

ELECTRICAL ENGINEERING (EE)

EE-621 Energy Storage Sys w/ EV App 4 Credits

Prerequisites: None

The purpose of this course is to introduce the basics of energy storage systems. We will look at several competing energy storage concepts and management systems. The emphasis is on rechargeable Li-ion batteries for EV applications. The course will focus on the fundamentals of Li-ion batteries with respect to the physical principles of operation, design, manufacturing, modeling and state estimation. Students are required to complete research projects and independent review of research topics with approval of the instructor.

Lecture: 4, Lab 0, Other 0

EE-626 Power Electronics for Vehicle Electrification 4 Credits

Prerequisites: None

This is an advanced class in power electronics. Advanced converter topologies, control methods, and analyses used in electric-vehicle and power-system domains will be discussed. Topics include state-variable modeling of DC-DC converters for closed-loop control system design, isolated DC-DC converter topologies (half, full, and dual bridges) and resonant DC-DC converter topologies (series, parallel and series-parallel) for wireless power transfer and battery charging, soft-switching concepts and control methods for isolated DC-DC converters, single-phase and three-phase inverter design, inverter control methods including six-step, Sine PWM, Space Vector PWM, and Discontinuous PWM and the design and control of multilevel and modular multilevel inverters.

Lecture: 0, Lab 0, Other 0

EE-633 Digital Control Systems 4 Credits

Prerequisites: None

Control of continuous-time processes using computer-based controllers is studied. Topics include design of control algorithms for implementation, modeling of discrete time systems, application of z-transforms, stability analysis, root locus analysis, controller design via conventional techniques, state-space analysis and modeling, and design and implementation of digital controller. Implementation of real-time digital controllers is performed in the laboratory. Graduate students will be assigned an area or topic for a final class project which will be involved in researching an actual digitally controlled application, identifying all sub-systems, study of digital controller, analysis of system performance using topics covered in the class, developing Simulink model for the control system and finally proposing alternative solution for the controller for system response improvement. Students may not receive credit for both EE-433 and EE-633.

Lecture: 3, Lab 2, Other 0

EE-646 Vector Control of AC Electric Machines 4 Credits

Prerequisites: None

Methods of controlling electric machines and their applications in electric vehicles are discussed. Topics include the theory of permanent-magnet and induction machines; coordinate-frame transformations; analysis and tuning of torque and speed control systems; modeling and dynamics of electric drives and vehicles, power-electronic devices, power-electronic circuits and switching schemes; rotor-flux oriented vector control; regenerative braking; and rotor-flux position-sensing methods. Machine and vehicle models will be developed using MATLAB Simulink. A low-voltage permanent-magnet machine and power-electronic inverter will be analyzed and tested. Students are also required to complete a research project, to be determined and assigned with approval of the instructor. Students may not receive credit for both EE-446 and EE-646.

Lecture: 3, Lab 2, Other 0

EE-682 Robot Dynamics and Control 4 Credits

Prerequisites: None

Review of mathematical principle for robotics including matrix operations and their concepts. Principles of robot analysis, design, and operation are presented. Topics include review of historical robotics evolutions and applications, robot coordinate system placement rules, kinematic model development, kinematic solutions and analysis, trajectory planning and movement optimization, collision avoidance and path planning, feedback control system for robotics, feedforward, study of sensors for robotics applications, vision system types and application for robotics and mobile robots. Graduate students will complete an advanced robotic application project to integrate and highlight the application of course materials. Examples of application area include surgery, space exploration, radioactive material handling, agriculture automation. Students may not receive credit for both EE-482 and EE-682.

Lecture: 4, Lab 0, Other 0

EE-691 Graduate Special Topics in EE 4 Credits

Prerequisites: None

Graduate Level Special Topics in Electrical Engineering.

Lecture: 4, Lab 0, Other 0

EE-695 Graduate Research in Electrical Engineering 8 Credits

Prerequisites: None

This course is directed research towards a master's thesis. Students take the course under the direction of a faculty advisor. This course may be repeated for credit.

Lecture: 0, Lab 0, Other 0

EE-699 Graduate Level Independent Study in Electrical Engineering 4 Credits

Prerequisites: None

Graduate level Independent Study in Electrical Engineering.

Lecture: 0, Lab 0, Other 0