Electrical Engineering: Power Electronics and Energy Systems

**EEPE 6354** Power Electronics (3 semester hours) Introduction to power electronics and its applications. DC-DC converters: Buck Converter, Boost Converter, Buck-Boost converter, Flyback converters, Forward converter, Full bridge and Half bridge converters. DC- AC Inverters: Single phase and three phase bridge inverters, Pulse-width modulation strategies- sinusoidal and space vector modulation. Resonant converters. AC-DC Phase Controlled Thyristor Converters. Closed loop control of DC Motor Drives. Introduction to AC motor drives and systems. Examples: Industrial, Transportation, Renewable Energy Applications. (3-0) Y

**EEPE 6356** Adjustable Speed Motor Drives (3 semester 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. (3-0) Y

**EEPE 6357** Control, Modeling & Simulation in Power Electronics (3 semester 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. (3-0) Y

**EEPE 6358** Electrification of Transportation (3 semester 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. (3-0) T


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 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. (3-0) T

**EEPE 7v91** Special Topics in Power Electronics (1-6 semester hours) Advanced power electronics and drives related topics relevant to the needs for research in power/energy systems. Topics may vary. May be repeated for credit. ([1-6]-0) R