

**Approval: 9<sup>th</sup> Senate Meeting**

**Course Number:** EN-501

**Course Name:** Energy Sources and Power Plants

**Credits:** 3-0-0-3

**Prerequisites:** Instructor's consent

**Intended for:** UG/PG

**Distribution:** **Compulsory foundation course for** M.Tech. (Energy Engineering) and elective for other students

**Semester:** Odd/Even

**Preamble:** This course will contribute to a comprehensive understanding of energy conversion techniques, review energy sources for established power plants, advantages and limitations of different power plants.

**Course Outline:** The objective of the course is to introduce the students of different engineering backgrounds to fundamental system working, performance, emissions, economics, and challenges related with conventional energy sources.

**Course Modules:**

**Module 1:**

Introduction: Fossil fuel resources: Coal, petroleum, shale gas and oil, natural gas, extra heavy oil, Stationary combustion systems, Transportation energy technologies, Systems perspective on transportation engineering **(6L)**

**Module 2:**

Thermal power plant: Steam boilers, steam turbines, gasification of hydrocarbon feedstock (e. g. coal, biomass, petroleum, waste) into 'syngas' combustion, fluidized bed combustion, integrated gasification combined cycle for high efficiency and low emissions electricity production, hybrid system of coal combustion and gasification, Improving power conversion, developing durable materials for handling hot brine, steam, cooling water and binary fluids; designing new methods for rejecting waste heat and improving the efficient handling of waste products associated with some operations, Advanced Rankine cycles, advanced gas turbine cycles, Kalina cycle, organic Rankine cycles and cogeneration may be incorporated. **(14L)**

**Module 3:**

Hydroelectric power: Technology of dam, hydro-turbines for power generation, environmental and societal effects, impact of reservoir on downstream rivers and lakes, impact on river morphology and suspended solids, river and flood plain ecology, fish ecology. **(8 L)**

**Module 4:**

Nuclear Energy: energy from fission of U-235, Nuclear chain reaction, uranium fuel cycles types of reactors- boiling water reactors, pressurized water reactors, benefits of nuclear energy, accidents and safety systems, radiation and radioactive wastes- storage of radioactive wastes and used fuels. **(10 L)**

**Module 5:**

Geothermal energy: Type and temperature of geothermal sources, three kinds of power plants- direct steam, flash and binary plants, efficiency improvement and design challenges. **(4 L)**

**Text Books:**

1. K. R. Rao - Energy and Power Generation Handbook: Established and Emerging Technologies, American Society of Mechanical Engineers, U.S. (2011)
2. Steven W Blume, Electric Power Systems Basics, IEEE Press 2007
3. Francis Vanek, Louis Albright, Largus Angenent, Energy Systems Engineering: Evaluation and Implementation, 2<sup>nd</sup> edition, McGraw-Hill Professional, (2012)