Elective Courses for Graduate Certificate in Power and Energy

A list of existing courses currently appropriate as elective courses are shown below, which are all three credit hour courses.

EE518 Electric Drives : Study of principles underlying analysis and design of power conditioning motor drives.
EE531 Alternative and Renewable Energy Systems: Study of non-traditional, electric generating systems, and the use of renewable energy sources. Energy sources include solar, wind, hydro, and biomass/biogas. Generating technologies include both inverter based equipment and rotating machinery.
EE532 Smart Grid – Automation and Control of Power System: This course covers introduction to smart grid, key technologies in transmission and distribution systems that enable smart grid, power market structure, and real time pricing.
EE533 Advanced Power System Protection: This course teaches philosophies for protecting power systems, covers micro-processor based relays, and provides projects on relay setting and relay testing.
EE535 Power Generation, Operation and Control: This course covers essential aspects of the energy management system of power systems. Will cover topics: power system economics, state estimation, power system stability, power quality, and fault location.
EE536 Power System Fault Analysis and Protection: This course teaches computer based methods for performing balanced and unbalanced fault analysis of power systems, and principles for protecting power systems.
EE537 Power System Analysis I: Basic concepts relating to electric power systems, with emphasis on the determination of transmission line parameters, representations of components of a power system, and generalized network analysis techniques.
EE538 Power System Analysis II: Introduction to modern power system practices, basic transient and steady-state stability analysis with emphasis on digital techniques.
EE539 Power Distribution Systems: Electric utility distribution power systems, addressing topics such as configuration, equation, customer class data, phase balancing, distributed generation, etc.
EE601 Electromagnetic Energy Conversion I: Generalized electric machine theory; parameter determination. Energy conversion in continuous media including magnetohydrodynamics.
EE603 Power Electronics: Study of solid-state power electronic devices and their applications in power conditioned electric motor drive systems. Examination of control philosophies, steady-state models, and numerical simulation of characterizing differential equations. [To be revised to cover inverters, voltage- and current-sourced converters, compensators and power flow controllers, special purpose FACTS (Flexible AC Transmission System) controllers, Alternative energy integration (wind, solar)]
EE699 Power system analysis using advanced software: Computer aided methods for power system analysis and application of prevailing power system analysis software package to perform various types of analyses
BAE 503 Fundamentals of Biorenewable Resource Engineering: This course introduces students to the science and engineering of converting Biorenewable resources into bioenergy and biobased produces. Topics include: defining the resource base; physical and chemical properties of biorenewable resources; description of

biobased products; methods of production for biorenewable resources; processing technologies for fuels, chemicals, fibers and energy; environmental impacts; and economics of biobased products and bioenergy.
BAE 504 Biofuels: An introduction to the basic principles for the production and utilization of biofuels with special emphasis on ethanol and biodiesel. Process chemistry of biofuels manufacturing, fuel properties and the use of ethanol in internal combustion engines and biodiesel engines will be discussed.
BAE 505 Thermochemical Processing of Biomass: Introduction to thermal and catalytic processes for the conversion of biomass to biofuels and other biobased products. Topics include gasification, fast pyrolysis, hydrothermal processing, syngas to synfuels, and bio-oil upgrading.
CME 515 Air Pollution Control: Kinetics and equilibria of photochemical and "dark" atmospheric reactions. Atmospheric statics and dynamics including lapse rates, inversions, and vertical and horizontal air motion. Single and area source diffusion. Stack meteorology.
CME 599: Energy Systems: Present and Future Technology: A study of current major electrical generation technologies in practice today including how fuels are recovered, processed and converted into electrical power. Coal, oil and gas, nuclear and renewable sources are considered along with the environmental consequences and benefits of each fuel source, as well as how each technology must adapt to meet future energy demands.
ME 530 Gas Dynamics: Consideration of the mass, energy, and force balances applied to compressible fluids. Isentropic flow, diabetic flow, flow with friction, wave phenomena and one-dimensional gas dynamics. Application to duct flows and to jet and rocket propulsion engines.
ME 548 Aerodynamics of Turbomachinery: Turbomachinery is an important part of power generation in modern power plants, wind turbines, and hydroelectric power. Together, ME 548 and ME 549 cover a complete spectrum of power plant power generation systems.
ME 549: Power Generation: Modern power plants for electric power generation and cogeneration. Thermodynamic analysis of different concepts of power plants. Design studies of specific power plants.
ME 563 – Basic Combustion Phenomena (proposed to be renamed as Combustion I): This course provides students with basic knowledge on combustion principles, power generation systems and environmental concerns and control.
ME 626 Advanced Heat Convection: Comprehensive study of heat convection: derivation of equations of convection of mass, momentum, and energy; boundary layer equations; classical solutions of laminar convection problems, turbulent convection; analogies between momentum and energy.
ME 606 Global Issues in Manufacturing: This seminar course will introduce students to a variety of global issues in manufacturing through presentations by leading national and international experts in these domains.
CE 533 Railroad Facilities Design and Analysis: Principles of railroad location, construction, rehabilitation, maintenance, and operation with emphasis on track structure design and analysis, bridges and bridge loading, drainage considerations, track geometry effects, and operating systems analysis. Important to energy/power due to the extensive use of rail to transport fuel and combustion by-products for power generation.
CE 602 Construction Administration: Administration of construction companies and projects, organization, economics, material management, productivity models, labor and equipment tracking, quality control and

managerial accounting. Construction labor relations, claims and construction financing are also discussed. Discusses manage processes for constructing industrial facilities.
CE 509 Control of the Construction Project: This course investigates the principles and practices for the control of budget and schedule for construction projects. Topics studied include: estimating construction costs and developing a project budget, planning construction operations and developing a project schedule, documenting and reporting of project progress and spending, and the management of change of contract amount, contract time, and contract scope of work. Energy related due to power plant construction planning and estimating processes.
CE/EGR 553 Environmental Consequences of Energy Production: This course will introduce the relationship of energy, pollution control technology, and the environment. The scientific and engineering aspects of energy production are examined and the associated environmental problems and control technologies are discussed.
CE 652 Fundamentals of Water Quality Control II: Theory and practices of wastewater treatment with emphasis on biological treatment processes for municipal and industrial wastewater treatment. Includes coverage of thermal pollution from industrial activity
CE 582 Advanced Structural Mechanics: Approximate methods of frame analysis; energy principles; flexibility and stiffness methods for trusses, frames, arches, non-prismatic members and flexible connections/supports; influence lines for statically indeterminate structures; introduction to plastic analysis; and use of available computer programs for structural analysis and matrix operations. Covers design methods for industrial structures.
CE 672 Landfill Design: This course deals with the geotechnical aspects of landfills for the disposal of municipal solid waste. Since landfill design is driven by state and federal regulations, time is taken to review these regulations. Landfills are evaluated as engineered systems consisting of multiple components. Each component is investigated individually, and methods are developed to predict and quantify the performance of these components so that appropriate materials, design criteria, and construction methods can be selected to assure that the landfill will function with minimal environmental impact. Landfills are required for power combustion by product storage and methane gas power generation.