

# GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Diploma Engineering

Level: Diploma

Branch: Mechanical / Mechanical (CAD/CAM) / Mechatronics Engineering/  
Automobile Engineering/Fabrication Technology/ Textile Processing  
Technology/ Textile Manufacturing Technology/ Textile Design/ CACDDM/  
Printing Technology/ Civil Engineering/ Mining Engineering

Subject Code: DI05000281

Subject Name: Renewable and Green Energy



<b>w. e. f. Academic Year:</b>	2026-2027
<b>Semester:</b>	5 <sup>th</sup>
<b>Category of the Course:</b>	MOPEC

<b>Prerequisite:</b>	<p>Students should have fundamental understanding of basic knowledge of Mathematics, Physics, and Environmental Science. Understanding fundamental concepts such as energy forms, units, power calculations, heat transfer, electricity basics, and simple engineering drawing is essential. Familiarity with conventional energy resources, energy conversion principles, and basic electrical components like voltage, current, and circuits will be helpful. Students should also possess awareness of environmental issues such as climate change, pollution, and sustainability. Basic computer skills for data analysis, simulations, and report preparation are desirable. This foundational knowledge will support better understanding of solar, wind, biomass, and other renewable energy technologies and applications.</p>
<b>Rationale:</b>	<p>Renewable &amp; Green Energy technologies are emerging as Energy Sources and technologies of the Future. The Energy Sector has been identified as a sector having maximum impact on global warming and Climate Change. More than 70% of environment related issues are caused by our energy demand and utilization which is mostly 'hydrocarbons' based. 'Decarbonization of Economy' is the modern mantra for saving Planet Earth from a potential environmental disaster. Promoting and facilitating rapid development of these 'hydrocarbon-free' technologies has become a priority worldwide. Deployment of Renewable Energy Sources for meeting our present and future energy demand is an immediate need for any nation. There is going to be huge demand of engineers/ technical professionals / manpower with in-depth knowledge, exposure and understanding about Renewable and Green Energy technologies. This course will provide the basic knowledge of prospective RE technologies, viz. solar energy, wind energy, bio energy, ocean energy, geothermal energy etc. This course would develop skills related to proper designing, constructing, operating, and monitoring RE systems. This course is concerning "Energy" which is subject for all disciplines of engineering and mechanical engineers will have an important role to play in effective deployment of RE Systems in the Industries.</p>

# GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Diploma Engineering

Level: Diploma

Branch: Mechanical / Mechanical (CAD/CAM) / Mechatronics Engineering/  
Automobile Engineering/Fabrication Technology/ Textile Processing  
Technology/ Textile Manufacturing Technology/ Textile Design/ CACDDM/  
Printing Technology/ Civil Engineering/ Mining Engineering

Subject Code: DI05000281

Subject Name: Renewable and Green Energy



## Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes
01	Interpret the need and scope of renewable and green energy resources.
02	Describe the working principles, components and applications of solar energy conversion systems.
03	Determine the principle of wind energy and evaluate the potential of wind energy conversion system.
04	Discuss various bioenergy resources and technologies including biogas, biomass and biofuels.
05	Identify additional green energy sources such as geothermal, tidal and hydrogen energy.

## Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR	Cr	Theory		Tutorial / Practical		
				ESE(E)	PA(M)	PA(I)	ESE(V)	
3	0	0	3	70	30	0	0	100

## Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	<b>Introduction to Renewable Energy</b> 1.1 Basics of Energy- Conventional & Non-Conventional Source of Energy 1.2 Global and Indian Energy Scenario 1.3 Impact of Conventional Energy Use on Global Environment 1.4 Classification of Renewable Energy and its potential as energy sources in future, Need of RE, advantages & limitations of RE. 1.5 Government Policies (Panchamrit Goals, UN-SDG towards RE)	05	11

# GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Diploma Engineering

Level: Diploma

Branch: Mechanical / Mechanical (CAD/CAM) / Mechatronics Engineering/  
Automobile Engineering/Fabrication Technology/ Textile Processing  
Technology/ Textile Manufacturing Technology/ Textile Design/ CACDDM/  
Printing Technology/ Civil Engineering/ Mining Engineering

