GRADUATE CERTIFICATE PROGRAMS IN

POWER AND ENERGY SYSTEMS

UNIVERSITY of HOUSTON | ENGINEERING

ABOUT THE POWER & ENERGY SYSTEMS CERTIFICATE PROGRAMS

The Department of Electrical and Computer Engineering (ECE) of the University of Houston offers two Graduate Certificate programs in Power and Energy Systems.

1. Power Electronics and Renewable Energy Technologies:
This program focuses on power electronics, electric machines, adjustable drive systems, and renewable energy technologies

2. Power Systems and Smart Grid:
This program focuses on the advanced courses related to power systems, smart grid, and power system protection. The courses offered are relevant to the industries such as oil and gas, power industries, utilities, and renewable energy. The program provides advanced instruction to give individuals the level of technical and business expertise needed to meet the increased industry demand for highly skilled professionals. The time to complete each certificate will be one year. The courses will be taught by the ECE power faculty and industry experts located in Houston. To provide the most flexibility for working professionals, all courses of the certification programs will be offered in the evenings as well as online.

UNIVERSITY OF HOUSTON AND ENERGY

University of Houston is the "Energy University" in Energy capital of the world. In addition, Houston has a large base of power and energy industries that need talented engineers to meet their growing demands for performing critical electric energy related tasks. The programs directly support the uniquely diverse industrial and technological environment of the greater Houston area, which is involved in electrical power generation, consumption, expansion, conversion, and manufacturing. The programs were developed at the request of industry with participation from a significant number of prominent electrical industry representatives. The courses offered are designed to concentrate on global industrial workplace and market applications. Each course presents the most current information on topics such as power system engineering, power electronics, smart grid, system operation, and energy management.

CAREERS IN POWER AND ENERGY SYSTEMS

The students of the PES program will be prepared with both the technical and business expertise required to take on leadership roles within the electrical industry. Career opportunities in power and energy systems are excellent – especially in the city of Houston, the Energy Capital of the World. Alumni of the electrical engineering graduate program work locally and overseas for Halliburton, Schlumberger, CenterPoint Energy and Burns & McDonnell, among many other companies.

CURRICULUM

The Cullen College of Engineering is offering two certificate programs in the area of Power and Energy Systems (PES), which will be administered through the Department of Electrical and Computer Engineering.

1. Power Systems and Smart Grid

The Certificate in Power Systems and Smart Grid program will require students to take the following two courses:

ECE 6326 Power System Analysis

ECE 6327 Smart Grid Systems

In addition, students must take one of the following courses:

ECE 6329 Power System Protection, Monitoring and Control

ECE 6334 High Voltage Electrical Substations Design and Architecture

ECE 6343 Renewable Energy and Distributed Power Generation

2. Power Electronics and Renewable Energy Technologies

The Certificate in Power Electronics and Renewable Energy Technologies program will require students to take the following two courses:

