

**6ME05 OPEN ELECTIVE-II**  
**(1) NON-CONVENTIONAL ENERGY SYSTEMS**

**Course Learning Objectives(CLOs):**

1. To study the introduction to renewable and non-renewable resources of energy.
2. To study the radiation transmission through covers & Solar Energy collections.
3. To study the solar energy utilisation and solar energy storage.
4. To study energy from ocean and energy from wind.
5. To study biomass energy resources like biomass and biodiesel.
6. To study photo voltaic cell, fuel cell and geothermal energy.

**Course Outcomes (COs):**

1. Understand concept of renewable and non-renewable sources.
2. Understand the basic concept of radiation transmission through covers and solar energy collections, the basic concept of Solar energy utilization and storage.
3. Demonstrate, concept of energy from ocean and wind.
4. Understand the concept of bio-mass energy resources, concept of direct energy conversion and fuel cell.

**UNIT I**

1. **Introduction:-** Global and Indian energy scenario, Need of Renewable energy, need, Renewable and non renewable energy sources, energy and environment,
2. **Solar Radiation:** Solar constant, Definitions of basic earth-sun angles. Types of Solar radiation, Measurement of solar radiation using Pyrheliometer, Pyranometer and Sunshine Recorder, estimation of solar radiation intensity. (7 hrs)

**UNIT II**

1. Solar thermal systems. Low temperature applications: solar water heating, space heating, drying. High temperature applications, dish and parabolic collectors. Central tower solar thermal power plants.
2. Solar Photovoltaic Systems: Basic principle of power generation in a PV cell ; Types of photovoltaic cell, Application of PV ; Brief outline of solar PV stand-alone system ; Storage and Balance of system. (8 Hrs)

**Unit III**

Wind Energy Systems: Potential of wind electricity generation in India and current scenario. Types of turbines, Coefficient of Power, Betz limit, Wind electric generators, Power curve; wind characteristics and site selection; Windfarms for bulk power supply to grid. (7 Hrs.)

**Unit IV**

Biomass Energy: Biomass: Sources and Characteristics; Wet biogas plants ; Biomass gasifiers: Classification and Operating characteristics; Updraft and Downdraft gasifiers; Gasifier based electricity generating systems. Introduction to biodiesel and

ethanol as alternative fuels, properties of biofuel (7 Hrs.)

#### **Unit V**

Ocean Energy: Tidal power plants : single basin and two basis plants, Ocean Thermal Electricity Conversion (OTEC) , Electricity generation from Waves.

Geothermal Energy: Principle, Geothermal sites in India ; Geothermal power plants.

Fuel Cells: Principles, types of fuel cells, (7 Hrs.)

#### **UNIT VI**

1. **Fuel Cells** : working principle, types of fuel cells, applications.
2. **Geothermal Energy Resources:** Hot Dry Rock system, Vapor dominated, liquid dominated, flash steam, binary fluid and total flow concept of power generation.

**(8Hrs)**

#### **Books Recommended:**

##### **Text Books:-**

1. Solar Energy; S.P. Sukhatme; TMH
2. Non-Conventional Energy Sources; G.D. Rai; Khanna Publications
3. Non-Conventional Energy Sources; B. H. Khan

##### **Reference Books:-**

1. Treatise on Solar Energy; H.P. Garg; John Wiley & Sons.
2. Renewable Energy Conversion, Transmission and Storage; BentSorensen; Elsevier Publication
3. Renewable Energy; Godfrey Boyle; Oxford University Press, Mumbai
4. Renewable Energy Sources and Emerging Technology; D.P. Kothari, K.C. Singal, Rakesh Ranjan; PHI

### **6ME05 OPEN ELECTIVE-II (2) AUTOMOBILE ENGINEERING**

#### **Course Learning Objectives:**

1. To study the Introduction of automobiles, engine types and working of SI and CI engines.
2. To study the fuel feed systems, their types and to understand the basics of cooling system.
3. To study the electrical system, Battery capacity and its ratings, starter motor drive and to understand the basics of Ignition system.
4. To study the basics of transmission system, clutches, gear boxes and to understand the principle of differential.
5. To study the braking system, steering system, wheel balancing and alignment and to study the introduction of power steering.
6. To study the basics of suspension system, shock absorbers and to study the types of lubricants and lubrication system, crankcase ventilation.

## **Course Outcomes (COs):**

1. Understand the basics of automobile engineering and its components.
2. Analyze & develop about the cooling system and its function.
3. Understand basic concept of transmission system and types of gears box, basic concept of electrical system and ignition system.
4. Apply the knowledge of suspension and lubrication.

**UNIT I :** Introduction, Classification of automobiles, chassis layout, basic working of SI and CI engines, engine parts, engine types, Multiple cylinder engines. (7 Hrs)

**UNIT II :** Fuel feed systems- fuel feed systems for petrol and diesel engines, Basic principles of Multipoint Fuel Injection Systems(MPFI) and Common Rail Diesel Injection Systems(CRDI). Cooling system: purpose, Air cooling and liquid cooling system, radiator, by pass recirculation system, antifreeze mixtures. (7 Hrs)

**UNIT III :** The electrical system. Battery Capacity, standard capacity ratings, starter motor drive-Bendix drive. Ignition system:- Battery coil ignition system, Electronic ignition system (7 Hrs)

**UNIT IV:** Transmission system:- Layout, Working principle of clutch, single plate friction clutch and multiplate clutch, Gear Boxes:- Sliding mesh, constant mesh gear box, Propeller shaft, Hotchkiss drive, torque tube drive, differential. (8 Hrs)

**UNITV:** Braking system: Mechanical, hydraulic brakes, power brakes and vacuum brakes. Steering system:- Function, types of linkages, steering gears, wheel balancing, wheel alignment, camber, castor, king pin inclination, toe-in& toe-out & their effects, Introduction to power steering. (7 Hrs)

**UNIT VI:** Suspensions : shock absorbers, Rigid axle and independent suspension system, Auto lubrication :-Types of lubricants, their ratings, multi viscosity oils. Engine lubrication:- types of lubricating systems, full pressure system, dry sump system, crankcase ventilation. (6Hrs)

## **Books Recommended**

### **Text Books:-**

1. Automobile Engineering- Vol. I & II; Kirpal Singh; Standard Publishers Distributors
2. Automobile Engineering; R.K. Rajput; Laxmi Publications, New Delhi

### **Reference Books:-**

1. Automotive Mechanics; Crouse & Anglin; TMH.
2. Automotive Mechanics; J. Heitner; East West Press
3. Automotive Mechanics; S. Srinivasan; TMH.