Certificate: Vehicle Electronics and Controls

The increasing use of electrical systems and electronic sensors and devices in vehicles and automobiles has resulted in new developments in this field for vehicle application. With rapid progress in battery technology, it is envisaged that electric vehicles will become more affordable and more efficient. Electric drive control requires the use of power devices which are primarily high power electronic devices. Modern vehicles will rely on both analog and digital hardware for efficient operation of the vehicle. Engineers would be required to be well versed in the design of hybrid electrical and electronic systems.

The Vehicle Electronics certificate will introduce the participants to analog and digital electronics. Starting with simple diodes and rectifiers, students will be introduced to other solid state devices that are used in electronic circuits. Participants will learn the design of amplifiers, switches and other commonly used circuits. They will also receive instruction on digital logic and the use of microprocessors. Besides featuring hands-on laboratory practice, participants will be involved in several group design projects.
(12 credit hours)

Certificate offered on Campus and via Distance Learning

AE 510 Vehicle Electronics 1
3 credits
Semiconductor diodes, junction transistors, FETS, rectifiers and power supplies, small signal amplifiers, biasing considerations, gain-bandwidth limitations, circuit models, automotive applications and case studies.

ECE 532 Auto Sensors and Actuators
3 credits
Study of automotive sensory requirements; types of sensors and future needs along with functions and types of actuators. Integrated smart sensors and actuators are also covered.

ECE 505 Digital Systems and Microprocessors
3 credits
Introduction to modern digital computer logic. Numbers and coding systems; Boolean algebra with applications to logic systems; examples of digital logic circuits; simple machining language programming; microprocessor programming input/output, interrupts and system design.

ECE 515 Vehicle Electronics II
3 credits
Introduction to feedback control, control strategies, analog and digital controllers, fuzzy control systems, neural networks for controllers, applications of fuzzy logic, expert systems and neural networks for intelligent control of dynamic systems.

ECE 519 Advanced Topics in EMC
3 credits
This course covers the EMC requirements and EMC test methods for large systems. Examples involving various types of applications (automotive, communications, computers) will be discussed. Discussion of design practices used in large installation, including component segregation, cable routing, connectors, grounding, shielding, common impedance coupling, ground planes, screening and suppression. Classification of electromagnetic environments will also be discussed.

ECE 5462 Electric Aspects of Hybrid Electric Vehicles
3 credits
To introduce fundamental concepts and the electrical aspects of HEV, including the fundamentals, design, control, modeling, battery and other energy storage, electric propulsion systems. It covers vehicle dynamics, energy sources, electric propulsion systems, regenerative braking, parallel and series HEV design, and practical design considerations, specifications of hybrid vehicles.

AENG 545 Vehicle Ergonomics I
3 credits
Overview of drive characteristics, capabilities, and limitations. Human variability and driver demographics, driver performance measurements. Driver information processing models, driver errors and response time. Driver sensory capabilities, vision, audition, and other inputs. Vehicle controls and displays. Driver anthropometry, biomechanical considerations.

ECE 531
3 credits
The course covers important technologies relevant to intelligent vehicle systems including: systems architecture, in-vehicle electronic sensors, traffic modeling and simulation. Students will design and implement algorithms and simulate driver-highway interactions.

ECE 533 Active Automotive Safety Systems
3 credits
The course covers enabling technologies relevant to active automotive safety systems. The study of such intelligent vehicle systems includes their architecture, sensors, and underlying algorithms. Modeling and simulation will also be covered. Students will design and simulate systems that embody the essential elements.