



**Kadi Sarva Vishwavidyalaya**  
**Faculty of Engineering & Technology**  
**Fourth Year Bachelor of Engineering (Electrical Branch)**  
With effect from: Academic Year 2020-21

<b>Subject Code: EE804-N</b>	<b>Subject Title: Renewable Energy Technology</b>
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**Course Objective:**

- The course gives exposure to various renewable energy technologies. The course will enable the student to understand energy availabilities, estimation, and its measurement. This also focuses about the storage and conversion devices for the renewable energies. Renewable energy is one of the answers to the energy crisis and also to reduce environmental pollution. Students can apply these concepts to extract energy, understand the quantum of energy that can be extracted from various measures and utilise it for specific applications.

**A. Teaching / Examination Scheme**

Teaching scheme				Total Credit	Evaluation Scheme					Total Marks
L	T	P	Total		Theory		IE Marks	CIA Marks	Pract. Marks	
Hrs	Hrs	Hrs	Hrs		Hrs	Marks				
3	0	0	3	3	3	70	30	20	00	120

**B. Outline of the syllabus:**

- 1. Wind Energy System:** Grid connected systems, system configuration, working principles, limitations, effects of wind speed on grid conditions, grid independent systems - wind-battery, wind-diesel, wind-hydro-biomass etc., wind operated pumps, controller for energy balance
- 2. Solar Energy:** Solar radiation, terrestrial solar radiation, radiation balance, generalized transmission scattering by atmosphere, absorption of solar radiation, direct solar radiation. Low temperature solar radiation collector, flat plate collectors, optical characteristics of the absorber and the cover, HWB collector model, low temperature applications of solar energy solar swimming systems, solar drying, basic drying parameters, design calculation of solar drier, solar heat pump, solar refrigeration and air conditioning, electricity by solar, solar panels for battery charging. Solar Phototonic System: Characteristics, applications to lighting and water Pumps, PV panels, characteristics of motors and pumps connected to PV set.



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3. **Biomass energy:** State the different types of biomass energy sources, Describe about the energy content in biomass, Describe the working of simple biogas plant, Types of Biomass Energy Sources, Energy content in biomass of different types, Types of Biomass conversion processes, Biogas production
4. **Other Energy Technology:** Fuel cell technology: electromechanical effects and fuel cells, Reversible cells, Ideal Fuel cells, other types of fuel cells, Efficiency of fuel cells. Hydrogen Energy Technology Ocean Energy: Power plant based on Ocean energy. Bio fuel technology.

**C. Lesson Planning**

Unit No	Lectures (Hours)	% Weight age	Topics
1	9	20	Wind Energy System: Grid connected systems, system configuration, working principles, limitations, effects of wind speed on grid conditions, grid independent systems - wind-battery, wind-diesel, wind-hydro-biomass etc., wind operated pumps, controller for energy balance.
2	20	40	Solar Energy: Solar radiation, terrestrial solar radiation, radiation balance, generalized transmission scattering by atmosphere, absorption of solar radiation, direct solar radiation. Low temperature solar radiation collector, flat plate collectors, optical characteristics of the absorber and the cover, HWB collector model, low temperature applications of solar energy solar swimming systems, solar drying, basic drying parameters, design calculation of solar drier, solar heat pump, solar refrigeration and air conditioning, electricity by solar, solar panels for battery charging. Solar Photovoltaic System: Characteristics, applications to lighting and water Pumps, PV panels, characteristics of motors and pumps connected to PV set.
3	9	25	Biomass energy: State the different types of biomass energy sources, Describe about the energy content in biomass, Describe the working of simple biogas plant, Types of Biomass Energy Sources, Energy content in biomass of different types, Types of Biomass conversion processes, Biogas production.
4	7	15	Other Energy Technology: Fuel cell technology: electromechanical effects and fuel cells, Reversible cells, Ideal Fuel cells, other types of fuel cells, Efficiency of fuel cells. Hydrogen Energy Technology Ocean Energy: Power plant based on Ocean energy. Bio fuel technology.
<b>Total</b>	45	100	



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**D. Instructional Method & Pedagogy**

- At the start of course, the course delivery pattern , prerequisite of the subject will be discussed
- Lecture may be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lectures, which may carries five marks in overall evaluation.
- Two internal exams may be conducted and average of the same may be converted to equivalent of 15 marks as a part of internal theory evaluation.
- Assignment based on course content will be given to the student for each unit/topic and will be evaluated at regular interval. It may carry a weight age of five marks in the overall internal evaluation.
- Surprise tests/Quizzes/Seminar /Tutorial may be conducted and having share of five marks in the overall internal evaluation.

**E. Students Learning Outcomes**

At the end of the course

- The students will be able to understand the renewable energy resources and Technologies.
- The students will gain the knowledge of implementing the generation of electricity using renewable energy resources.

**F. Recommended Study Materials**

<http://www.nrel.gov/>

**Reference books:**

1. Non-conventional energy sources by G.D. Rai, Khanna Publishers
2. Solar Energy: Fundamentals and Applications by H.P. Garg & Jai Prakash, Tata McGraw Hill
3. Solar Energy: Principles of Thermal Collection and Storage by S,P Sukhatme, Tata McGraw Hill
4. Alternative Energy Sources by B.L. Singhal Tech Max Publication
5. Non Conventional Energy Resources by S.Hasan Saeed and D.K.Sharma
6. Fuel Cells by Bockris and Srinivasan; McGraw Hill
7. Magneto Hydrodynamics by Kuliovsky and Lyubimov, Addison
8. Solar Engineering of Thermal Processes by Duffic and Beckman, John Wiley



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