RENEWABLE ENERGY SYSTEMS

PE-I : EPS								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BPSC06	**Elective**	3	0	0	3	30	70	100
Contact Classes: 45	**Total Tutorials: Nil**	**Total Practical Classes: Nil**				**Total Classes: 45**		

I. COURSE OVERVIEW:

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:

The students will try to learn:

I. The environmental and economics related to renewable energy sources in comparison with fossil fuels
II. The basic characteristics of renewable energy sources and technologies for their utilization
III. The managerial skills to assess feasibility and drive strategies for alternative sources of energy

III. COURSE OUTCOMES:

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 insolation	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

MODULE –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 hybrid systems.

MODULE –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, wind mill component design, economics and demand side management, energy wheeling, energy banking concepts, safety and environmental aspects, wind energy potential and installation in India.

MODULE -IIIBIO GAS, TIDAL AND OCEAN ENERGY CONVERSION SYSTEMS(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.

MODULE -IVGEO-THERMAL ENERGY AND FUEL CELLS(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.

MODULE -VENERGY SYSTEMS AND GRIDS(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

V. Text Books:

1. DP Kothari, K CSingal, RRanjan, "Renewable Energy Resources and Emerging Technologies", PHI 2nd Edition, 2011.
2. John Twidell and Tony Weir,"Renewable Energy Resources",CRCPress 2nd Edition, 2006.

VI. 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, New Delhi, 2nd Edition, 2000.
10. D. D. Hall and R. P. Grover, "Biomass Regenerable Energy", 1st Edition, 2000.

VII. 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

VIII. E-Text Books:

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