EE 641: Advanced Power System Operation and Control

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| **Lecture Schedule** | | See Time Table | **Semester** | Fall 2018 | | |
| **Credit Hours** | | Three | **Pre-requisite** | Power System Operation and Control (UG), Advanced Power Systems | | |
| **Instructor** | | Dr. Muhammad Asghar Saqib | **Contact** | saqib@uet.edu.pk | | |
| Tel. (Office): 042-9902 9423 (HV Eng. Lab) | | |
| **Office** | | HV Eng. Lab, Old/Main Block, Opposite New Auditorium Building | **Office Hours** | Monday - Thursday  02:00 pm – 03:00 pm | | |
| **Course Description** | | This course commences in exploring further into some of the themes introduced in our undergraduate course on ‘Power System Operation and Control’, and then discusses some advanced topics in the area. A number of engineering and economic matters associated with the planning, operation and control of power generation and transmission in electric utilities will be discussed. Theoretical and practical computational approaches applied to modern power generation systems, in the context of their operation and control, are the main focus of the subject. Economic dispatch from thermal power plants, unit commitment, hydro-thermal scheduling, energy interchange between multiple utilities and short-term demand forecasting are the major topics to be covered in the course. | | | | |
| **Measurable Learning Outcomes** | **CLOs** | **Description** | | | **Domains & Levels** | **PLOs**  **Levels** |
| CLO1 | Applying various optimization techniques in economic dispatch of thermal units. | | | Cognitive, 3 | PLO2  High |
| CLO2 | Analysing the unit commit problem using solution methods such as priority list, Lagrange relaxation solution and mixed-integer linear programming. | | | Cognitive, 4 | PLO3  Medium |
| CLO3 | Assessing the fuel-scheduling issues in the context of hydro-thermal scheduling. | | | Cognitive, 5 | PLO4  High |
| CLO4 | Understanding the energy auction and daily auction using unit commitment, and the concepts of energy interchange between different utilities, power pools and transmission capability issues. | | | Cognitive, 3 | PLO1  High |
| CLO5 | Formulating various approaches in short-term demand forecasting | | | Cognitive, 4 | PLO3  Medium |
|  | CLO6 | Assignments and presentations | | | Cognitive, 5 | PLO5/PLO9  High |
| **Textbook(s)** | | Power Generation, Operation and Control, Third Edition, by Allen J. Wood, Bruce F. Wollenberg and Gerald B. Sheble, John Wiley & Sons, 2014. | | | | |
| **Grading Policy** | | * Assignments & Project 20% * Quizzes 10% * Midterm 30% * Final 40% | | | | |

**Lecture Plan**

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| **Weeks** | Topics | **Readings and CLOs** |
| **3\*** | **Economic Dispatch of Thermal Units and Methods of Solution**  The Economic Dispatch Problem; LP Method; Lambda Iteration Method; Economic Dispatch via Binary Search; Economic Dispatch using Dynamic Programming; Composite Generation Production Cost Function; Dispatch with Network Losses Considered, and Various Auction Mechanisms. | **Ch. 3**  **CLO1** |
| **3\*** | **Unit Commitment**  Introduction to Unit Commitment; Unit Commitment Solution Methods such as Priority-List Methods, Lagrange Relaxation Solution, Mixed Integer Linear Programming; Security-Constrained Unit Commitment, and Daily Auctions using Unit Commitment | **Ch. 4**  **CLO2** |
| **3\*** | **Generation with Limited Energy Supply**  Introduction; Fuel Scheduling; Fuel Scheduling by Linear Programming; Hydrothermal Scheduling; Hydroelectric Plant Models; Scheduling Problems; The Hydrothermal Scheduling Problem; Hydro-Scheduling using Linear Programming, and Dynamic Programming Solution | **Ch. 5**  **CLO3** |
| **3\*** | **Interchange, Pooling, Brokers and Auctions**  Introduction; Interchange Contracts; Energy Interchange between Utilities; Inter-utility Economy Energy Evaluation; Interchange Evaluation with Unit Commitment; Multiple Utility Interchange Transactions; Power Pools; Energy-Broker System; Transmission Capability Issues, and Auction Emulation using Network LP | **Ch. 11**  **CLO4** |
| **3\*** | **Short-Term Demand Forecasting**  Introduction; Analytic Methods; Demand Models; Commodity Price Forecasting; Econometric Models; Time-Series Models; ANNs; Model Integration, and Demand Prediction | **Ch. 12**  **CLO5** |

**\* -** Tentative