Description of Courses

POWE 600- PROJECT-INDEPENDENT STUDY (3 Cr.): This course requires participation, under the supervision of a faculty member, in a research study. Before registering, the student must create a proposal regarding the nature of the research, the specific goals of the research, and the desired final report outcome; this proposal must be submitted to and approved by the supervising faculty member and the department before registering. Pre-req.: RSCH 690.

POWE 601-ADVANCED POWER SYSTEM ANALYSIS (3Cr.): Modern techniques in VAR control of HV/EHV interconnected power systems. Advanced power flow analysis: FACTS equipment representation in power flows, power flow analysis in compensation and control studies, HVDC light power flow modeling and solution. Stability of multimachine power systems, Advanced fault analysis including open circuits and simultaneous faults, Analysis of Power system harmonics, State estimation.

POWE 602-ADVANCED POWER ELECTRONICS (3Cr.): Advanced power electronic converters, techniques to model and control switching circuits, resonant converters, Pulse Width Modulation (PWM) techniques, soft switching methods, and low-voltage high-current design issues are studied. Single-phase and multi-phase, controlled and uncontrolled rectifiers and inverters with different operating techniques and their design and control issues are explained.

POWE 603-INTRODUCTION TO ROBUST CONTROL (3Cr.): Modeling and paradigms for robust control, robust stability and measures of robust performance, analysis of robust stability and performance, design for robust stability and performance.

POWE 604-DSP MICROPROCESSORS (3Cr.): Device architecture, various aspects of hardware / software design, problems related to real-time acquisition and processing of analog data, design principles for the state-of-the-art data conversation interfaces.

POWE 605-OPTIMAL OPERATION OF POWER SYSTEMS (3Cr.): Unit commitment and application of dynamic programming, Fuel budgeting and planning, Probabilistic production cost modeling, Hydrothermal coordination, Power system security and application of expert systems, State estimation, Optimal power flow, Interchange evaluation and power pools.

POWE 606-FAULT-TOLERANT POWER SYSTEMS (3Cr.): Critical fault events in

POWE 607-OPTIMAL USE OF POWER PRODUCTION AND TRANSMISSION FACILITIES IN HYDRO POWER SYSTEM (3Cr.): Overview of the scheduling process in hydro-thermal power systems (long-, mid-, and short-term). Methods applicable for optimization of system resources. Issues related to transmission system use (transmission access, transfer capacity, technical limitations caused by thermal ratings, possible contingencies and stability problems). Methods used to study phenomena related to transmissions use. Theoretical challenges in System Operation, Markets of the future, System planning in a competitive environment.

POWE 608-POWER SYSTEM RELIABILITY AND SECURITY (3Cr.): The course will cover methodology and techniques for reliability and security analysis of power systems. The topics in the course can be grouped in three parts: 1. Techniques for reliability evaluation, such as minimum cut set and Markov models to model weather effects and maintenance. Models for evaluation of generation systems (LOLP, LOLE and Energy not supplied). 2. Load flow models applied to contingency analysis. 3. Combination of load flow modeling and reliability evaluation for analysis of meshed networks (regional and main grid). To give a deeper understanding of the problems in power system reliability and security, and to provide methods and techniques to solve these problems.

POWE 609-POWER MARKET OPERATIONS (3Cr.): Market design in restructured power systems, artificial neural network applications to power systems, short-term load forecasting, electricity price forecasting, price-based unit commitment, arbitrage in electricity market, gaming and market monitoring, asset valuation and risk analysis, security-constrained unit commitment, ancillary services auction, transmission pricing and regional transmission organizations.

POWE 610-DEREGULATED POWER SYSTEMS (3Cr.): Overview of key issue in electric utilities restructuring, Poolco model, bilateral contracts, market power, stranded costs, transmission pricing, electric utility markets in the Arab region, OASIS, tagging electricity transactions, electric energy trading, risk in electricity markets, hedging tools for managing risks, electricity pricing, volatility in power markets, RTO.

POWE 611-POWER SYSTEM TRANSACTION MANAGEMENT (3Cr.): Power interchange transaction management in the deregulated electric power industry. Course topics include power system security assessment, total and available transfer capability (TTC/ATC), transaction management system (TMS), transaction information system (TIS), tagging, interchange distribution calculator (IDC), congestion management, transmission loading relief (TLR).

POWE 612-POWER SYSTEM STABILITY AND CONTROL (3Cr.): General
background and overview of power system stability issues (angle and voltage stability, transient, midterm and long-term stability), Synchronous machine theory and modeling, Machine representation in stability studies, AC transmission components, Power System Loads, Excitation systems, Prime movers and energy supply systems, HVDC, Control of active power and reactive power, Small-signal stability, Transient stability, Methods for improving stability. The course material gives an in-depth description of the topics where parts of it are covered in the prerequisite courses. MATLAB/SIMULINK software package is used in the analysis and design of application problems.

POWE 613-MODELING AND SIMULATION OF POWER SYSTEM COMPONENTS (3Cr.): This course is recommended for those interested in learning to use computer simulation to investigate the dynamic and controlled behavior of electrical power components. Being with an introduction to MATLAB / SIMULINK, the course goes through the key steps of modeling, implementing and verifying the simulation of single and three, phase transforms, single and three, phase induction machines, three, phase wound filled synchronous machines and permanent magnet machines useful in power application. Students are expected to implement and verify simulation projects, and also discuss observed behaviors on topics such as inrush current in transformers, motoring, generating and braking operation of machines, and pulsating torque from sub synchronous resonance.

