



Course Syllabus  
Gyanmanjari Diploma Engineering College  
Semester-4(Diploma)

**Subject:** Renewable Energy- DETME14213

**Type of course:** Minor

**Prerequisite:** Environment & Sustainability

**Rationale:** Renewable energy comes from unlimited, naturally replenished resources, such as the sun, tides and wind. Renewable energy can be used for electricity generation, space and water heating & cooling and transportation. A move towards renewable energy is essential for environment protection, but it also has great economic value. Studying renewable energies opens up a wide range of career options in a rapidly expanding industry. Renewable energy is derived from natural sources that are replenished at a higher rate than they are consumed. Sunlight and wind, for example, are such sources that are constantly being replenished. Renewable energy sources are plentiful and all around us. Technologies such as solar and wind are at the heart of transformations taking place across the global energy system. Their increasing deployment is crucial for efforts to tackle greenhouse gas emissions, reduce air pollution and expand energy access. The most compelling advantage of renewable energy is its potential to positively impact the environment. Fossil fuels, such as coal, oil and gas contribute around 75% of global greenhouse gas emissions. To tackle the threat of climate change, emissions need to be reduced by almost half by 2030.\

**Teaching and Examination Scheme:**

Teaching Scheme			Credits	Examination Marks					Total Marks
CI	T	P	C	Theory Marks		Practical Marks		CA	
				ESE	MSE	V	P	ALA	
3	0	2	4	60	30	10	20	30	150

*Legends: CI-Classroom Instructions; T – Tutorial; P - Practical; C – Credit; ESE - End Semester Examination; MSE- Mid Semester Examination; V – Viva; CA - Continuous Assessment; ALA- Active Learning Activities.*





**Course Content:**

Sr. No	Course Content	Hrs	% Weightage
1	<b>Introduction of renewable energy and solar energy:</b> Definition of Energy, Classification of energy sources, Conventional sources of energy, Comparison between conventional and non-conventional sources of energy, Advantages & Limitations of renewable sources of energy. Solar Physics, Solar cell, Solar Pond, Solar thermal collector, Types of heat losses from the flat plate collectors, Solar concentrator, Applications of solar energy like cooking, distillation, pumping and drying.	8	20
2	<b>Wind Energy Technology:</b> Introduction to Wind energy. Components, building, working, classification, and advantages & disadvantages of wind turbine, Horizontal & Vertical and its comparison Introduction, working, classification & Basic Components of WECS (Wind Energy Conversion System).	11	25
3	<b>Bio Energy Technologies:</b> Introduction, Definition, sources, forms, advantages, disadvantages, characteristics, applications of Biomass, Definition, stages & factors affecting photosynthesis process, Different processes like Thermo chemical, Biochemical, Pyrolysis, Hydro gasification, Hydro generation, Introduction, classification, working, construction, advantages, disadvantages & applications of Biogas plants, Factors affecting the production of Biogas, Different designs of Biogas plants.	11	25
4	<b>Green Energy Technology:</b> -Definition of tide & tidal power, its types, components, advantages & Disadvantages, Introduction, advantages & disadvantages to wave energy, Energy from waves like kinetic energy & potential energy, Types of waves like surface waves and internal waves, Wave energy conversion by floats Applications of wave energy, Introduction & its alternative sources, Advantages, Disadvantages & Applications of Geothermal energy, Introduction & its energy resources, Advantages, Disadvantages & the types of Ocean energy, Introduction & Principle of OTEC, Types of OTEC system : Closed cycle Open cycle, Advantages, Disadvantages & Applications of an OTEC system, Definition & Introduction of fuel cell, Basic components, Working & Types of fuel cell, Advantages, Disadvantages & Applications of fuel cell, Introduction & Working of MHD, Components of MHD system, Types of MHD systems like open cycle closed cycle system, Advantages & Disadvantages of MHD system	15	30

**Continuous Assessment (ALA):**

Renewable Energy- DETME14213





Sr. No	Active Learning Activities	Marks
1	<b>Case study</b> Carry out case study of any one of renewable energy used in Gujarat and upload report on GMIU web portal	10
2	<b>Energy used for various household appliances</b> Students have to identify the consumption of energy used for various household appliances like Washing Machine, TV, Refrigerator, etc. and upload report on GMIU web portal	10
3	<b>Making of solar oven</b> The solar oven you build in this activity is a relatively simple one made out of a pizza box, aluminum foil, plastic wrap, and a sheet of black paper. You cut a flap out of the pizza box's lid and line this flap with aluminum foil so that sunlight can be reflected off of the foil and into the box. upload model photographs on GMIU web portal	10
Total		30

### Suggested Specification table with Marks (Theory):60

Distribution of Theory Marks (Revised Bloom's Taxonomy)						
Level	Remembrance (R)	Understanding (U)	Application (A)	Analyze (N)	Evaluate (E)	Create (C)
Weightage	35%	30%	30%	5%	-	-

### Course Outcomes:

After learning the course, the students should be able to:	
CO1	Grasp renewable energy, solar physics, collectors, and applications.
CO2	Understand wind energy, turbines, and WECS components.
CO3	Understand bioenergy, biomass, biogas processes, and plant designs.
CO4	Understand of tidal, wave, geothermal, ocean, OTEC, fuel cells, and MHD systems, focusing on principles, types, and applications.





**List of Practical:**

Sr. No	Descriptions	Unit no.	Hrs.
1	<b>Introduction to Renewable Energy Resources:</b> Explore various renewable energy sources and their significance.	1	4
2	<b>Introduction to Instrumentation for Measuring Parameters of Solar, Wind, and Bio Energy:</b> Study the instruments used to measure technical parameters of solar, wind, and bioenergy systems.	1	4
3	<b>Demonstration of Solar Thermal Devices:</b> Demonstrate the working and construction of different solar thermal devices like box solar cookers and solar water heaters.	1	4
4	<b>Demonstration of Solar Photovoltaic Devices:</b> Explore the working of solar photovoltaic devices, including solar PV panels, inverters, storage batteries, and charge controllers, along with their specifications.	1	4
5	<b>Study of Wind Mills and Performance Evaluation:</b> Study different types of windmills and evaluate their performance parameters, including wind velocity and power using anemometers.	2	4
6	<b>Study of Biomass and Biogas Plants:</b> Learn about different types of biomass and biogas plants.	3	4
7	<b>Study of Green Energy Sources:</b> Explore different green energy sources such as tidal, geothermal, MHD, OTEC, wave, and ocean energy.	4	4
8	<b>Field Visits/Virtual Visits of Renewable Energy Installations:</b> Visit or explore different renewable energy installations to gain practical knowledge.	-	2
		Total	30

**Instructional Method:**

The course delivery method will depend upon the requirement of content and the needs of students. The teacher, in addition to conventional teaching methods by black board, may also use any tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.

From the content 10% topics are suggested for flipped mode instruction.

Students will use supplementary resources such as online videos, NPTEL/SWAYAM videos, e-courses, Virtual Laboratory.

The internal evaluation will be done on the basis of Active Learning Assignment.

Practical/Viva examination will be conducted at the end of semester for evaluation of performance of students in the laboratory.





**Reference Books:**

- [1] Solar energy – Principles of thermal collection and storage By Sukhatme S.P and J.K. Nayak. – McGraw Hill.
- [2] Non-conventional energy sources By G.D.Rai – Khanna publication.
- [3] Renewable energy technologies By R.Ramesh&Narosa – Narosa publishing house.

