ENERGY ENGINEERING
(Professional Elective-III)

Course Code: 15CH1129

L	T	P	C
3	0	0	3

Course Outcomes :

At the end of the Course, the Student will be able to:

CO 1 Distinguish various forms of energy available and choose the best possible source of energy for a given environmental condition.

CO 2 Recognize the importance of non-conventional resources such as Solar, Wind, Ocean and Bio mass.

CO 3 Describe the fundamentals of the operation of batteries.

CO 4 Analyze the factors affecting the performance of batteries.

CO 5 Discuss the operation of fuel cells and super capacitors and their role in solving energy crisis.

UNIT-I (10 Lectures)

Sources of energy, types of fuels- energy and relative forms. Calorific value- gross and net value, calculation of calorific value from fuel analysis, experimental determination energy resources present and future energy demands with reference to India.

COAL:

Origin, occurrence, reserves, petrography, classification, ranking, analysis, testing, storage, coal carbonization and byproduct recovery, liquefaction of coal, gasification of coal, burning of coal and firing mechanism, burning of pulverized coal.

LIQUID FUELS:

Petroleum: origin, occurrence, reserves, composition, classification, characteristics, fractionation, reforming, cracking, petroleum products,

Natural gas, coke oven gas, producer gas, water gas, LPG, burning of gaseous fuels, hydrogen (from water) as future fuel., fuel cells, flue gas, analysis: Orsat apparatus

UNIT-II (10 Lectures)

NONCONVENTIONAL RESOURCES:

Solar Energy: Introduction to solar radiation, solar constant, solar radiation on earth, solar radiation data for India. Solar thermal power and its conversion, solar collectors, flat plate, performance analysis of flat plate collector.

Wind Energy: Properties of wind, Availability of wind energy in India, Wind velocity, Wind machine fundamentals, Types of wind machines and their characteristics.

Bio Mass and Biogas: Principles of Bio-conversion, Photosynthesis, Bio gas production, Aerobic and anaerobic bio conversion process, Raw materials, properties of bio gas, producer gas, transportation of bio gas plant, biogas plant technology and status.

Geothermal Energy: Structure of earth's interior, geothermal sites, earthquakes and volcanoes, geothermal resources.

Ocean Energy: Principle of ocean thermal energy conversion, wave energy conversion machines, power plants based on ocean energy.

UNIT-III (10 Lectures)

BATTERIES:

Fundamentals, EMF, reversible cells and irreversible cells, reversible electrodes, relationship between electrical energy and energy content of a cell, free energy changes and emf in cells, relationship between the energy changes accompanying a cell reaction and concentration of the reactants, effect of cell temperature on batteries, derivation of number of electrons involved in a cell reactions, thermodynamic calculation of the capacity of a battery, calculations of energy density of cells, heating effects in batteries, spontaneous reaction in electrochemical cells, pressure development in sealed batteries.

UNIT-IV (10 Lectures)

FACTORS AFFECTING BATTERY PERFORMANCE :

Factors affecting battery capacity, voltage level current drain of discharge, types of Discharge continuous, intermittent, constant current, constant load, constant power, service life, voltage regulation, changing methods, battery age & storage condition, effect of battery design.

UNIT-V (10 Lectures)

FUEL CELLS & SUPER CAPACITOR:

Introduction to super capacitors, types of super capacitors, introduction to fuel cells, types of fuel cells and technology development

Fuel Cells: What is a fuel cell, Types of fuel cells, fuel cells applications, main components of a PEM fuel cell.

TEXT BOOKS:

1. Gupta, O.P. "Fuels, Furnaces and Refractories", Khanna Publishers, New Delhi, 1990.
2. Samir Sarkar, "Fuels and Combustion", Orient Longman, 2nd Edition ,1998.
3. Rai, G.D. "Non-Conventional Energy Resources", Khanna Publsihers, New Delhi, 1993.
4. Linden D and Reddy T.B., "Hand book on batteries and Fuel cells", McGraw Hill Book Co., New York, 3rd Edition, 2002.

REFERENCES:

1. Sukhathme , S.P. "Solar Energy", Tata Mc Graw Hill, New Delhi, 1996.
2. Murphy, W.R., Mc.Kay, G. "Energy Management", Butterworth, 1st Edition, 2000.