



SEMESTER-III

PHYSEC201

PART-A: RENEWABLE ENERGY AND ENERGY HARVESTING

Marks = 100 [ESE (50) IT (20) LAB (30)]

Contact Hours: 30

***Course objective:** The aim of this course is to impart theoretical knowledge on various energy sources and their harvesting techniques along with the exposure of hands-on learning.*

Unit 1: Energy Sources

Concept of work and energy. Definition and units of energy, power. Classification of energy sources: Primary and Secondary energy, Commercial and Non-commercial energy, Renewable and Non-renewable energy, Importance of renewable energy resources. Overview of Indian & world energy scenario with latest statistics- consumption & necessity. Need of eco-friendly & green energy. **(6 Lectures)**

Unit 2: Fossil fuels and Alternate Sources of energy: Energy consumption in various sectors. Fossil fuels and their classifications. Advantages and disadvantages of fossil fuels. Nuclear fuel and its types. Nuclear reactor: Construction and working. Advantages and disadvantages of nuclear energy. Need of renewable energy, non-conventional energy sources and sustainability. Biomass and biogas generation and applications. Hydroelectric power. **(7 Lectures)**

Unit 3: Solar energy: Solar energy and its origin (pp-cycle). Importance of solar energy, storage of solar energy, solar pond, non-convective solar pond, applications of solar pond and solar energy, solar water heater, flat plate collector, solar distillation, solar cooker, solar green houses, solar cell. Need and characteristics of photovoltaic (PV) systems. **(5 Lectures)**

Unit 4:

Wind Energy harvesting: Fundamentals of Wind energy, Wind speed and power relation, Wind Turbines and different electrical machines in wind turbines.

Ocean Energy: Ocean Energy Potential against Wind and Solar, Wave Characteristics and Statistics, Wave Energy Devices. Tide characteristics and Statistics, Tide Energy Technologies, Ocean Thermal Energy. **(5 Lectures)**

Unit 5:

Geothermal Energy: Geothermal Resources, Geothermal Technologies.

Hydro Energy: Hydropower resources, hydropower technologies, environmental impact of hydro power sources.

Piezoelectric Energy harvesting: Introduction, Physics and characteristics of piezoelectric effect, materials and mathematical description of piezoelectricity, Piezoelectric parameters, Piezoelectric energy harvesting applications. **(7 Lectures)**



LAB: PART-B: 30 hours. (Practical/Project/ Field work):

Following are the lists of practicals:

1. To study the voltage and current of solar cells in series.
2. To study the voltage and current of solar cells in parallel.
3. To calculate the efficiency of a solar cell.
4. To study the application of solar cells for providing electrical energy to the domestic appliances.
5. To study the conversion of vibration to voltage using piezoelectric materials.
6. To study the conversion of thermal energy into voltage using thermoelectric modules.

Expected learning outcomes: *At the end of this course the students are expected to get acquainted with the theoretical knowledge on various energy sources such as Fossil fuels, Solar energy, Wind energy, Ocean Energy, Geothermal Energy, Piezoelectric energy along with energy harvesting techniques through the exposure of hands-on learning.*

Reference Books:

- i. Non-conventional energy sources - G.D Rai - Khanna Publishers, New Delhi.
- ii. Solar energy - M P Agarwal - S Chand and Co. Ltd.
- iii. Solar energy - Suhas P Sukhative, Tata McGraw - Hill Publishing Company Ltd.
- iv. Godfrey Boyle, "Renewable Energy, Power for a sustainable future", 2004, Oxford University Press, in association with The Open University.
- v. Dr. P Jayakumar, Solar Energy: Resource Assesment Handbook, 2009.
- vi. J. Balfour, M.Shaw and S. Jarosek, Photovoltaics, Lawrence J Goodrich (USA).
- vii. http://en.wikipedia.org/wiki/Renewable_energy.