Subject Code: DI05000281

Subject Name: Renewable and Green Energy



2.	<b>Solar Energy Technology</b> 2.1 Solar Radiation – understanding different terminologies 2.2 Solar Radiation Measurement (Pyranometer, Pyrheliometer, Sun shine recorder) 2.3 Solar PV System- cell, modules & arrays, Net metering concept 2.4 Recent advancement in Solar Panel (Bifacial, Monofacial) 2.5 Factors to be considered for Solar Panel Design & Installation, Case study 2.6 Solar Thermal Energy Collectors & its types 2.7 Application of Solar Thermal Energy (Solar heaters, Solar ponds, Solar cookers, Solar distillation, Solar space heating and drying) 2.8 Solar Thermal Electric Conversion 2.9 Simple numerical on Solar energy	15	34
3.	<b>Wind Energy Technology</b> 3.1 Wind Energy terminologies 3.2 Lift & Drag force terminology in Wind 3.3 Types of Wind Turbines – Horizontal axis wind turbine (HAWT) and vertical axis wind turbine (VAWT), on-shore & off-shore WTG 3.4 WTG construction and configuration 3.5 Estimation of Wind Power, Turbine Power & Annual Generation 3.6 Site Selection of Wind Power Plant 3.7 Hybrid Plant 3.8 Wind energy potential in India & Gujarat 3.9 Simple numerical on Wind Energy	09	20
4.	<b>Bio Energy Technology</b> 4.1 Biomass & its sources 4.2 Biomass Conversion Technologies- Biomass Gasification & pyrolysis Process 4.3 Types of Biogas Plant 4.4 Factors affecting biogas generation 4.5 Biocoal - Introduction, Process of briquetting, machinery, GCV 4.6 Biofuels- Biodiesel, Bioethanol	06	13
5.	<b>Additional Green Energy Sources</b> 5.1 Ocean Energy 5.1.1 Tidal Energy, energy from tides, tidal power plant, single & double basin plant 5.1.2 Ocean thermal energy Conversion (OTEC- Open & Closed) 5.1.3 Wave Energy 5.1.4 Hydro- small & micro hydro Power plants	10	22

# GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Diploma Engineering

Level: Diploma

Branch: Mechanical / Mechanical (CAD/CAM) / Mechatronics Engineering/  
Automobile Engineering/Fabrication Technology/ Textile Processing  
Technology/ Textile Manufacturing Technology/ Textile Design/ CACDDM/  
Printing Technology/ Civil Engineering/ Mining Engineering

Subject Code: DI05000281

Subject Name: Renewable and Green Energy



5.2 Geothermal energy - Vapour & liquid dominated systems, binary cycle, hot dry rock resources, magma resources		
5.3 Green Hydrogen Generation & Fuel Cell Technology		
5.4 MHD Power generation		
<b>Total</b>	<b>45</b>	<b>100</b>

## Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
26	34	10	0	0	0

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

## References/Suggested Learning Resources:

### (a) Books:

Sr. No.	Title of Book	Author	Publication
1.	Solar Energy – Principles of Thermal Collection and Storage	Sukhatme S.P. and J. K. Nayak	McGraw Hill Education
2.	Principles of Solar Engineering	D. Yogi Goswami, Frank Kreith & John F Kreider	Taylor & Francis
3.	Non-Conventional Energy Sources	G.D. Rai	Khanna Publication
4.	Renewable Energy Technologies	R. Ramesh & Narosa	Narosa publishing house
5.	Non- Conventional Energy Resources	B. H. Khan	Tata McGraw Hill
6.	Non- Conventional Resources of Energy	G.S. Sawhney	PHI
7.	Non- Conventional Energy Resources	Shobh nath singh	Person India
8.	Solar Energy Engineering	Soteris Kalogirou	Elsevier/Academic Press

# GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Diploma Engineering

Level: Diploma

Branch: Mechanical / Mechanical (CAD/CAM) / Mechatronics Engineering/  
Automobile Engineering/Fabrication Technology/ Textile Processing  
Technology/ Textile Manufacturing Technology/ Textile Design/ CACDDM/  
Printing Technology/ Civil Engineering/ Mining Engineering

Subject Code: DI05000281

Subject Name: Renewable and Green Energy



9.	Renewable Energy, power for a sustainable future	Godfrey Boyle, 2004	Oxford
----	--	---------------------	--------

## (b) Open-source software/Learning website:

1. <http://vlab.amrita.edu/>
2. <https://nptel.ac.in/courses/112/105/112105051/>
3. <https://nptel.ac.in/courses/108/105/108105058/>
4. <https://nptel.ac.in/courses/121/106/121106014/>
5. <http://ocw.mit.edu/courses/energy-courses/>
6. National Renewable Energy Laboratory (NREL), USA
7. Solar Energy Corporation of India Limited (SECI)
8. US Department of Energy, Energy efficiency & Renewable Energy
9. Ministry of New and Renewable Energy , New Delhi
10. Bureau of Energy Efficiency
11. Centre for Wind Energy Technology
12. The Energy Resource Institute

## Suggested Student Activities for Students: If any

Sr. No.	Activity
1.	Introduction to Instrumentation for measuring technical parameters of Solar, Wind and Bio Energy Sources. Viz. Solari Meter, Anemometer, Lux Meter, Digital Temperature Meter with different types of probes for different measurements.
2.	Demonstration on Working of different Solar Thermal Devices & their construction – Box Solar Cooker, Dish Solar Cooker, Solar Water Heater – FPC/ETC, insulated piping, and Hot Water Storage Tank.
3.	Demonstration on Working of Solar Photovoltaic Devices & their components, viz, Solar PV Panel, Solar Inverter, Storage Battery and Charge Controller and their technical specifications.
4.	Introduction to Instrumentation for measuring technical parameters of Solar, Wind and Bio Energy Sources. Viz. Solari Meter, Anemometer, Lux Meter, Digital Temperature Meter with different types of probes for different measurements.
5.	<b>Field Visits / Virtual Visits of different RE installations</b>
6.	Make an easy solar oven at home for cookies.

# GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Diploma Engineering

Level: Diploma

Branch: Mechanical / Mechanical (CAD/CAM) / Mechatronics Engineering/  
Automobile Engineering/Fabrication Technology/ Textile Processing  
Technology/ Textile Manufacturing Technology/ Textile Design/ CACDDM/  
Printing Technology/ Civil Engineering/ Mining Engineering

Subject Code: DI05000281

Subject Name: Renewable and Green Energy



	(for instructions: - <a href="#">Click here</a> )
7.	Prepare a display chart of Solar PV System
8.	Prepare a display chart of different types of Solar Collectors (FPC, ETC)
9.	Prepare a chart/presentation of HAWT power generation
10.	Prepare a chart/presentation of VAWT power generation
11.	Make a Power Point presentation on the MHD
12.	Prepare display chart of Ocean Thermal Energy Conversion (OTEC)
13.	Identify the potential of RE in India and total RE installed capacity (MW) of India

## Instruments required for carried out students' activity

Sr. No.	Equipment Name
1.	Measuring Instruments: - <ul style="list-style-type: none"><li>• Soleri Meter (Pyranometer),</li><li>• Multimeter,</li><li>• Anemometer,</li><li>• Sunshine recorder,</li><li>• Digital Thermometer with different probes (surface, air, liquid)</li></ul>
2.	Models of various solar energy collectors <ul style="list-style-type: none"><li>• Flat plate Collector (FPC)</li><li>• Cylindrical Parabolic Collectors</li><li>• Evacuated Tube Collector (ETC)</li><li>• Solar Photo Voltaic (SPV)</li></ul>
3.	Box type solar cooker, Solar Air Heater
4.	Various of models of Wind mill <ul style="list-style-type: none"><li>• HAWT</li><li>• VAWT</li></ul>
5.	Various of model hydro turbine using running tap

\* \* \* \* \*