

Resource and Energy Engineering (REE)

COURSES

REE 1301. INTRODUCTION TO RESOURCE & ENERGY ENGINEERING. 3 Hours.

Provides a review and discussion of the history of energy usage, the relation between energy usage and quality of life, the societal impact of energy use, and the environmental constraints on energy usage. Emphasis is placed on the role that engineering disciplines play in solving energy problems. The full impact that the various energy alternatives have on economic and environmental issues will be reviewed in order to provide a rational basis for energy choices now and in the future. The course also provides foundational experience using units, 2D and 3D coordinate geometry, vector algebra and scientific problem solving in preparation for higher level courses. Prerequisite: C or better in MATH 1426 (or concurrent enrollment).

REE 1306. THE CHEMISTRY OF FUELS. 3 Hours.

The course deals with formation of natural resources as well as formation of alternative fuels. The chemical composition and physical and chemical properties of the principal fossil hydrocarbons (coal, petroleum, natural gas), and their refining, upgrading, and conversion chemistry will be explored. The chemistry of different types of fuel cells and the use of hydrogen as a fuel will be investigated, including advantages and disadvantages of alternative technologies. The lab component covers fuel production processes and analytical methods for assessing fuel properties. Prerequisite: C or better in CHEM 1465.

REE 2301. THERMAL ENGINEERING. 3 Hours.

Basic concepts and definitions, properties of pure substances, work and heat, first law of thermodynamics, second law of thermodynamics, entropy, and introduction to conductive, convective, and radiative transfer. Prerequisite: C or better in each of the following: CHEM 1465 (or concurrent enrollment) or CHEM 1441 and CHEM 1442 (or concurrent enrollment); MATH 2425 (or HONR-SC 2425) and PHYS 1444; or student group.

REE 3301. PRINCIPLES OF ENERGY ENGINEERING. 3 Hours.

Design of energy systems including generation, delivery, conversion and efficiency. Topics include efficiencies of both new and established energy generation and conversion methods; electricity generation by fossil fuels, nuclear, solar, wind and hydropower; and alternative energy technologies. Energy systems are evaluated quantitatively by modeling and by introducing the principles of fluid mechanics, thermodynamics and heat transfer. Prerequisite: C or better in both MAE 2323 and REE 2301 or equivalent.

REE 3302. SUSTAINABLE ENERGY SYSTEMS. 3 Hours.

This course presents the production and consumption of energy from a systems perspective. Sustainability is examined by studying global and regional environmental impacts, economics, energy efficiency, consumption patterns and energy policy. First, the physics of energy and energy accounting methods are introduced. Next, the current energy system that encompasses resource extraction, conversion processes and end-uses are covered. Responses to current challenges such as declining fossil fuels and climate change are then explored. Prerequisite: C or better in REE 2301 or equivalent.

REE 3303. PETROLEUM & GAS ENGINEERING. 3 Hours.

The course provides the student with a basic knowledge and understanding of the oil and gas engineering and industry, including its history, technical aspects, business model, and impact on society and the environment. The primary emphasis is on operations in exploration, production, transportation, refining, and marketing. At the end of the course, the student should be able to speak in a general way on all aspects of the industry and be familiar with common industry terminology. Prerequisite: C or better in both GEOL 3340 and REE 3301.

REE 3304. ENERGY STORAGE TECHNOLOGIES. 3 Hours.

Explores the various energy storage technologies, their working, and their practical applications. Focuses on the state-of-the-art review of current and most recent technologies. Offers students an opportunity to explore various innovations in the field of energy storage that can be helpful for fulfilling our current energy storage needs. Covers many different energy storage systems such as mechanical, chemical, electrochemical, thermal, and thermochemical. Prerequisite: REE 2301, EE 2440.

REE 3310. DATA ANALYTICS AND VISUALIZATION FOR ENERGY SYSTEMS. 3 Hours.

This course focuses on the applications of data science for energy systems operations and control. Fundamental elements of data storytelling are explored to analyze energy data. These elements include data curation, dataset cleaning and manipulation, and data visualization as a tool for identifying qualities necessary to answer questions. Students will learn to ask questions of data, to draw insights from data and use them to solve problems, and to create and present visualizations that effectively communicate data-driven findings and decisions. Prerequisite: C or better in both IE 3301 and REE 3301.

REE 4301. ENERGY SYSTEMS MODELING. 3 Hours.

Many of the most pressing energy challenges of our time transcend traditional disciplinary boundaries and necessitate the use of systems models to analyze possible solutions. This course will show how methodological approaches can be applied to construct such energy systems models. Particular emphasis will be devoted to models that combine concepts from engineering, economics, natural sciences, and policy. The featured models will showcase a broad range of methodological approaches, such as optimization, simulation, machine learning, decision analysis, stochastic processes, and dynamical systems. More generally, the course will train students to build mathematical models that represent complex real-world energy system problems. Topics include basics of energy systems engineering, concepts in probability and statistics, spatial representation (e.g. GIS), and more. Recommend background knowledge in data analytics. Prerequisite: C or better in IE 3301 and REE 3301.

REE 4302. SMART GRID. 3 Hours.

Fundamentals of smart electric power grid including definition, design criteria, and technology. Application of data collection, processing, and communications to the power grid. Seeks to motivate development of the smart grid, evaluating options for adding sensing, communications, computation, intelligence, control, and automation to various parts of the electric system. Topics include automation in existing power systems; generation; transmission; distribution; and smart grid definition. Prerequisite: Grade C or better in both EE 3317 and REE 3304.

REE 4303. MANAGEMENT OF ENERGY PROJECTS. 3 Hours.

This project course is intended to provide students with an industry-relevant experience. Students will apply their engineering knowledge and skills to solve problems in the production, processing, storage, distribution, and utilization of energy. A faculty member will follow the progress and serve as an advisor to the project. Each project must have a clearly defined problem or need; must show a solution methodology; and must be value-added to the sponsor. Prerequisite: Must be a senior in the REE Professional Program.

REE 4305. ENERGY GOVERNANCE. 3 Hours.

Introduces contemporary energy markets, government policies, and regulations. Explores energy as a strategic resource influenced by economics, market conditions and environmental constraints. Explores the relationship between nonrenewable and renewable energy sources and how different regions adapt and address local needs and concerns. Evaluates the impact of government policies on energy usage and alternative energy development efforts. Prerequisite: C or better in both IE 2308 and REE 3302.

REE 4310. CAPSTONE DESIGN. 3 Hours.

Students will apply knowledge gained in the program to an application oriented capstone project. Activities will demonstrate technical skills in energy system knowledge, identifying opportunities, analysis for quantifiable savings, engineering economics, report writing, and presentation. Prerequisite: Must be a senior in the REE Professional Program.

REE 4390. SPECIAL TOPICS IN ENERGY ENGINEERING. 3 Hours.

Special topics pertinent to the field of energy engineering. May be repeated, provided that topics are different. Prerequisite: Prior approval by the Program Director.