KTU Students

Course code	Course Name	L-T-P - Credits	Year of Introduction
EE367	New and Renewable Sources of Energy	3-0-0-3	2016

Prerequisite: Nil

Course Objectives:

- To give sufficient knowledge about the promising new and renewable sources of energy
- To equip students in working with projects and to take up research work in connected areas.

Syllabus:

Solar energy - Solar radiation measurements - Applications of solar energy - Energy from oceans- Tidal energy - Wind energy -Small Hydro Power (SHP) Stations- Biomass and bio-fuels - geothermal energy -Power from satellite stations - Hydrogen energy.

Expected Outcome:

- The students will be able to design and analyse the performance of small isolated renewable energy sources.

References:

1. A.A.M. Saigh (Ed): Solar Energy Engineering, Academic Press, 1977
2. Abbasi S. A. and N. Abbasi, Renewable Energy Sources and Their Environmental Impact, Prentice Hall of India, 2001..
3. Boyle G. (ed.), Renewable Energy - Power for Sustainable Future, Oxford University Press, 1996
4. Earnest J. and T. Wizelius, Wind Power Plants and Project Development, PHI Learning, 2011.
5. F. Kreith and J.F. Kreider: Principles of Solar Engineering, McGraw Hill, 1978
6. G.N. Tiwari: Solar Energy-Fundamentals, Design, Modelling and Applications, Narosa Publishers, 2002
7. J.A. Duffie and W.A. Beckman: Solar Energy Thermal Processes, J. Wiley, 1994
8. Johansson T. B., H. Kelly, A. K. N. Reddy and R. H. Williams, Renewable Energy – Sources for Fuel and Electricity, Earth scan Publications, London, 1993.
9. Khan B. H., Non-Conventional Energy Resources, Tata McGraw Hill, 2009.
10. Rao S. and B. B. Parulekar, Energy Technology, Khanna Publishers, 1999.
11. Sab S. L., Renewable and Novel Energy Sources, MI. Publications, 1995.
12. Sawhney G. S., Non-Conventional Energy Resources, PHI Learning, 2012.
13. Tiwari G. N., Solar Energy- Fundamentals, Design, Modelling and Applications, CRC Press, 2002.

Course Plan

Module	Contents	Hours	Sem. Exam Marks
I	Introduction, Classification of Energy Resources; Conventional Energy Resources - Availability and their limitations; Non-Conventional Energy Resources – Classification, Advantages, Limitations; Comparison of Conventional and Non-Conventional Energy Resources; World Energy Scenario; Indian Energy Scenario. ENERGY STORAGE: Sizing and Necessity of Energy Storage.	5	15%
II	SOLAR THERMAL SYSTEMS: Introduction, Solar Constant, Basic Sun-Earth Angles, Measurement of Solar Radiation Data – Pyranometer and Pyrheliometer .Principle of Conversion of Solar Radiation into Heat, – Solar thermal collectors – General description	11	15%

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	and characteristics – Flat plate collectors – Heat transfer processes – Solar concentrators (parabolic trough, parabolic dish, Central Tower Collector) –performance evaluation..		
FIRST INTERNAL EXAMINATION			
III	SOLAR ELECTRIC SYSTEMS: Solar Thermal Electric Power Generation –; Solar Photovoltaic – Solar Cell fundamentals, characteristics, classification, construction of module, panel and array. Solar PV Systems – stand-alone and grid connected; Applications – Street lighting, Domestic lighting and Solar Water pumping systems..	5	15%
IV	ENERGY FROM OCEAN: Tidal Energy – Principle of Tidal Power, Components of Tidal Power Plant (TPP), Classification of Tidal Power Plants, Advantages and Limitations of TPP. Ocean Thermal Energy Conversion (OTEC): Principle of OTEC system, Methods of OTEC power generation – Open Cycle (Claude cycle), Closed Cycle (Anderson cycle) and Hybrid cycle (block diagram description of OTEC); Site-selection criteria, Biofouling, Advantages & Limitations of OTEC.	7	15%
SECOND INTERNAL EXAMINATION			
V	WIND ENERGY: Introduction, Wind and its Properties, History of Wind Energy, Wind Energy Scenario – World and India. Basic principles of Wind Energy Conversion Systems (WECS), Classification of WECS, Parts of WECS, Derivation for Power in the wind, Electrical Power Output and Capacity Factor of WECS, Advantages and Disadvantages of WECS	7	20%
VI	BIOMASS ENERGY: Introduction, Photosynthesis process, Biomass fuels, Biomass conversion technologies, Urban waste to Energy Conversion, Biomass Gasification, Biomass to Ethanol Production, Biogas production from waste biomass, factors affecting biogas generation, types of biogas plants – KVIC and Janata model; Biomass program in India. Small hydro power: Classification as micro, mini and small hydro projects - Basic concepts and types of turbines - Design and selection considerations. EMERGING TECHNOLOGIES: Fuel Cell, Small Hydro Resources, Hydrogen Energy, alcohol energy, nuclear fusion and power from satellite stations.	7	20%
END SEMESTER EXAM			

QUESTION PAPER PATTERN:

Maximum Marks: 100 Exam Duration: 3Hourrs.

Part A: 8 compulsory questions. One question from each module of Module I - IV; and two each from Module V & VI. Student has to answer all questions. (8 x5)=40

Part B: 3 questions uniformly covering Modules I & II. Student has to answer any 2 from the 3 questions: (2 x 10) =20. Each question can have maximum of 4 sub questions (a,b,c,d), if needed.

Part C: 3 questions uniformly covering Modules III & IV. Student has to answer any 2 from the 3 questions: (2 x 10) =20. Each question can have maximum of 4 sub questions (a,b,c,d), if needed.

Part D: 3 questions uniformly covering Modules V & VI. Student has to answer any 2 from the 3 questions: (2 x 10) =20. Each question can have maximum of 4 sub questions (a,b,c,d), if needed.

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