ECE 6305 Power Electronics Converters and Control

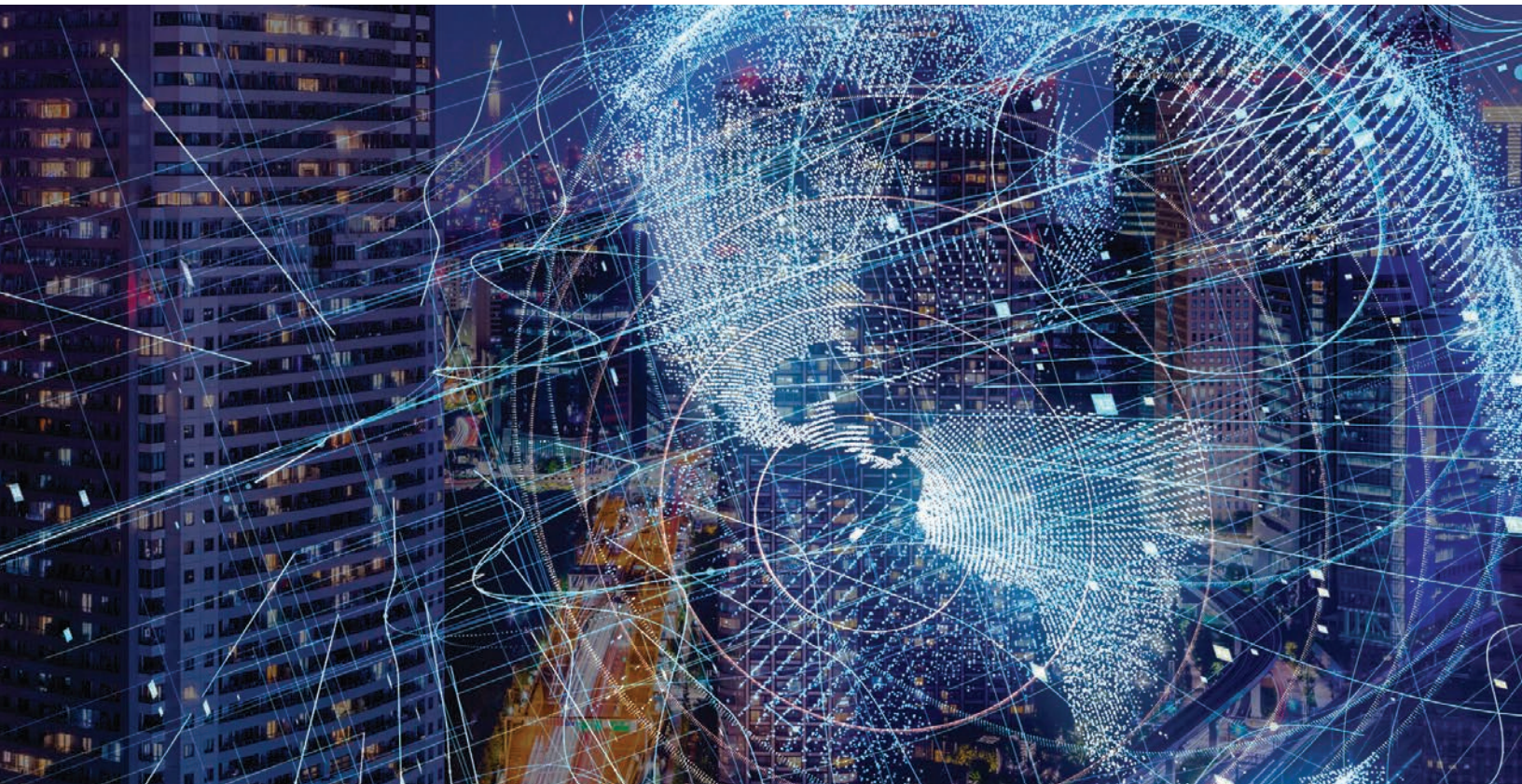
ECE 6343 Renewable Energy and Distributed Power Generation

In addition, students must take one of the following courses:

ECE 6319 Transformers and Electric Machines

ECE 6317 Adjustable speed Motor Drive systems

ECE 6318 Advanced Power Converters and Applications



COURSES

ECE 6326 Power System Analysis: Power System Fundamentals. Transmission Line Parameters and Steady-State Operation. The Impedance Model (Zbus), Admittance Model (Ybus) and Network Calculations. Power Flow Analysis, Economic and Reliable Operation of Power Systems, Symmetrical Fault Analysis, Power Distribution Systems, Architecture and Composition of Industrial Power System

ECE 6327 Smart Grid Systems: Basic of Smart Grid, Definition and Applications. Smart switches, Self-healing, Communication Technologies, Two-way Digital Communications Paradigm and Network Architectures, Wireless Standards (Protocols: Zigbee, WiFi, WiMax), Smart metering and Advanced Metering Infrastructure, Local Area Networks: Home network and HEN (home energy management), Wide Area Wireless mesh networking. Cyber Security Challenges. Smart Appliances and load modeling (economic view point). Electric Vehicles and Vehicle-to-Grid Systems. Distribution network reconfiguration and other intelligent distribution control methods.

ECE 6329 Power System Protection, Monitoring and Control: Protection Basics; Instrument Transformers; Grounding schemes, fault detection and identification; Distribution Protection, Instantaneous overcurrent protection, Time overcurrent protection, Bus protection, Differential Protection; Protection of Transformer, Generator, and Motors. Phase Distance Schemes, Ground Distance Scheme, Supervising element, and Fault Type Selection Logic; Communication Aided Distance Protection; Line Current Differential Protection; Phasor Measurement units; Synchrophasor Vector Processor; Wide area protection.

