RENEWABLE ENERGY SYSTEMS

PEC-I: EPS

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BPSB04	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

I. COURSEOVERVIEW:

This course envisages the renewable source of energy available in nature and to expose the students on sources of energy crisis, principle of operation of solar photo voltaic cell, different solar energy collectors and storage methods. It facilitates the study of wind turbines, geothermal energy, ocean, biomass, energy storage and distribution technologies. It concludes the knowledge of renewable energy resources for electrical applications.

II.COURSE OBJECTIVES:

This course should enable the students to:

I. Explain the concepts of Non-renewable and renewable energy systems
II. Understand integrated operation of renewable energy sources.
III. Outline utilization of renewable energy sources for both domestic and industrial applications.
IV. Analyze the environmental and cost economics of renewable energy sources in comparison with fossil fuels.

III. COURSEOUTCOMES

After successful completion of the course, students will be able to:		
CO 1	**Understand** the need of energy conversion and the various methods of energy storage	Understand
CO 2	**Analyze** the major parameters of sun movement, solar radiation and tracking systems for calculation of solar insulation	Analyze
CO 3	**Identify** different concentrating collectors for conversion of solar energy into thermal energy	Apply
CO 4	**Explain** the concepts involved in wind energy conversion system using vertical and horizontal wind mills	Understand
CO 5	**Illustrate** the operational methods of ocean energy for electrical energy conversion	Understand
CO 6	**Utilize** the distribution technologies for renewable energy distribution and storage	Apply

IV.SYLLABUS

UNIT-I	GLOBAL AND NATIONAL ENERGY SCENARIO	Classes: 09

Over view of conventional & renewable energy sources, need and development of renewable energy sources, types of renewable energy systems, future of energy use, global and Indian energy scenario, renewable and non-renewable energy sources, energy for sustainable development, potential of renewable energy sources, renewable electricity and key elements, global climate change, CO2 reduction potential of renewable energy, concept of hybridsystems.

UNIT-II	SOLAR AND WIND ENERGY	Classes: 12

Solar energy system: Solar radiation, availability measurement and estimation, solar thermal conversion devices and Storage, applications solar photovoltaic conversion, solar thermal applications of solar energy systems; Wind Energy Conversion: potential, wind energy potential measurement, site selection, types of wind turbines, wind farms, wind generation and control, nature of the wind, power in the wind, factors influencing wind, wind data and energy estimation, wind speed monitoring, classification of wind, characteristics, applications of wind turbines, offshore wind energy, hybrid systems, wind resource assessment, Betz limit, site selection, wind energy conversion devices,windmillcomponentdesign,economicsanddemandsidemanagement,energywheeling,energybanking

concepts, safety and environmental aspects, wind energy potential and installation in India.

UNIT-III	BIO GAS, TIDAL AND OCEAN ENERGY CONVERSION SYSTEMS	Classes: 12

Biogas: Properties of biogas (Calorific value and composition), Biogas plant technology and status, Bio energy system, design and constructional features, Biomass resources and their classification, Biomass conversion process, thermo chemical conversion, direct combustion, biomass gasification, pyrolysis and liquefaction, biochemical conversion, anaerobic digestion, types of biogas plants, applications, alcohol production from biomass, Bio diesel production, urban waste to energy conversion, Biomass energy programme in India.

Tidal Energy generation: Characteristics of tides, power generation schemes, components in tidal power plant, wave energy, principle of wave energy plant, wave energy conversion machines, Ocean thermal energy conversion: principle, cycles of operation, types of OTEC plants, applications.

UNIT-IV	GEO-THERMAL ENERGY AND FUEL CELLS	Classes: 06

Geothermal Energy: Structure of earth‟s interior, geothermal fields, gradient, resources, geothermal power generation; Fuel cells: introduction, principle of operation, types of fuel cells, state of art fuel cells, energy output of a fuel cell operating characteristics of fuel cells, thermal efficiency, need for hybrid systems, types of hybrid systems.

UNIT-V	ENERGY SYSTEMS AND GRIDS	Classes: 06

Introduction, energy systems, distribution technologies, energy storage for grid electricity, social and environmental aspects of energy supply and storage, electricity grids(networks), dc grids, special challenges and opportUNITies for renewable electricity, power electronic interface with the grid

Text Books:

1. DP Kothari, K C Singal, R Ranjan, “Renewable Energy Resources and Emerging Technologies”, PHI 2nd Edition, 2011.
2. John Twidell and Tony Weir,“Renewable Energy Resources”, CRC Press 2nd Edition,2006.

Reference Books:

1. Volker Quaschning “Understanding Renewable Energy Systems”, by UK, 1st Edition,2005.
2. Faner Lin Luo Honer Ye, “Renewable Energy Systems-Advanced Conversion, Technologies &Applications” by Taylor & Francisgroup CRC press, 1st Edition,2000.
3. S P Sukhatme, “Solar Energy Principles of thermal collection and storage”, 1st Edition,1999.
4. J. A. Duffie and W A Beckman, “Solar Engineering of Thermal Processes”, 1st Edition,1995.
5. Anthony San Pietro, “Biochemical and Photosynthetic aspects of Energy Production”, Academic Press, 1st Edition, 1980.
6. Bridgurater, AV, “Thermochemical Processing of Biomass”, Academic Press, 1st Edition,1981.
7. Kreith, F and Kreider, J F, “Principles of Solar Engineering”, McGraw-Hill, 1st Edition,1978.
8. Bent Sorensen, “Renewable Energy”, Elsevier Academic Press, 2011.
9. Rakosh Das Begamudre, “Energy conversion systems”- New Age International Publishers, NewDelhi, 2nd Edition,2000.
10. D. D. Hall and R. P. Grover, “Biomass Regenerable Energy”, 1st Edition,2000.

Web References:

1. https://www.researchgate.net
2. https://www.aar.faculty.asu.edu/classes
3. https://www.facstaff.bucknell.edu/
4. https://www.electrical4u.com
5. https://www.iare.ac.in

E-Text Books:

1. https://www.jntubook.com/
2. https://www.freeengineeringbooks.com