

COURSE TITLE : RENEWABLE ENERGY SOURCES
COURSE CODE : 5035
COURSE CATEGORY : E
PERIODS/WEEK : 4
PERIODS/SEMESTER : 52
CREDITS : 4

TIME SCHEDULE

MODULE	TOPICS	PERIODS
1	Types of Renewable Energy Sources	13
2	Solar Energy	13
3	Wind Energy	13
4	Application of Power Electronics In Renewable Energy	13
Total		52

Course Outcome:

Sl.	Sub	On completion of this course the student will be able:
1	1	To understand the renewable energy sources.
	2	To understand the working of power plants using renewable energy
2	1	To comprehend the various methods of energy conversion from solar.
	2	To comprehend the solar power plants.
3	1	To comprehend the wind power plants.
	2	To comprehend the components in wind electrical systems.
4	1	To comprehend different controllers in co operated with PV system.
	2	To understand standalone and grid connected solar energy and wind energy system.

Specific Outcome:

MODULE I Types of Renewable Energy Sources

- 1.1.1 To explain different forms of non-conventional energy sources.
- 1.1.2 To describe the basics of solar, bio-gas, wind, tidal, geothermal energy sources.
- 1.1.3 To describe bio-gas conversion technologies.
- 1.1.4 To list the factors affecting bio digestion.
- 1.1.5 To describe the classifications of bio-gas plants.
- 1.1.6 To distinguish between dom and drum type plants.
- 1.1.7 To describe the methods for obtaining energy from biomass.
- 1.1.8 To explain the classification of biomass gasifiers.
- 1.1.9 To describe the geothermal resources.
- 1.1.10 To describe the hydrothermal resources.
- 1.1.11 To explain the methods of ocean, thermal power generation.
- 1.1.12 To explain open cycle OTEC system and closed or Anderson OTEC cycle.
- 1.1.13 To describe the basic principle of tidal power.
- 1.1.14 To explain chemical energy sources.
- 1.1.15 To explain the magneto hydro dynamic (MHD) power plants.

- 1.2.1 To describe the types of biogas plants.
- 1.2.2 To describe the vapour dominated power plant.
- 1.2.3 To describe the liquid dominated systems.
- 1.2.4 To compute simple problems related to geothermal plants.
- 1.2.5 To describe the inter connection in geothermal fossil systems.
- 1.2.6 To distinguish between geothermal preheat hybrid system and fossil superheat hybrid system.
- 1.2.7 To describe the application of geothermal energy.
- 1.2.8 To explain the schematic layout of tidal power house with a sketch.
- 1.2.9 To compute energy and power in simple single basin tidal system.
- 1.2.10 To describe the operation and classification of fuel cells.
- 1.2.11 To describe different types of fuel cells- hydrogen, fossil fuel, hydrocarbon fuel, alcohol fuel, hydrazine fuel.
- 1.2.12 To describe the open cycle MHD generation system.
- 1.2.13 To describe the closed cycle MHD generation system.

MODULE II Solar Energy

- 2.1.1 To explain the solar radiation received on the earth's surface
- 2.1.2 To describe the solar radiation geometry
- 2.1.3 To describe the solar radiation measurements
- 2.1.4 To describe the principles of the conversion of solar radiation into heat

- 2.1.5 To explain solar collectors - focusing type& flat type
- 2.1.6 To describe various types of focusing collectors
- 2.1.7 To explain various types of solar energy storage systems
- 2.1.8 To describe the solar pond
- 2.1.9 To explain the applications of solar energy

- 2.2.1 To describe solar water heating
- 2.2.2 To describe solar space heating
- 2.2.3 To describe solar space cooling
- 2.2.4 To describe the thermal electric conversion of solar energy
- 2.2.5 To describe photo electric conversion energy
- 2.2.6 To describe solar distillation
- 2.2.7 To describe solar pumping
- 2.2.8 To describe agricultural and industrial process heat
- 2.2.9 To describe solar furnace
- 2.2.10 To describe solar cooking
- 2.2.11 To describe solar green houses

MODULE III Wind Energy

- 3.1.1 To describe the principles of wind energy conversions
- 3.1.2 To describe wind data and energy estimation
- 3.1.3 To describe basic components of wind energy conversion system
- 3.1.4 To describe the classification of WEC system
- 3.1.5 To describe the merit and demerits of WECs.

- 3.2.1 To explain wind energy collectors
- 3.2.2 To explain horizontal axis wind machines
- 3.2.3 To explain vertical axis wind machines
- 3.2.4 To distinguish between horizontal axial machines and vertical axial machines
- 3.2.5 To describe the components of wind electric systems
- 3.2.6 To list out the schemes for electric generation
- 3.2.7 To describe constant speed constant frequency system.
- 3.2.8 To describe variable speed constant frequency system.
- 3.2.9 To describe variable speed & variable frequency system
- 3.2.10 To describe the principle of induction generators.
- 3.2.11 To describe wind energy storage.
- 3.2.12 To explain various applications of wind energy.
- 3.2.13 To describe the environmental aspects of wind energy.

MODULE IV Application of Power Electronics In Renewable Energy

- 4.1.1 To explain the block diagram of solar PV system.
- 4.1.2 To describe the use of power conversion in PV application.
- 4.1.3 To describe boost converter.
- 4.1.4 To describe buck converter
- 4.1.5 To explain the concept of maximum power point tracking (MPPT).
- 4.1.6 To describe charge controller in P V system.
- 4.1.7 To describe block diagram of wind energy system.
- 4.1.8 To describe the use of power converter in wind energy application.
- 4.1.9 To describe -DC- converter.

- 4.2.1 To describe stand alone solar energy system.
- 4.2.2 To describe grid connected solar energy system.
- 4.2.3 To describe stand alone wind energy system.
- 4.2.4 To describe grid connected wind energy system.

CONTENTS

MODULE – I

Non conventional energy sources – solar – bio gas – wind – tidal – geo thermal – bio gas – conversion – factors effecting bio digestion – classification – dom and drum type – methods of energy extraction from biomass – classification of bio mass gasifiers. Resources - geo thermal – hydrothermal – vapour dominated and liquid dominated- problems related to geo thermal – interconnections geo thermal fossil systems – comparison – geo thermal preheat hybrid system- fossil superheat hybrid system – applications geo thermal – power generation – ocean thermal – open cycle OTEC- closed cycle OTEC. Tidel power – basic principle – schematic layout – single basin tidal system - Chemical energy – operation and classifications of fuel cells - hydrogen- fossil fuel- hydro carbon fuel- alcohol fuel – MHD power plants.

MODULE –II

Solar energy – solar radiation – measurements - solar energy conversion in to heat – solar collectors - focusing – storage systems – solar pond - Application of solar energy in heating - Thermal electrical conversion of solar energy. Photo electrical energy conversion – principle – construction of PV modules– storage.

MODULE - III

Wind energy conversion – components in WEC system- classification- comparison - merits and demerits - Wind electric generation – classifications – storage – application - Environmental aspects of wind energy.

MODULE – IV

Block diagram of solar electric system- power conversion PV system - charge controller – different types – maximum power point tracking (MPPT) - Block diagram of wind energy conversion system - power converter in wind energy. Standalone and grid connected system in solar and wind energy.

REFERENCE BOOKS

1. D.S. Chauhan. Non-Conventional Energy Resources: New age International
2. G.D. Rai. Non-conventional Energy Sources: Dhanpath Rai & Sons