ENERGY TECHNOLOGY (EGY)

EGY 100 Understanding the Economics of Today's Energy Business
Instruction in the course provides a comprehensive overview of the North American energy industry and the current technological, economic, and political environment in which the industry currently find itself. Availability for consumers; the basic of system operations, including generation, transmission, and distribution; the characteristics and pros and cons of the different methods of electrical generation; the classes of the electricity consumers and the needs and characteristics of each consumer class will be addressed in this course. The history of the electric industry, including the history of regulation, deregulation, and market restructuring; the wholesale and retail electric marketplace, marketplace participants, and the various market structures will be studied.
Upon successful completion of this course, students should be able to:
Briefly describe the history of the electrical industry including the roles of key figures in its development, and summarize the current electricity marketplace including the importance of electricity in modern societies and the trends in its usage in the US and the world.
State what electricity is in simplest terms, describe electrons and conductors, and give examples of electricity sources and energy consuming devices.
Identify electrical terms that correlate to the concepts of rate of flow, pressure, and friction or resistance in the analogy of water flowing in a pipe, and utilize Ohm's law to predict the effect of changing voltage or resistance on current.
Explain in basic terms how electricity is created through both chemical and electromagnetic means and name the minimum components required for batteries and generators.
Describe common useful tasks that use the magnetism, heat, and light effects of electrical flow.
Describe how electrical distribution is accomplished, list the four key physical sectors involved and note the unique physical properties of an electric deliver system that must be managed for the system to work.
Name the three customer categories of the electricity business and relate how much electricity they currently use and are expected to use in the future, how they use it, the differences in their usage patterns over the year, the average rate for kWh they each pay and why the rates are different.
Define generation and list and describe the different types of generating systems and their characteristics, costs and environmental concerns, explain how each type is used to meet the demand curve, and how demand response helps meet generation needs.
List the different types of owners of generation, describe how they evaluate needs and develop capacity, and name likely future generation sources.
Define electrical transmission, list the types of transmission, describe the physical characteristics of the transmission system, and explain who owns transmission systems and how they operate and plan the systems.
Note the costs of the systems, the current status of the transmission grid and issues with new construction.
Describe radial feed, loop feed, and network system distribution systems and their relative costs and advantages, and list the types of system ownership and the current status of distribution systems in the country.
Identify the critical concerns of the physical electric systems, the role of system operations, who is responsible for systems operations, and how supply and demand are matched using the scheduling of generation, reserves and transmission.
Describe how system operations are changing.
Identify the market participants and their roles in both the vertically integrated and competitive market models.
Define electric market structure, describe the structures currently in the US, their goals and how they function, and how different structures address daily system operation.
Discuss the historical basis for regulation, who the regulators are and their goals, and how they establish rates and rules.
Explain what tariffs are, the rate case process, the various types of regulatory

EGY 101 Power Plant Industry Fundamentals
This course provides a comprehensive overview of power plant fundamentals and the challenges and advantages of major electrical power generation unit types. A very basic understanding of the principles of thermodynamics as well as the theory and design of fossil, nuclear, hydro, solar, and wind generation systems and related equipment, along with storage technologies will be addressed. Maintenance and operational requirements and special concerns involved in each type of generation are addressed. Topics of instruction consider the difficult choices faced by developers of electrical generation facilities for accommodating costs and environmental concerns, as well as ensuring reliable and economical fuel/energy supplies are available for customer needs. Options for future generation systems and the related advantageous choices each holds for future sources of electricity for the US will be studied. Research reports on the subject matters and sub-topics related to power generation are required of participants in this course.
Upon successful completion of this course, students should be able to:
Discuss the overarching principles of an electrical generation facility.
List the main types of electrical generation facilities, and as an overview, identify the engineering, maintenance, operational and environmental challenges common to all types.
Describe the design of coal generating stations, the operational characteristics and the major components of a plant.
Discuss the varied challenges associated with burning of coal, as well as how these challenges are met, and describe why coal is the most used fuel for the production of electricity.
Describe combustion turbine generating system components and their operations.
Discuss the limitations and advantages of using natural gas as a fuel for electricity production.
Explain the basics of nuclear fuel generation theory as well as plant design, and describe the components and operation of pressurized water reactors.
Describe the components and operation of boiling water reactors.
Explain the principles of hydroelectric generation and discuss the operational concerns associated with same.
Explain how electricity is produced within a solar cell and by solar thermal systems as well, listing the limitations and potential for using the sun to meet electric power needs.
Describe how wind energy is converted to electricity, relating the limitations and advantages of wind power.
Relate the processes and environmental advantages of creating electric power from biomass.
Describe how municipal solid waste power generation benefits to the environment using municipal solid waste.
Describe the methods for generating electricity via ocean currents, ocean waves, tides and ocean thermal differences.
Identify the challenges of using geothermal energy electricity production.
Explain the basic operation of a fuel cell.
List the components, processes and power storage technologies associated with compressed air, flywheels, super-conducting magnetic energy, NaS batteries, flow batteries and nickel-cadmium batteries Relate the process of storing energy in the form of hydrogen, citing the advantages and disadvantages of using hydrogen to capture and create electrical energy.
List and explain current concerns for power plant operations including fuel availability and environmental restrictions.
Discuss likely priorities for future generation plant investments, renovations and modifications.
Corequisites: EGY 100.
3 Credits 3 Weekly Lecture Hours

