

## Course Contents

1. Give details of the course, on the following lines:

- a. Course Code           ESE-839
- b. Title                    Geothermal Engineering
- c. Credit Hours         3
- d. Objectives           (explained under heading 3)
- e. Outcomes

The course will help students in designing the systems working on the geothermal energy whether these are related to power generation or related to geothermal based heating and cooling of buildings. And also it will help a lot in shifting the focus from conventional energy resources to renewable energy resources.

f. Contents with suggested contact hours

Topics and their details	Contact Hours
(1) Geothermal Resources and Their Use	10
(a) Worldwide geothermal development and types of geothermal systems (b) Geology, volcanoes and volcanic rocks (c) Geochemistry of geothermal systems (d) Overview of geophysics for geothermal exploration, geothermal resource assessment (e) Geological Mapping and Geochemical Analysis	
(2) Geothermal Energy Technology	10
(a) Types of geothermal systems (b) Thermodynamics, properties of water and steam tables, heat transfer, fluid mechanics, steam-field equipment (c) Steam Power plants, their working and working principle of geothermal based power plants, two-phase flow, geothermal power cycles (d) Direct heating and cooling of buildings using	

<p>geothermal energy</p> <p>(e) Heat exchangers to be used for geothermal energy purposes</p> <p>(f) Custom Instrumentations used for geothermal purposes</p>	
(3) Geothermal Exploration	10
<p>(a) Hydrothermal alteration, clays, fluid inclusions</p> <p>(b) Scaling and corrosion in geothermal wells</p> <p>(c) Environmental aspects of geothermal development</p> <p>(d) Physical properties of rocks and self-potential</p> <p>(e) Scaling and corrosion in geothermal wells, drilling engineering</p> <p>(f) geothermal drilling and wellbore processes,</p> <p>(g) Environmental aspects of geothermal exploration, development and exploitation.</p>	
(4) Modeling and Simulation of Geothermal Systems	15
<p>(a) Modeling and simulation of geothermal power plants</p> <p>(b) Economic aspects of geothermal based power plants compared to the conventional systems.</p> <p>(c) Modeling and Simulation of geothermal heating and cooling system</p> <p>(d) Economic aspects of geothermal based heating and cooling systems compared to the conventional systems.</p> <p>(e) Reservoir modeling, reservoir monitoring and steam-field management.</p>	

g. Details of lab work, workshops practice (if applicable).

NA

h. Recommended Reading (including Textbooks and Reference books).

S.No.	Title	Author(s)	Assigned Code	Remarks
1	Geothermal Energy: An Alternative Resource for the 21 <sup>st</sup> Century	Harsh K. Gupta and Sukanta Roy	HS	Text
2	Geothermal Energy: Utilization and Technology	Mary H. Dickson and Mario Fanelli	MM	Ref
3	Geothermal Energy Systems	Ernst Huenges and Patrick Ledru	EP	Ref
4	Geothermal Power Plants. 3rd edition. 2012	Ron DiPippo	RD	Ref