ Exam)
	CO2	(0.7*Test) +(0.3*Univ Exam)
	CO3	(0.7*Test) +(0.3*Univ Exam)
	CO4	(0.7*Test) +(0.3*Univ Exam)
	CO5	(0.7*Test) +(0.3*Univ Exam)
	CO6	(0.7*Test) +(0.3*Univ Exam)

Indirect	CO1	(1*Exit Survey)
	CO2	(1*Exit Survey)
	CO3	(1*Exit Survey)
	CO4	(1*Exit Survey)
	CO5	(1*Exit Survey)
	CO6	(1*Exit Survey)

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LESSON PLAN

Note: - Content beyond syllabus (CBS) is in **bold**

Weekly Plan	Topic	Module
Week 1 (25/07/22 – 27/07/22)	Introduction to Renewable Energy Sources. Classification of Energy Sources. International and Indian scenario.	1
Week 2 (01/08/22 – 05/08/22)	Need for Renewable Energy Sources. Energy consumption as a measure of a nation's development. Hybrid energy. Prospects of Renewable Energy Sources.	1
Week 3 (08/08/22 – 12/08/22)	Solar radiation terms, Diffuse and scattered radiation. Solar geometry, Earth-sun angles.	1
Week 4 (15/08/22 – 19/08/22)	Pyranometer, Pyrheliometer. Attenuation and measurement of solar radiation on horizontal and inclined surfaces, methods of solar radiation estimation.	2
Week 5 (22/08/22 – 26/08/22)	Solar collectors. Introduction and working principle of flat plate collectors. Concentrating collectors. Thermal performance analysis of flat plate collectors. Energy balance equations. Losses.	2
Week 6 (29/08/22 – 02/09/22)	Solar thermal devices. Solar air heaters. Solar water heaters. Solar dryers. Solar kilns. Solar ponds. Solar distillation. Solar cooker.	2
Week 7 (05/09/22 – 09/09/22)	Unit Test – 1	
Week 8 (12/09/22 – 16/09/22)	Solar space heating and thermal power plant. Photovoltaic effect, PV types, Introduction and working principle of solar PV systems, Photovoltaic system.	3
Week 9 (19/09/22 – 23/09/22)	Components and working principle of wind energy conversion systems, Betz limits, Environmental impacts of wind energy, Site selection considerations, various types of wind energy conversion systems, constructional features of horizontal and vertical axis wind machines, performance analysis of horizontal and vertical axis wind machines.	4
Week 10 (26/09/22 – 30/09/22)	Introduction of bioenergy, types of biogas plants, conversion technologies, design and construction details of biogas plant, site selection, filling a digester for starting, maintaining biogas production	5
Week 11 (03/10/22 – 07/10/22)	Introduction and application to Hydrogen energy, General introduction to infrastructure requirement for hydrogen production, storage, dispensing & utilization. Principles of fuel cells, types of fuel cells, power generation by fuel cells, applications of fuel cells.	5

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Week 12 (10/10/22 – 14/10/22)	Introduction to geothermal technologies, Methods of extracting geothermal energy, Prospects of geothermal energy in India. Wave energy conversion devices, tide energy conversion devices, Ocean Thermal Energy Conversion systems. Energy conservation, energy security, energy economics, energy audit- definition, need, types of energy audit, Energy conservation in Buildings: Energy Conservation Building Codes (ECBC): Green Building, LEED rating.	6
Week 13 (17/10/22 – 21/10/22)	UNIT TEST – 2	