POWE 614-POWER SYSTEM DESIGN OF ALTERNATIVE ENERGY SOURCES (3Cr.): System design modeling, economic feasibility, and applicants of alternative and renewable energy sources including: fuel cells, storage batteries, bioelectrochemical cells, redox flow cells, ocean thermal energy converters, and magnetohydrodynamic converters. The modes of system interconnections, including linkage to conventional power systems, are also studied.


POWE 616-MODERN TRENDS IN POWER SYSTEM PROTECTION (3Cr.): Typical protective static and digital relay systems, Directional sensing of faults, Modern trends in backup and line protection of generators, transformer, reactors, shunt capacitors, bus bar, motor, and long EHV series-compensated lines, Stability, reclosing, and load shedding, Systems swings, grounding, and transient over voltage protection, Coordination and CAD applications.

POWE 617-HIGH VOLTAGE DC TRANSMISSION SYSTEMS (3Cr.): Line-commutated converter analysis, Rectifier and inverter controls, System Protection, Harmonics, Supplementary controls and multi-terminal operation.
POWE 618 - INTERNATIONAL STANDARDS & TECHNICAL SPECIFICATIONS OF ELECTRICAL POWER EQUIPMENTS (3Cr.): Regulations and practices for design, maintenance requirements, and special equipment, International Electrotechnical Commission (IEC) Code applied in the industrial environment, IEC standards regarding the main specifications, testing, inspection and commissioning of power equipment, Electric safety regulations and standards.

POWE 619 - TRANSIENTS IN POWER SYSTEMS (3Cr.): Switching transients and over voltages: Causes, effects, modeling, and measurement, Harmonics: sources, characteristics, effects, and mitigation, Static lightning protection: surge nature, surge arresters, insulation coordination, measuring techniques and surge testing, System neutrals—Protective grounding.

POWE 620 - ADVANCED ELECTRICAL MACHINES (3Cr.): Performance and control of special types of electrical machines: Stepper motors, Reluctance motors, Permanent magnet machines. Linear induction motors. Linear synchronous motors. Self-excited generators.


POWE 622 - ADVANCED INDUSTRIAL AUTOMATION (3Cr.): Point-to-point protocol to control an inverter or 2 soft starter using PLC, control over an Ethernet network-Master and slave connections, built-in controllers and their use. Management of analog signals. Special functions.

POWE 623 - POWER ACTIVE FILTER DESIGN (3Cr.): Analysis and design of linear active filters with emphasis on realization using embedded controllers. Sensitivity analysis. Switched capacitor filters.


POWE 625 - OPTIMAL CONTROL SYSTEMS (3Cr.): Design of optimal control systems. Topics include optimization under constraints, linear quadratic regulators, Ricatti equation, suboptimal control, dynamic programming, calculus of variations, and Pontryagins minimum principle.
POWE 626-INTELLIGENT CONTROL SYSTEMS (3Cr.): Principles of intelligent control including adaptive, learning, and self, organizing systems. Neural networks and fuzzy logic systems for feedback control. Discrete event systems and decision, making supervisory control systems. Manufacturing work cell control. Advanced sensor processing including Kalman filtering and sensor fusion.


POWE 628-COMPUTATIONAL INTELLIGENCE IN ENGINEERING (3Cr.): Introduction to soft computing, fuzzy set theory, neural networks, genetic algorithms, intelligent software agents, comparison with traditional alternatives, advanced engineering applications.

POWE 629-SPECIAL TOPICS IN POWER SYSTEMS (3Cr.): Advanced topics of current interests in Electric Power Engineering. Topics are selected by the instructor from current literature.

POWE 630-SPECIAL TOPICS IN AUTOMATIC CONTROL SYSTEMS (3Cr.): Topics covered in this course are related to subjects such as: Optimal control, stochastic control, fuzzy logic control systems, PLC controllers, and/or other topics as selected by the instructor.

POWE 631-SPECIAL TOPICS IN ELECTRIC MACHINES (3Cr.): Advanced topics of current interests in modern trends of power electronics. Topics are selected by the instructor from current literature.

POWE 632-RENEWABLE ENERGY RESOURCES IN LEBANON (3cr): This course provides an introduction to renewable energy resources with a scientific examination of the energy field and an emphasis on alternate energy sources and their technology and application. It includes basic concepts, principles, potentials and limitations of various renewable energy sources including wind energy, solar thermal energy, solar photovoltaic energy, biomass energy, geothermal energy and hydraulic energy. Evaluation of energy projects: cost analysis, achievability, reliability and its environmental impact and energy management.

POWE 699-MASTER'S THESIS (6Cr.): The Master's project aims to develop an understanding of the field of study beyond the undergraduate degree, with emphasis on
the conduct of original research, the application of theory into practice through real life models, and the effective communication of information through the appropriate channels. A comprehensive knowledge, as well as training in data interpretation and analytical skills is essential. One of the key goals for the Master's project is to give students the tools and confidence to carry out independent research. In addition, the student must possess the ability to express thoughts clearly, both verbally and in written form. Pre-req.: RSCH 690.

RSCH 690- Research Methodology (3Cr.): Research: a way of thinking, entering into research and research methodology, steps for conducting a successful research: formulating a research problem, conceptualizing a research design, constructing an instrument for data collection, selecting samples, writing a research proposal, collecting data, processing & displaying data, writing a research report. Research at Beirut Arab University: enrollment, intramural grants, incentives … The course contains a project that will help students start their master thesis or project.