ECE 6334 High Voltage Electrical Substations Design and Architecture: Industrial substation configuration and composition; cable and busway system design, installation, protection and testing; switching apparatus fundamentals, types, calculation, design, operation, protection; capacitor switching; surge nature, insulation characteristics; system neutrals; arresters, grounding, static lightning protection; insulation coordination; substation planning, design, construction, automation, operation. HVDC and FACTS

ECE 6305 Power Electronics Converters and Control: Power Electronics and applications; Review of power devices including wide band gap devices. Harmonics and power factor in non-sinusoidal systems. AC-DC Phase Controlled Thyristor Converters. DC-DC converters: Buck, Boost, and Buck-Boost converters. Flyback, Cuk, and Full bridge converters. DC-AC Inverters: Square wave, Sinusoidal, Space Vector PWM, and current regulated inverters. Introduction to Active Rectifiers, Resonant Converters, and Multi-level converters.

ECE 6319 Transformers and Electric Machines: Transformers for power supplies and power distribution: Basics and operation, Equivalent circuits. Introduction to torque production in DC and AC motors. Operation, analysis, and dynamics of induction, synchronous, reluctance, and permanent magnet motors; Introduction to finite element analysis of electric machinery. Electromagnetic, structural, and thermal fields in electric machines; National Electric Code (NEC) applied in the industrial environment; standards for motors

ECE 6317 Adjustable speed Motor Drive systems: Control equipment for motors and generators; motor starting. Steady state and dynamic performance of electric machines – induction, synchronous, reluctance, and PM machines. Two axis models of AC machines and AC drives. Control characteristics of electric machines and control methodologies. Direct torque and flux control and current regulated controllers. Field orientation control techniques – stator flux, rotor flux, and air gap flux orientation.

ECE 6343 Renewable Energy and Distributed Power Generation: Fundamentals of Energy. Sustainability and renewable energy. Interconnection of energy and environment. Grid synchronization. Renewable energy sources and availability. Basics of hydro, wind, solar, geothermal, and fuel cell systems. Power Converters and drives for energy conversion. Converters and controllers for integration of renewable energy sources. Solar and wind energy technologies and system design. Hybrid power generation systems. Grid energy storage systems. Introduction to Microgrids and energy management. Microgrids and Energy Management. Control of Microgrids.

ECE 6318 Advanced Power Converters and Applications: Pulse width modulation of converters and inverters. Soft switching converters. High frequency resonant converters. Power factor correction rectifiers and distributed power systems. Active rectifiers. Multi-level converters. Matrix converters. Multiple input converters. Applications for transportation, electrification of oil and gas, and wireless power transfer

APPLICANTS

The targeted applicants for this program are practicing power and power electronics engineers with a minimum level of a BS degree in Electrical Engineering. Applicants with a bachelor degree in technology or a related science field will be considered on a case-by-case basis. This program serves students outside the normal Master's Degree in Electrical Engineering. Moreover, the successful completion of a certificate does not constitute admissions into a Master's Degree program.

FACULTY

The teaching of this curriculum will be from the faculty of ECE department and also some industry experts.

Prof. Kaushik Rajashekara Director of Power & Energy Systems Program and Professor of Electrical & Computer Engineering

Expertise: Power electronics and Drive Systems, Transportation Electrification, Microgrids and Renewable energy technologies.

Dr. Harish S. Krishnamoorthy Assistant Professor in Electrical & Computer Engineering

Expertise: Power electronics, high power density converters, electric vehicles, power supply design and Microgrids.

PROGRAM ADMINISTRATION

The program will be administrated by Dr. Kaushik Rajashekara, Director of Power and Energy Systems and Professor of Electrical and Computer Engineering. For any questions, please contact the Academic Advisor **Nafeesa Lynn at nlynn@central.uh.edu**.

CERTIFICATE GPA REQUIREMENT

The minimum cumulative GPA requirement necessary to receive the proposed graduate certificate is 3.0 on a 4.0 scale.

Electrical and Computer Engineering
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