

Subject Code: 2ET4000109	Subject Title: Renewable Energy Power Plants
Pre-Requisite	-----

Course objectives:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Maintain the efficient operation of various types of renewable energy power plants.

TEACHING AND EVALUATION SCHEME:

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)			
Lecture	Tutorial	Practical	Credit	Theory Marks		Practical Marks	
				University Assessment	Continuous Assessment	University Assessment	Continuous assessment
2	-	2	3	60	40	--	50

Course contents:

SR. NO.	TOPIC	TOTAL HOURS	WEIGHTAGE (%)
1	Solar PV and Concentrated Solar Power Plants Solar Map of India: Global solar power radiation, Solar PV. Concentrated Solar Power (CSP) plants, construction and working of: Power Tower, Parabolic Trough, Parabolic Dish, Fresnel Reflectors. Solar Photovoltaic (PV) power plant: Components layout, construction and working. Rooftop solar PV power system	5	20 %
2	Large Wind Power Plants Wind Map of India: Wind power density in watts per square meter Lift and drag principle; long path theory. Geared type wind power plants: components, layout and working. Direct drive type wind power plants: components, layout and working. Constant Speed Electric Generators: Squirrel Cage Induction Generators (SCIG), Wound Rotor Induction Generator (WRIG); Variable Speed Electric Generators: Doubly-fed induction generator (DFIG), Wound rotor synchronous generator, Permanent magnet synchronous generator (PMSG).	7	30 %

3	Small Wind Power Plants Horizontal axis small wind turbine: Horizontal axis small wind turbine: direct drive type, geared type, components and working, Vertical axis small wind turbine: direct drive and geared, components and working, Types of towers and installation of small wind turbines on roof tops and open fields. Electric generators used in small wind power plants	5	20 %
4	Micro-hydro Power Plants Energy conversion process of hydro power plant. Classification of hydro power plant: High, medium and low head. Layouts of micro-hydro power plants, Construction and working of hydro turbines used in different types of hydro power plant: 1. High head – Pelton turbine 2. Medium head – Francis turbine 3. Low head – Kaplan turbine Safe Practices for micro hydro power plants.	6	20 %
5	Biomass-based Power Plants Properties of solid fuel for biomass power plants: bagasse, wood chips, rice husk, municipal waste. Properties of liquid and gaseous fuel for biomass power plants: Jatropha, bio-diesel, gobar gas. Layout of a Bio-chemical based (e.g. biogas) power plant: Layout of a Thermo-chemical based (e.g. Municipal waste) power plant Layout of a Agro-chemical based (e.g. bio-diesel) power plant.	5	10 %

List of Practical:

1. Dismantle the parabolic trough CSP plant.
2. Assemble the parabolic trough Concentrated Solar Power (CSP) plant.
3. Assemble the parabolic dish CSP plant.
4. Dismantle the parabolic dish CSP plant.
5. Assemble the solar PV plant to produce electric power.
6. Dismantle the solar PV plant.
7. Identify the routine maintenance parts of the large wind power plant after watching a videoprogram.

8. Assemble a horizontal axis small wind turbine to produce electric power
9. Dismantle a horizontal axis small wind turbine.
10. Assemble a vertical axis small wind turbine to produce electric power
11. Dismantle a vertical axis small wind turbine.
12. Identify the routine maintenance parts of the micro hydro power plant after watching a videoprogram.
13. Assemble a micro hydro power plant.
14. Dismantle a micro hydro power plant.
15. Assemble a small biogas plant to generate electric power
16. Dismantle the biogas plant.

Course outcomes:

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented. COs associated with the above mentioned competency:

- a) Maintain the optimized working of solar PV and CS power plants.
- b) Maintain the optimized working of large wind power plants
- c) Maintain the optimized working of small wind turbines.
- d) Maintain the optimized working of micro hydro power plants.
- e) Maintain the optimized working of biomass-based power plants.

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Understand the various renewable energy sources and its need in the current scenario.	2 Understanding
CLO2	Understand solar radiation and concentrated type power plants.	2 Understanding 4 Analyzing
CLO3	Understand the large wind power plants like, CSEG, SCIG, WRIG, PMSG	2 Understanding 3 Applying
CLO4	Understand the small wind power plants and horizontal, vertical axis wind turbines working and layout.	4 Analyzing
CLO5	Understand the energy conversion process of micro-hydro power plants and its types.	3 Applying

CLO6	Understand the bio-mass plant to utilize the agricultural waste and process of the bio-diesel manufacturing.	4 Analyzing
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Po-Competency-Co Mapping :

Course Learning Outcomes	Program Outcomes(Po's)												Program-specific Outcomes(PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CLO1	M						M								
CLO2	L	M		M			H								L
CLO3	M						L							M	M
CLO4		L		L			H		L					M	
CLO5							M								
CLO6	H	M				M	H		M			H		H	