

Department of Electrical & Electronics Engineering

COURSE MODULES OF THE SUBJECT TAUGHT FOR THE SESSION EVEN SEM 2023-24

Course Syllabi with CO's

RENEWABLE ENERGY SOURCES			
Faculty Name: Maria Sushma S		AY 2023-24	
Course Code:	BETCK205E	CIE Marks	50
Course Type	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P: S)	3	Exam Hours	03
Total Hours of Pedagogy	40 hours	Credits	03
Course objectives <ul style="list-style-type: none"> To understand energy scenario, energy sources, and their utilization. To explore society's present needs and future energy demands. To Study the principles of renewable energy conversion systems. To be exposed to energy conservation methods. 			
Teaching-Learning Process These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes and make Teaching –Learning more effective <ol style="list-style-type: none"> Use a pie chart showing the distribution of renewable energy sources Use wind turbine models Use sun path diagrams 			
Module-1 (08 hours)			
Introduction: Principles of renewable energy; energy and sustainable development, fundamentals and social implications. worldwide renewable energy availability, renewable energy availability in India, brief descriptions on solar energy, wind energy, tidal energy, wave energy, ocean thermal energy, biomass energy, geothermal energy, oil shale. Introduction to the Internet of energy (IOE).			
Revised Bloom's Taxonomy Level: L1 – Remembering, L2 – Understanding, L3 – Applying, L4 – Analysing			
Module-2 (08 hours)			
Solar Energy: Fundamentals; Solar Radiation; Estimation of solar radiation on horizontal and inclined surfaces; Solar radiation Measurements- Pyrheliometers, Pyrometer, Sunshine Recorder. Solar Thermal systems: Flat plate collector; Solar distillation; Solar pond electric power plant.			
Solar electric power generation- Principle of Solar cell, Photovoltaic system for electric power generation, advantages, Disadvantages and applications of solar photovoltaic system.			
Revised Bloom's Taxonomy Level: L1 – Remembering, L2 – Understanding, L3 – Applying, L4 – Analysing			
Module-3(08 hours)			
Wind Energy: Properties of wind, availability of wind energy in India, wind velocity and power from wind; major problems associated with wind power, Basic components of wind energy conversion system (WECS); Classification of WECS- Horizontal axis- single, double and multi-blade system. Vertical axis- Savonius and darrieus types.			
Biomass Energy: Introduction; Photosynthesis Process; Biofuels; Biomass Resources; Biomass conversion technologies -fixed dome; Urban waste to energy conversion; Biomass gasification (Downdraft) .			
Revised Bloom's Taxonomy Level: L1 – Remembering, L2 – Understanding, L3 – Applying, L4 – Analysing			
Module-4(08 hours)			
Tidal Power: Tides and waves as energy suppliers and their mechanics; fundamental characteristics of tidal power, harnessing tidal energy, advantages and limitations.			
Ocean Thermal Energy Conversion: Principle of working, OTEC power stations in the world, problems associatedwith OTEC.			
Revised Bloom's Taxonomy Level: L1 – Remembering, L2 – Understanding, L3 – Applying, L4 – Analysing			

Module-5 (08 hours)

Green Energy: Introduction, Fuel cells: Classification of fuel cells – H₂; Operating principles, Zero energy Concepts. Benefits of hydrogen energy, hydrogen production technologies (electrolysis method only), hydrogen energy storage, applications of hydrogen energy, problem associated with hydrogen energy.

Revised Bloom's Taxonomy Level: L1 – Remembering, L2 – Understanding, L3 – Applying, L4 – Analysing

Suggested Learning Resources:**Textbooks (Title of the Book/Name of the author/Name of the publisher/Edition and Year)**

1. Nonconventional Energy sources, G D Rai, Khanna Publication, Fourth Edition,
2. Energy Technology, S. Rao and Dr. B.B. Parulekar, Khanna Publication. Solar energy, Subhas P Sukhatme, Tata McGraw Hill, 2nd Edition, 1996.

Reference Books:

1. Principles of Energy conversion, A. W. Culp Jr., McGraw Hill, 1996
2. Non-Convention Energy Resources, Shobh Nath Singh, Pearson, 2018

Web links and Video Lectures (e-Resources):

- E-book URL: <https://www.pdfdrive.com/non-conventional-energy-sources-e10086374.html>
- E-book URL: <https://www.pdfdrive.com/non-conventional-energy-systems-nptel-d17376903.html>
- E-book URL: <https://www.pdfdrive.com/renewable-energy-sources-and-their-applications-e33423592.html>
- E-book URL: <https://www.pdfdrive.com/lecture-notes-on-renewable-energy-sources-e34339149.html>
https://onlinecourses.nptel.ac.in/noc18_ge09/preview

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Poster presentation on the theme of renewable energy sources
- Industry Visit

Course outcome (Course Skill Set)

At the end of the course the student will be able to:

CO1-Describe the environmental aspects of renewable energy resources. In Comparison with various conventional energy systems, their prospects, and limitations.

CO2-Describe the use of solar energy and the various components used in energy production with respect to applications like heating, cooling, desalination, and power generation.

CO3-Understand the conversion principles of wind and tidal energy

CO4-Understand the concept of biomass energy resources and green energy

CO5-Acquire the basic knowledge of ocean thermal energy conversion and hydrogen energy.

The Correlation of Course Outcomes (CO's) and Program Outcomes (PO's)

Course Code	BETCK105E				TITLE: RENEWABLE ENERGY SOURCES							
List of Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	P O4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO-1	2	2	-	-	-	2	-	2	-	-	-	3
CO-2	2	2	-	-	-	2	-	2	-	-	-	2
CO-3	2	2	-	-	-	2	-	2	-	-	-	2
CO-4	2	2	-	-	-	2	-	2	-	-	-	3
CO-5	2	2	-	-	-	2	-	2	-	-	-	2