American University of Beirut
Faculty of Engineering and Architecture
Department of Electrical and Computer Engineering

EECE 678 - Advanced Power System Analysis
Course Syllabus
Spring 2013

Instructor
Name: Dr. Rabih Jabr
Office: Bechtel 513
Extension: 3637
Email: rabih.jabr@aub.edu.lb
Office hours: M 10:00 am – 12:00 noon, W: 10:00 am – 11:30 am, F: 10:00 am – 11:00 am, and by appointment.

Catalog description
A course on optimal dispatch of generation, symmetrical components and unbalanced faults, transient stability, control of generation, state estimation in power stytems, and power system simulation.

Time and Place
Section 1: MW 2:00 – 3:30 pm, Bechtel 403

Credit hours: 3 credits

Prerequisites
By course: EECE 471 – Fundamentals of Power Systems Analysis

By topic: Balanced three-phase circuit analysis; perunit system; basic models of generators, transformers and transmission lines; loadflow computation; transfer function of closed-loop control systems; numerical methods in linear algebra.

Textbook(s) and/or required materials
1. J.D. Glover, M.S. Sarma, and T.J. Overbye: *Power System Analysis and Design – 4th Edition* (Thomson, 2007).
2. Lecture notes posted on moodle.

References
1. J.J. Grainger and W.D. Stevenson, Jr.: *Power System Analysis* (McGraw Hill, 1994).
2. A.J. Wood and B.F. Wollenberg: *Power Generation, Operation, and Control – 2nd Edition* (Wiley, 1996).
3. P. Kundur: *Power System Stability and Control* (McGraw-Hill, 1994).
4. P.M. Anderson: *Analysis of Faulted Power Systems* (IEEE Press, 1995).
5. A.R. Bergen and V. Vittal: *Power System Analysis – 2nd Edition* (Prentice-Hall, 2000).
6. A.S. Debs: *Modern Power Systems Control and Operation* (Kluwer, 1988).
7. P.M. Anderson and A.A. Fouad: *Power System Control and Stability – 2nd Edition* (IEEE Press, 2003).
8. H. Saadat: *Power System Analysis – 2nd Edition* (McGraw-Hill, 2004).
9. B.M. Weedy and B.J. Cory: *Electric Power Systems – 4th Edition* (Wiley, 1998).
10. P. Schavemaker and L. van der Sluis: *Electric Power System Essentials* (Wiley, 2008).
11. J.D. McCalley: *Lectures on Power System Analysis*, Iowa State University (2009).

Course Objectives

The objectives of this course are to:

1. Provide students with an understanding of power system methods for the economic operation of generating units, unbalanced fault computation, and transient stability
2. Provide students with the essential background on power generation control
3. Introduce students to state estimation in power systems
4. Present computer simulation tools to solve power system problems

Course Topics

1. Symmetrical Components
2. Unsymmetrical Faults
3. Transient Stability
4. Control of Generation
5. Economic Generation Dispatching
6. State Estimation

Course Learning Outcomes

At the end of the course, students:

1. Can use the equal-lambda criterion to solve power dispatch problems and account for generation limits and power losses
2. Are able to formulate the optimal power flow problem and solve it using available software
3. Can use the method of symmetrical components for analyzing unbalanced three-phase systems
4. Can calculate the fault current for single line-to-ground, line-to-line, and double line-to-ground faults
5. Can describe the synchronous machine rotor dynamics via the swing equation
6. Can use the equal-area criterion to analyze the transient stability of one synchronous machine connected to a system equivalent
7. Can use numerical integration techniques for solving swing equations in multi-machine stability studies
8. Can describe the control model of generator units
9. Can describe the Automatic Generator Control (AGC) system
10. Are able to formulate the power system state estimation problem
11. Can solve the power system state estimation problem using the weighted least-squares technique
12. Are able to run computer simulations of practical power system problems

Computer usage

PowerWorld Simulator or similar power systems software

Evaluation methods

1. Midterm exam (March 20, 2013)	35%
2. Final exam	40%
3. Homework / CAD assignments / Project	20%
4. Class participation	5%