EGY 201 Energy Systems Piping and Tubing
This course is designed for students pursuing employment in the varied occupational fields of power plant maintenance and operations. Piping systems covered in this course include chemical, pneumatic, hydraulic, fuel oil, steam, and water. Drawings and detail sheets, to include Piping and Instrumentation, Drawings (P & ID's) specific to power plant piping and tubing will be covered. Applicable codes, classification systems, and testing of piping/tubing systems will also be addressed. Valve, and steam trap design, terminology, application, and operation will be included. Quality control and abnormal operating conditions associated with power plant piping systems are covered as well.
Upon successful completion of this course, students should be able to:
Discuss the piping systems used to distribute industrial water, air and other gases, steam, waste-water and lubricants.
Install and maintain pipe/tubing, valves and fittings.
Identify various metal pipe and fitting materials comparing strength ratings, safety factors, and methods/tools used for cutting and joining each.
Cite the accessories associated with the installation of pipe and tubing, such as, but not limited to, hangers, expansion joints, and insulation.
Compare the different types of plastic pipe materials, citing specifications, and proper methods of preparation and assembly.
Describe the composition, fabrication, and use of hoses utilized to convey liquids and gases.
Describe the function, operation, and maintenance of varied general purpose valves to include: check, gate, globe, pressure reducing, and Sloan valves.
3 Credits 2 Weekly Lecture Hours
2 Weekly Lab Hours

EGY 203 Thermodynamics of Energy Systems
This course provides, in a practical approach, an introduction to the theory, principles, calculations, and practices associated with heat transfer, fluid flow, and the thermodynamics applicable to the varied types of equipment used in power plants for the production of electricity. Topics of coverage are centered around the theories and calculations involving energy equations, steam tables, and diagrams, heat transfer cycles/equations, and laws associated with pumps (in relationship to the efficient and safe operation of power plant equipment and systems). Students will perform theoretical calculations and demonstrate the safe operations of a steam generation unit while performing laboratory exercises related to the below listed competencies.
Upon successful completion of this course, students should be able to:
Identify basic thermodynamic principles associated with the heating and cooling of fluids, to include: the properties of water and steam, as well as temperature and sensible heat.
Describe the development of qualitative and quantitative concepts of work, energy and heat.
Discuss the application of the first law of thermodynamics for both non-flow, and flow systems, with relevance to the basic energy equations applicable to the associate systems.
Describe the second law of thermodynamics, respectively, that all forms of energy are not equivalent in their ability to perform useful work.
Describe the state of a system based on the observable properties of pressure, temperature, and volume.
Discuss the relationship between pressure and volume of gases and predict qualitatively the behavior of most gases.
Explain the thermodynamic importance of the mixture of gases and the products of combustion (both internal and external).
Define a vapor power cycle (as a series of thermodynamic processes in which a working fluid can undergo an energy transition) with regard to conversion of energy from one form to another for a more purposeful use.
Differentiate between internal and external combustion, and describe the sequence of events of two and four stroke cycle engines, along with the reliability that is essential in the development of mechanical energy.
Describe the performance criteria associated with power cycles, and the Carnot cycle, along with a study of the reverse Carnot cycle, explaining the many thermodynamic limitations and performance criteria associated with refrigeration cycles (only as the theory applies to the production of electricity).
Define the three mechanisms of heat transfer (conduction, convection, and radiation) relating same to an industrial application, where, simultaneously phenomena may occur requiring consideration when designing for, or analyzing, heat transfer.
Prerequisites: EGY 101 and (MAT 111 or MAT 120 or MAT 135 or MAT 151) and TME 115.
Corequisites: PCT 100 and (PHY 101 or PHY 107).
3 Credits 2 Weekly Lecture Hours
2 Weekly Lab Hours

