**IV B.TECH - I SEMESTER**

**ALTERNATIVE SOURCES OF ENERGY**

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| **Course Code: ME7T4D** | **Credits: 3** |
| **Lecture: 3 periods/week** | **Internal assessment: 30 marks** |
| **Tutorial: 1 period /week** | **Semester end examination: 70 marks** |

**COURSE OBJECTIVES:**

- The main objective of this course is to let the students recognize various non-conventional energy resources

**COURSE OUTCOMES:**

Upon completion of this course the student will be able to:

1. Explain the fundamental principles, classification of collectors, methods of storage and application of solar Energy
2. Describe the basic concepts of Wind Energy and Biomass Energy
3. Discuss the fundamentals of Geothermal Energy and Ocean Energy.
4. Recall different energy conversion Techniques.

**Pre-Requisite:** Basic Thermodynamics

**UNIT I**

**SOLAR ENERGY PRINCIPLES AND APPLICATIONS:**

Role and potential of new and renewable source, solar energy option, Environmental impact of solar power, solar constant, extraterrestrial and terrestrial solar radiation, solar radiation on tilted surface, instruments for measuring solar radiation and sun shine, solar radiation data.

**Applications**- solar heating/cooling technique, solar distillation and drying, Central Power Tower, photovoltaic energy conversion.

**UNIT II**

**SOLAR ENERGY COLLECTION AND STORAGE:**

Flat plate collectors: Liquid Flat plate collector construction and working principle, Factors effecting performance, Evacuated tube collector, concentrating collectors: Working principle-Modified Flat plate collector, Hemi Spherical Bowl Mirror Concentrator, Linear Fresnel Lens Concentrator, Circular Fresnel Lens Concentrator, Cylindrical Parabolic collector, Compound parabolic collector, Orientation and tracking modes of cylindrical parabolic collector.

**Storage:** Different methods: Sensible, latent heat and stratified storage, solar ponds.

**UNIT III**

**WIND ENERGY:**

Origin and types of wind, Wind Data Measurement, Applications of Wind Energy, Components of horizontal axis windmill and Darrieus vertical axis windmill, Power extraction and Betz criteria, Power vs wind speed characteristics

**BIO-MASS:**
Principles of Bio-Conversion, Biomass gasification, combustion characteristics of bio-gas, utilization for cooking, I.C Engine operation. Anaerobic digestion, types of Bio-gas digesters, Factors effecting biomass digestion.

**UNIT IV**
**GEOTHERMAL ENERGY:**
Resources, types of wells, methods of harnessing the energy, potential in India.
**OCEAN ENERGY:**
OTEC: Origin and resource, Principles of OTEC Technology
TIDAL ENERGY: Origin and Potential, conversion techniques: types of basins
WAVE ENERGY**:** Origin and Potential, conversion techniques: Heaving Float type, Pitching type, Heaving and Pitching type, Oscillating water column type, Surge devices.

**UNIT V**
**DIRECT ENERGY CONVERSION:**
Need for DEC, principles of DEC: Thermo-electric generators, seebeck, peltier and joul Thomson effects, Figure of merit, MHD generators, principles, faraday's laws, FUEL CELLS: principle, Classification, PAFC, PEMFC: Construction and working, Advantages and disadvantages of fuel cells, thermodynamic aspects.

**Learning Resources**

**Text Books:**

1. B. H. Khan "Non-Conventional Energy Sources", Tata Mc Graw Hill-2009
2. G.D. Rai – "Non-Conventional Energy Sources", Khanna publishers – 2009

**Reference Books:**

1. S. P. Sukhatme, " Solar Energy- Principles and Applications", Tata Mc Graw Hill-2006
2. G.N Tiwari and M.K Ghosal – "Renewable energy resources" -Narosa Publishing House-2005
3. Twidell & Weir- "Renewable Energy Sources" ,Taylor & Francis Group-2006