Lok Jagruti Kendra University
University with a Difference

Diploma in Mechanical Engineering

Subject Code: 025060505

Alternate Energy Sources

Programme / Branch Name			Diploma in Mechanical Engineering			
Course Name	Alternate Energy Sources				**Code**	025060505
Course Type	HSSC	BSC	ESC	PCC	OEC	PEC

Legends: HSSC: Humanities and Social Sciences Courses BSC: Basic Science Courses
ESC: Engineering Science Courses PCC: Program Core Courses
OEC: Open Elective Courses PEC: Program Elective Courses

1. Teaching and Evaluation Scheme

Teaching Hours / Week				**Evaluation Scheme**			
L	**T**	**P**	**Total Credit**	**CCE**	**SEE (Th)**	**SEE (Pr)**	**TOTAL**
3	0	2	4	50	50	50	150

Legends:
L: Lectures T: Tutorial P: Practical
CCE: Continuous & Comprehensive Evaluation
SEE (Th): Semester End Evaluation (Theory)
SEE (Pr): Semester End Evaluation (Practical)

2. Prerequisites

- ✓ Environmental Science
- ✓ Basic High School Science

3. Rationale

The course presents the various sources of renewable energy including wind, solar, and biomass as potential sources of energy and investigates the contribution they can make to the energy profile of the nation. The technology used to harness these resources will be presented.

4. Objectives

- ✓ To Understand the need, importance and scope of alternate energy resources.
- ✓ To Create awareness about sources of energy and able to estimate how long the available conventional fuel reserves will last.
- ✓ To learn concepts of the renewable energy sources like wind, solar, Bio and other renewable energy resources.
- ✓ To know methods for Environmentally friendly energy production and consumption.
- ✓ To identify Energy-efficient systems and products for various applications.

5. Contents

Unit No.	Topics	Sub-Topics	Learning Outcome	% Weightage	Hours
1.	**Introduction**	1.1. Energy needs of India 1.2. Classification of Energy Resources 1.3. Energy efficiency and Energy security 1.4. Importance of Renewable Resources in India	• Understand the need of Alternate Sources and the various methods of energy storage	10	4
2.	**Solar Energy**	2.1. Basic Concepts 2.2. Types of Collectors 2.3. Collection Systems 2.4. Photo-Voltaic Technology: 2.4.1 Solar Thermal Effect 2.4.3 Solar Cell 2.4.3 Electric Power Generation 2.5. Solar Energy Applications 2.5.1 Solar water heater 2.5.2 Solar Cooker-Box type 2.5.3 Solar dryer	• Learn the fundamental concepts about solar energy systems and devices. • Explain the field applications of solar energy.	30	12
3.	**Wind Energy**	3.1. Wind Power Systems 3.2. Wind Speed and Power Relation Components 3.3. Turbine Types 3.4. Turbine Rating. 3.5. Choice of Generators and Site Selection 3.6. Wind Energy Forecasting, 3.7. Variable Speed Operation 3.8. Maximum Power Operation	• To get familiar with the basic terminology of a wind Power Plant. • Identify Winds energy as alternate form of energy and to know how it can be tapped.	20	10
4.	**Bio Energy**	4.1. Bio-Mass and Bio-Gas: Principles of Bio-Conversion 4.2. Bio-Gas Digesters Types 4.3. Gas Yield and Combustion Characteristics 4.4. Fermentation and Wet Processes 4.5. Applications-Utilization for Cooking	• To understand Bio mass and its conversion into energy. • To demonstrate applications of Bio Mass.	16	6
5.	**Other Renewable Energy Sources**	5.1. Geothermal Energy 5.2. Ocean Thermal Energy 5.3. Wave Energy 5.4. Tidal Energy 5.5. Waste to Energy 5.6. Heat to Energy	• To illustrate Wave energy, Ocean energy, Geothermal Energy and Tidal energy.	24	10

		5.7. Fuel Cells: Types and Applications.	• To identify opportunities for utilization of waste and heat as energy.		
				Total Hours	**42**

6. List of Practicals / Exercises

The practical/exercises should be properly designed and implemented in an attempt to develop different types of skills so that students can acquire the competencies/Programme outcomes. Following is the list of practical exercises for guidance.

Sr. No.	Practical / Exercises	Key Competency	Hours
1.	To measure the solar radiation on horizontal and tilted surface using solar radiation using Pyranometer.	Operation of Thermopile. Observe readings on Millivoltmeter	4
2.	To understand solar water pumping.	Visualize components of Solar Water Pump Functioning of Solar collector array. Observe Heat Transfer phenomenon.	2
3.	To study the constructional details of a box, type solar cooker.	Observe main parts of solar cooker.	2
4.	To evaluate the performance of box, type solar cooker.	Distinguish between Absorber, Reflector and Collector. Notice conditions for effective cooking.	2
5.	To study the various types of wind mill and evaluate the performance parameter of wind mill.	Verify various components of a Wind Mill. Apply mathematical equations for Performance calculations.	4
6.	To demonstrate the various types of gasifier and biogas plant.	Identify components of a Biogas Plant.	4
7.	To study the ocean energy, wave energy, geothermal energy conversion systems.	Describe various energy conversion systems.	6
8.	To estimate the economics of the solar energy conversion equipment.	Calculate the size of Solar Panels according to load. Estimate approximate cost and ROR on initial Capital.	4
		Total Hours	**28**

7. Suggested Specification Table for Evaluation Scheme

Unit No.	Unit Name	Distribution of Topics According to Bloom's Taxonomy					
		R %	U %	Ap %	C %	E %	An %
1.	Introduction	50	50	-	-	-	-
2.	Solar Energy	25	25	30	-	-	20
3.	Wind Energy	40	20	20	-	-	20
4.	Bio Energy	20	40	40	-	-	-
5.	Other Renewable Energy Sources	60	15	25	-	-	-

Legends: R: Remembering U: Understanding
App: Applying C: Creating
E: Evaluating An: Analyzing

8. Textbooks

1) Rai G.D, "Non-conventional Energy Sources" Khanna Publishers, 2006.
2) A. Duffie and W.A. Beckmann, Solar Engineering of Thermal Processes-John Wiley (1980)

9. Reference Books

1) F. Kreith and J.F. Kreider, Principles of Solar Engineering, McGraw-Hill (1978).
2) T.N. Veziroglu, Alternative Energy Sources, Vol 5 and 6, McGraw-Hill (1978).
3) David Hu. Hand Book of Industrial Energy Conservation, Van Nostrand Co., 1983
4) Handbook of Energy Engineering, Albert Thumann, D. Paul Mehta, 2008 Fairmont Press, Inc.

10. Open Sources (Website, Video, Movie)

1) Introduction to Non-Conventional Energy System -https://nptel.ac.in/courses/108/108/108108078/
2) Non-Conventional Energy Resources - https://nptel.ac.in/courses/121/106/121106014/
3) Alternative Energy Sources - https://www.youtube.com/watch?v=ieju2BPFUaw&list=PLhqHHC-xbfBPwHlAwAJSTlZXX06rJ28vA