RKUNIVERSITY

SYLLABUS

Course Title	NON-CONVENTIONAL ENERGY CONVERSION SYSTEMS
Course Code	TH213
Course Credit	Lecture : 04
	Practical : 01
	Tutorial : 00
	Total : 05

Course Learning Outcomes

At the end of the course the students will be able to

- **Study** various non-conventional sources of energy like wind, biomass etc and its applications in remote areas of the country.
- **Understand** the working criteria of various direct energy conversion systems and study its applications.
- **Understand** the importance of non-conventional energy resources for the present energy scenario.
- **Understand** and pursue further research work behind the development of non-conventional energy sources as a part of their research work.
- **Understand** other direct energy conversion systems like magneto hydrodynamics, thermoelectric and fuel cells.
- **Evaluate** methods for generation of hydrogen power and production of hydrogen.

Detailed Syllabus

Sr. No.	Name of chapter & Details	Hours Allotted
	SECTION-I	
1	**Solar, Geothermal, OTEC, Tidal and wave energy conversion systems:** • Introduction of solar, solar radiation geometry and its measurement, solar radiation data and estimation of average solar radiation. • General study of geothermal energy sources, geothermal fields and exploration of geothermal field, area of further research interest in geothermal energy conversion systems. • General study of Ocean thermal energy conversion systems, principle of ocean thermal energy conversion systems, exploration and benefits of OTEC, area of further research interest in OTEC. • Other ocean energy sources: general study of tidal and wave energy conversion systems, prospects of research in ocean energy conversion systems.	**13**

2	**Biogas & Biomass Energy:** • Biogas conversion technologies, biogas generation, factors affecting biogas generation, classification of biogas plants, advantages and disadvantages of floating drum plant, and fixed dome type plant. • constructional details and design criteria of various biogas plants, selection of site, problems related to biogas plants, fuel properties of biogas, utilization of biogas, biogas development in India. • Biomass as a source of energy, advantages and limitations, energy plantation, advantages, plants proposed for energy plantation, methods of obtaining energy from biomass, biomass gasification, classification of biomass gasifier, chemistry of gasification process. • Application, advantages and disadvantages of biological conversion of solar energy.	**15**
	Total	**28**
	SECTION-II	
3	**Wind Energy:** • Brief history, wind data, wind measurement and measuring instruments, basic principles of wind energy conversion. • Basic terms, Power in the wind, maximum power (Betz limit), basic components of wind energy conversion systems (WECS), classification, advantages and disadvantages of different WECS, design consideration of horizontal axis and vertical axis machines. • Analysis of aerodynamics forces acting on blades, performance of wind machines, wind farms, site selection consideration, energy storage, applications, maintenance, safety, environmental aspects, economic consideration of wind machines.	**10**
4	**Direct Energy Conversion Systems other than solar:** • Fuel cells, principle of operation and design consideration of fuel cells, their classification advantages, disadvantages, work output and EMF of fuel cells, Applications of fuel cells. • Magneto-hydrodynamic power generation – Principle of MHD power generation, MHD systems. • Advantages and disadvantages, problems associated with MHD, plant configurations, detailed analysis of MHD generation. • Thermoelectric power, basic principles, thermoelectric power generator, performance analysis thermoelectric materials and their selection. Thermionic generation, thermionic emission and work function, basic thermionic generator and its analysis. • Recent trends in direct energy conversion systems.	**11**
5	**Hydrogen Energy:** • Introduction, Hydrogen Production methods. • Hydrogen storage, hydrogen transportation, utilization of hydrogen gas. • Hydrogen as alternative fuel for vehicles.	**7**
	Total	**28**

Instructional Method and Pedagogy:

- At the beginning of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, blackboard, OHP etc.
- Attendance is compulsory in lectures and laboratory.
- Minimum two internal exams will be conducted and average of two will be considered as a part of overall evaluation.
- Assignments based on course content will be given to the students at the end of each unit/topic and will be evaluated at regularly.
- Surprise tests/Quizzes/Seminar/Tutorials will be conducted.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.
- Tutorials and assignments are to be submitted as term-work in laboratory related to course contents.

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, TMH.
3. Solar Energy: Principles of Thermal Collection and Storage by S. P. Sukhatme, TMH.
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 Publication.
8. Solar Engineering of Thermal Processes by Duffic and Beckman, John Wiley.