

Course Title: Geothermal Engineering (Elective Course)

Course Code: ESE-839

Objectives: The overall objective of this course is to introduce the energy graduates with the geothermal energy systems and how they can use geothermal energy for power generation, building applications and other energy related applications. Objectives include designing, sizing, and the modeling of geothermal energy systems, especially estimating the performance, economics, and environmental effects of these geothermal energy systems.

Learning Outcomes: On successful completion of the module the student will be able to perform detailed feasibility studies, scientific analysis, and conduct research on geothermal energy and technologies, from exploration, exploitation, and technical aspects of utilization to environmental, social and economic considerations.

Course Contents:

Geothermal Resources and Their Use: An overview of worldwide geothermal development and types of geothermal systems, geology, volcanoes and volcanic rocks, geochemistry of geothermal systems, overview of geophysics for geothermal exploration, geothermal resource assessment and geological mapping and geochemical analysis.

Geothermal Energy Technology: Types of geothermal systems, Thermodynamics, properties of water and steam tables, heat transfer, fluid mechanics, steam-field equipment, steam Power plants, their working and working principle of geothermal based power plants, two-phase flow, geothermal power cycles, direct heating and cooling of buildings using geothermal energy and heat exchangers to be used for geothermal energy purposes, and custom Instrumentations used for geothermal purposes.

Geothermal Exploration: Detailed study on hydrothermal alteration, clays, fluid inclusions, scaling and corrosion in geothermal wells, environmental aspects of geothermal development, physical properties of rocks and self-potential, scaling and corrosion in geothermal wells, drilling engineering, geothermal drilling and wellbore

processes, environmental aspects of geothermal exploration, development, and exploitation.

Modeling and Simulation of Geothermal Systems: Modeling and simulation of geothermal power plants, economic aspects of geothermal based power plants compared to the conventional systems, modeling and simulation of geothermal heating and cooling system, economic aspects of geothermal based heating and cooling systems compared to the conventional systems, reservoir modeling, reservoir monitoring and steam-field management.

Recommended Books

- Geothermal Energy: An Alternative Resource for the 21st Century- Harsh K. Gupta and Sukanta Roy
- Geothermal Energy: Utilization and Technology: Mary H. Dickson and Mario Fanelli
- Geothermal Energy Systems- Ernst Huenges and Patrick Ledru
- Geothermal Power Plants. 3rd edition. 2012- Ron DiPippo