| AE-414: Renewable Energy Sources | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **L** | **T** | **P** | Credit | Area | | **CWS** | **PRS** | **MTE** | **ETE** | **PRE** |
| 3 | 0/1 | 2/0 | 4 | DEC | | 15/25 | 25/- | 20/25 | 40/50 | - |

**Objectives:** To familiarize the students with renewable energy sources like solar, geothermal, wind and tidal.

| AE-414: Renewable Energy Sources | | Contact Hours |
|---|---|---|
| **Unit-1** | Man and Energy, world production and reserve of conventional energy sources, Indian production and reserves, Energy alternatives | **7** |
| **Unit-2** | Solar radiation: Origin, nature and availability of solar radiation, estimation of solar radiation. Photovoltaic cells. Design consideration and performance of different types of solar cells. Flat plate, focusing collectors. Effects of receiving surface location and orientation | 7 |
| **Unit-3** | Devices for solar thermal collection and storage. Energy storage devices such as water storage systems, packed Bed storage systems, phase change storage systems. Heat transfer considerations relevant to solar energy. Characteristics of materials and surfaces used in solar energy absorption | **7** |
| **Unit-4** | Application systems for space heating, solar water pumps, solar thermal pond, Solar Thermal Power plants, solar distillation, Solar Refrigeration and solar air conditioning, other solar energy utilization | **7** |
| **Unit-5** | Solar PV systems. Fuel Cell Technologies. Generation and utilization of biogas, design of biogas plants, Wind energy systems. | **7** |
| **Unit-6** | Geothermal Energy Systems. Tidal energy systems. Oceanic power generation. Design considerations, Installation and Performance Evaluation. MHD power generations. Role of the nonconventional energy sources in power planning. | **7** |
| | **Total** | **42** |



| **Reference Books:** | |
|---|---|
| 1 | G. D. Rai, “Energy Technolgy”, Khanna Publishers, ISBN- 97881740907438 |
| 2 | S.P. Sukhatme“, Solar Energy”, Tata-Mcgraw hill, New Delhi, ISBN- 0074624531. |
| 3 | “Solar Energy thermal process” JADuffie and W.A. Beckman, John Wiley& sons, New York, ISBN- 1118418123 |
| 4 | Solar energy, Frank Kaieth& Yogi Goswami, Taylor and Francis, ISBN- 1560327146. |
| 5 | Treatise of Solar Energy, H.P. Garg, John Willey & sons, ISBN- 9027719306. |

**Course Outcomes**

| | |
|---|---|
| CO1 | To study basics of Renewable Energy Sources |
| CO2 | To discuss solar radiation, design consideration and performance of different types of solar cells |
| CO3 | To describe devices for solar thermal collection and storage |
| CO4 | To explain different application systems of solar energy |
| CO5 | To analyze Solar PV systems. Fuel Cell Technologies, design of biogas plants, Wind energy systems. |
| CO6 | To apply knowledge of geothermal energy systems for practical problems. |

**CO-PO/PSOMatrix**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 1 | 1 |
| CO2 | 3 | 3 | 2 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 1 | 1 |
| CO3 | 3 | 3 | 3 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 3 | 3 | 2 |
| CO4 | 3 | 3 | 3 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 3 | 2 |
| CO5 | 2 | 2 | 2 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 2 | 2 |