EGY 205 Electrical Energy Production
This course is designed to introduce the electrical power production technician to the integral phases, processes, and equipment associated with the generation of electricity. The study of processes leading to the ultimate production of electricity (via generation) will include: fuel handling, boilers, prime movers, and most importantly generators (environmental concerns will be addressed for each phase of production). The inter-relationships among the three areas of electricity production; generation, transmission, and distribution will also be covered. Aspects of distributed generation (the installation of small units to meet industry needs) will be included as well. Green power units such as fuel cells, solar power, and renewable energy for the production of electricity will also be discussed.
Upon successful completion of this course, students should be able to:
Discuss use, as it relates to the planning and development of electric power stations to include site selection, construction cost, fuel cost and the types of power station units available.
Relate energy conversions necessary for electricity production, namely; combustion, heat and temperature, and compare and contrast fuels.
Describe the handling processes (as they relate to delivery, storage, utilization, and waste recovery) associated with electric power generation plant fuels.
Relate varied furnace type requirements, heat sources, furnace combustion, types of fuels used, and the rate of combustion necessary to produce steam efficiently.
Identify the make-up of a boiler, heat transfer tubes, heater elements, fuel burners, air supply (both forced and induced draft), feed water, heat exchangers, and steam vessels.
Explain and demonstrate the operation of an electrically powered boiler (as a steam generator).
Elaborate on the internal combustion engine, reciprocating steam engine and steam turbine, with regard to utilization as a prime mover for electricity production (describing their use in converting heat energy to mechanical energy for use in driving electric generators).
Describe the design and operation of various generator types, relating the use of magnetism for their operation.
Explain the properties of electric generators, with regard to output, phasing, series vs.
parallel operation, synchronization, and how each is type of generator is used for producing electricity.
Discuss the coordination of the equipment and processes necessary for producing electricity; namely, the appropriate actions necessary for operators to achieve safe, efficient, and reliable electricity generation.
Describe the relevance of the three broad classifications of maintenance (normal, emergency, and preventive) with respect to the operation of an electric power plant.
Utilize fuel to site the basis reasons for the implementation of green power.
Compare and contrast green power systems with regard to the generation of electricity, to include; wind, fuel cells, solar, hydro, nuclear, geo-thermal, micro turbines and bagasse (burning of vegetation).
Prerequisites: TME 115 and TEL 101.
Corequisites: TEL 102 and (CHE 106 or CHE 101).
3 Credits 2 Weekly Lecture Hours
2 Weekly Lab Hours

EGY 207 Planning Scheduling and Maintenance
This course is designed to provide students with an introduction to the field of power plant maintenance, with an emphasis on systematic approaches to planning and scheduling. Students will gain practical exposure to the systematic methodologies associated with structuring and arranging for the performance of work in a proactive, rather than reactive manner. Roles, responsibilities, task descriptions, and performance criteria of plant maintenance and operator technicians will be addressed. Engagement of plant maintenance and plant operator technicians in team work will be stressed.
Upon successful completion of this course, students should be able to:
Describe the general requirements of a maintenance planning and scheduling program.
Elaborate on the role of a plant operator for maintenance planning and scheduling.
Identify the multidiscipline skills and knowledge the maintenance technician must possess in order to perform assigned tasks.
Relate the documentation requirements for an effective maintenance program.
Discuss how to organize oneself for determining/performing scheduled maintenance.
Gather and evaluate information in order to design a personal check-list for bringing work assignments to a desired conclusion.
Utilize a systematic approach in order to plan as well as prepare for completion of maintenance functions.
Participate, as a team player, in prescribed action leading to completion of work assignments.
Complete/submit appropriate documentation in a prescribed format and manner.
Formulate, via observation and reasoning, recommendations for the improvement of maintenance procedures.
Prerequisites: IST 101 and IST 105 and IST 200 and PCT 100 and PCT 112 and TME 115.
Corequisites: EGY 101.
2 Credits 2 Weekly Lecture Hours