

Electrical Engineering: Power Electronics and Energy Systems

[EEPE 6354](#) Power Electronics (3 semester credit hours) 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. Introduction to AC motor Drives Systems and control. Prerequisite: [EE 3311](#). (3-0) Y

[EEPE 6356](#) Adjustable Speed Motor Drives (3 semester credit hours) 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. Introduction to fault tolerant and sensorless control of machines. Prerequisite: [EE 3311](#). (3-0) Y

[EEPE 6357](#) Control, Modeling and Simulation in Power Electronics (3 semester credit hours) Principles of modeling and fundamentals of controller design for inverters, and switching dc-dc power converters will be discussed with an emphasis on generalized averaging methods. Special attention will be given to analysis and design of regulated power supplies for low power and medium power level supplies. An introduction to nonlinear phenomenon in power electronic systems and adjustable speed motor drives will be included. Finally analysis and design of multi-converter systems will be discussed and the use of advanced control methods such as Feedback linearization and sliding mode control in such systems will be explored. Prerequisite: [EEPE 6354](#). (3-0) Y

[EEPE 6358](#) Electrification of Transportation (3 semester credit hours) Introduction to electric and hybrid vehicles. Hybrid vehicle architectures - series, parallel and plug-in hybrid vehicle architectures - range extender and full hybrid systems. Propulsion system analysis, powertrain component sizing, and vehicle simulation. Energy requirements, energy storage devices, and fuel cell vehicles. Power electronic converters for electric and hybrid vehicles. Energy management and control strategies. Characteristics of commercially available hybrid vehicles. Introduction to more electric aircraft and architectures. Marine electric propulsion system. Prerequisite: [EEPE 6354](#). (3-0) T

[EEPE 6359](#) Renewable Energy Systems and Distributed Power Generation Systems (3 semester credit hours) Fundamentals of energy and sustainability. Interconnection of energy and environment. Renewable energy sources and availability: wind, solar, and fuel cell systems. Converters and controllers for integration of renewable energy sources. Solar and wind energy system design. Hybrid power generation systems. Smart grid system. Prerequisite: [EEPE 6354](#). (3-0) T

[EEPE 7354](#) Advanced Power Converters (3 semester credit hours) Pulse width modulation of converters and inverters. Space vector PWM strategies. 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. (3-0) T

[EEPE 7356](#) Computer Aided Design of Electric Machines (3 semester credit hours) Principles of force generation and distribution of electromagnetic forces within induction, permanent magnet synchronous, and reluctance machines. Introduction to finite element analysis of electric machinery. Electromagnetic, structural, and thermal fields in electric machines. Multi-physics analysis of electric machines. Optimization methodologies in multi-objective problems. Applications of artificial intelligence methods for optimal design of electric machinery. Prerequisite: [EEPE 6356](#). (3-0) T

[EEPE 7V91](#) Special Topics in Power Electronics (1-6 semester credit hours) Advanced power electronics and drives related topics relevant to the needs for research in power/energy systems. May be repeated for credit as topics vary (12 semester credit hours maximum). Prerequisite: [EEPE 6354](#). ([1-6]-0) R