Power Engineering

1. Fluid mechanics, Machinery and Theory of Machines

2. Engineering Thermodynamics and Heat Transfer

3. Mathematics

4. Elements of Electronics and Electrical Engineering

5. Thermal power plants

6. Diesel, Gas turbine and Combined cycle power plant

7. Hydro power plants

8. Nuclear power plant

9. Power from renewable energy

10. Energy, Economics and Environmental issues of power plants

Detailed syllabus

1. Fluid mechanics, Machinery and Theory of Machines

Introduction : Concept of fluids, continuum; density, viscosity, surface tension, vapour pressure. Fluid statics, kinematics, flow and measurements, Viscous incompressible, Internal viscous and Principal of similarity.

Classification of fluid machines, Rotodynamic machines, Pumps, Reciprocating Machines, Air compressors

Mechanisms and Machines, Link, Kinematic Pair (sliding/rolling), classification, four bar mechanisms, inversion - slider crank, scotch yoke and oscillating cylinder mechanisms, Velocity and Acceleration Analysis, Balancing, Critical Speeds and Vibrations, Gyroscopes, Cams, Gears, Goyrnors

Mechanics of deformable bodies.

2. Engineering Thermodynamics and Heat Transfer

Fundamental concepts of system, control volume, state properties, equilibrium, processes. Laws of thermodynamics, heat and work; State postulate; P-V-T behaviour of simple compressible substances; phase rule, equations of state; compressibility factor, internal energy and enthalpy, Heat Engine, Heat Pump, Thermal efficiency, COP; Carnot cycle, Maxwell equations; Clapeyron equation; Clausius Clapeyron equation, Joule Thompson coefficient; compressibility and expansion coefficient.

Compression of air and gases, Air standard engine cycles, Gas turbine cycles, Vapour cycles, Reversed Carnot cycle, Binary vapour cycles. Cogeneration cycles, Psychrometrics, Combustion Analysis

Heat transfer:- conduction, convection and radiation, Heat exchangers:- Types, parallel and counter flow types, Introduction to LMTD. Correction factors, fouling factor. E-NTU method for heat exchangers.

3. Mathematics

Fourier series and transformation, calculus of complex variables, probability and statistics, graph theory,

4. Elements of Electronics and Electrical Engineering

Digital electronics and integrated circuits (Microprocessors and microcontrollers), Electrical machines, circuit theory and network, electrical and electronic measurements, electrical equipment in power station, Power transmission and distribution, control systems, High voltage engineering.

5. Thermal power plants

General layout of modern thermal power plant, Site selection, Presents status of power generation in India. Rankine cycle - improvisations, Layout of modern coal power plant, Super Critical Boilers, FBC Boilers, Turbines, Condensers, Steam & Heat rate, Subsystems of thermal power plants – Fuel and ash handling, Draught system, Feed water treatment. Binary Cycles and Cogeneration systems.

6. Diesel, Gas turbine and Combined cycle power plant

Otto, Diesel, Dual & Brayton Cycle - Analysis & Optimisation. Components of Diesel and Gas Turbine power plants. Combined Cycle Power Plants. Integrated Gasifier based Combined cycle systems.

7. Hydro power plant:-

Fundamentals, potential of hydropower in India- its development and future prospect. General hydrology-hydrological cycle, precipitation, run-off and its measurement, hydrography, unit hydrograph, flow duration and mass curve. Site investigations. Classification of hydroelectric power plants. Pondage and storage. Operating principles of different types of hydropower plants like run-off-the-river type. Storage reservoir plant-pumped storage plant. Design, construction and operation of different components: Dams, spillways, Canals, penstocks, surge tanks, draft tubes etc; Power – house structure.
Selection of prime mover, speed and pressure regulation, methods of governing, starting and stopping of water turbines, operation of hydro turbines. Machine loading and frequency control, Maintenance of hydropower plants.

8. Nuclear power plants:-

Basics of Nuclear Engineering, Nuclear fusion and fission, Chain reaction, Nuclear fuels, Layout and subsystems of Nuclear Power Plants, Working of Nuclear Reactors:-Components

of nuclear reactor, Classification of reactors, Pressurized water reactor, Boiling water reactor, Gas cooled reactor, CANDU reactor, Fast breeder reactor, Nuclear waste and its disposal, Safety measures for Nuclear Power plants, Nuclear power plants in India.

9. Power from renewable energy:-

Hydro Electric Power Plants – Classification, Typical Layout and associated components including Turbines. Principle, Construction and working of Wind, Tidal, Solar Photo Voltaic (SPV), Solar Thermal, Geo Thermal, Biogas and Fuel Cell power systems.

10. Energy, Economics and Environmental issues of power plants:-

Power tariff types, Load distribution parameters, load curve, Load curves, Load duration curves, Connected load, Maximum load, Peak load, Base load and peak load power plants, load factor, plant capacity factor, plant use factor, demand factor, diversity factor, cost of power plant, comparison of site selection criteria, relative merits & demerits, capital & operating cost of different power plants. Performance and operating characteristics of power plant. Pollution control technologies including Waste Disposal and management.