

B.E ELECTRICAL AND ELECTRONICS ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER - VI

RENEWABLE ENERGY SYSTEMS (3:0:0) 3

(Open Elective – Group I)

(Effective from the academic year 2021-22)

Course Code	21EE651	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	3

Course Objectives:

1. Awareness about Renewable Energy Sources and technologies.
2. Adequate inputs on a variety of issues in harnessing renewable Energy.
3. Recognize current and possible future role of renewable energy sources.

Module – 1

Introduction: Importance of electric power generation in Indian economy, factors influencing power generation, Green energy concepts, Causes of Energy Scarcity, Solution to Energy Scarcity, Factors Affecting Energy Resource Development, Energy Resources and Classification, Renewable Energy – Worldwide Renewable Energy Availability, Renewable Energy in India.

Solar Thermal Energy Collectors: Types of Solar Collectors, Configurations of Certain Practical Solar Thermal Collectors, Material Aspects of Solar Collectors, Concentrating Collectors, Parabolic Dish – Stirling Engine System, Working of Stirling or Brayton Heat Engine, Solar Collector Systems into Building Services, Solar Water Heating Systems, Passive Solar Water Heating Systems, Applications of Solar Water Heating Systems, Active Solar Space Cooling, Solar Air Heating, Solar Dryers, Crop Drying, Space Cooling, Solar Cookers, Solar pond.
(8 Hours)

Module – 2

Solar Cells: Components of Solar Cell System, Elements of Silicon Solar Cell, Solar Cell materials, Practical Solar Cells, I – V Characteristics of Solar Cells, Efficiency of Solar Cells, Photovoltaic panels (series and parallel arrays).

Wind Energy: Windmills, Wind Turbines, Wind Resources, Wind Turbine Site Selection.
(8 Hours)

Module – 3

Hydrogen Energy: Benefits of Hydrogen Energy, Hydrogen Production Technologies, Hydrogen Energy Storage, Use of Hydrogen Energy, Advantages and Disadvantages of Hydrogen Energy, Problems Associated with Hydrogen Energy.

Geothermal Energy: Geothermal Systems, Classifications, Geothermal Resource Utilization, Resource Exploration, Geothermal Based Electric Power Generation, Associated Problems, environmental Effects.
(8 Hours)

Module – 4

Biomass Energy: Biomass Production, Energy Plantation, Biomass Gasification, Theory of Gasification, Gasifier and Their Classifications, Updraft, Downdraft and Cross-draft Gasifiers, Fluidized Bed Gasification, Use of Biomass Gasifier, Applications of Biomass Gasifier.

Biogas Energy: Introduction, Biogas and its Composition, Anaerobic Digestion, Biogas Production, Benefits of Biogas, Factors Affecting the Selection of a Particular Model of a Biogas Plant.

Tidal Energy: Introduction, Tidal Energy Resource, Tidal Energy Availability, Energy Availability in Tides, Tidal Power Basin, Turbines for Tidal Power, Advantages and Disadvantages of Tidal Power, Problems Faced in Exploiting Tidal Energy. (8 Hours)

Module - 5

Sea Wave Energy: Introduction, Motion in the sea Waves, Power Associated with Sea Waves, Devices for Harnessing Wave Energy, Advantages and Disadvantages of Wave Power.

Ocean Thermal Energy: Introduction, Principles of Ocean Thermal Energy Conversion (OTEC), Ocean Thermal Energy Conversion plants, Basic Rankine Cycle and its Working, Closed Cycle, Open Cycle and Hybrid Cycle, Carnot Cycle, Application of OTEC in Addition to Produce Electricity, Advantages, Disadvantages and Benefits of OTEC. (8 Hours)

Course Outcomes: At the end of the course the student will be able to

CO1: Discuss causes of energy scarcity and its solution, energy resources and availability of renewable energy.

CO2: Discuss types of solar collectors, their configurations, solar cell system, its characteristics and their applications.

CO3: Explain the operation of various renewable energy systems.

CO4: Explain different emerging energy conversion technologies and storage.

Question paper pattern:

SEE will be conducted for 50 marks.

- The question paper will have 50 questions. Each question is set for 01 mark.
- SEE Pattern will be in MCQ Model (Multiple Choice Questions) for 50 marks.
- The duration of the examination is 01 Hour.

CIE will be announced prior to the commencement of the course.

- Three Unit Tests each of **20 Marks** (Duration 01 hour).
- Two assignments each of 10 Marks.
- Two alternate assessment tools (AATs) for **20 Marks** (duration 01 hour).

The sum of three tests, two assignments, and AATs will be out of 100 marks and will be scaled down to 50 marks.

Textbooks:

1. Shobh Nath Singh, "Nonconventional Energy Resources", Pearson, 1st Edition, 2015.

References:

1. Godfrey Boyle, "Renewable Energy: Power for a sustainable Future", Oxford, 3rd Edition, 2012.
2. Tasneem Abbasi, S.A. Abbasi, "Renewable Energy Sources: Their Impact on global Warming and Pollution", PHI 1st Edition, 2011.