The University of Jordan
School of Engineering
Department of Electrical Engineering
2nd Semester – A.Y. 2017/2018

Course: Selected topics in power and machines – 0903589

Instructor: Dr. Mohammed A Haj-ahmed
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Course Website:

Catalog Data: Synchronous machine steady state and transient characteristics; Park's transformation. Introduction to power system stability problem; rotor angle stability, voltage stability, long and short term stability. Swing equation. Steady-state stability. Transient stability. Power system control. Load frequency control. Automatic generation control. Reactive power and voltage control. Wind generators types and characteristics. Wind generators stability.

Prerequisites by Course: **EE 0903482 –** Power systems II (pre-requisite)

Prerequisites By Topic: Students are assumed to have a background in the following topics:
- Basic circuit analysis techniques.
- Basic electromagnetic and machines concepts.
- Basic control theory concepts.

Textbook: **Power System Analysis, Hadi Saadat, 2nd Edition, McGraw-Hill.**

References:
- *Power system stability and control, P.Kundur, 1994, McGraw-Hill.*
- *Power system analysis, W.D. Stevenson & J.J. Grainger, 1994, McGraw-Hill.*
- *Power generation, operation and control, A.J. Wood and B.F. Wollenberg, 1983, Wiley.*
- *Power system dynamics, stability and control, J. Machawski, J. Bialek, J. Bumby, 2008, Wiley.*
- *Dynamic simulation of electric machinary using MATLAB/SIMULINK, C. Ong, 1998, PTR Prentice-Hall.*

Schedule & Duration: 16 Weeks, 42 contact hours (50 minutes each) including exams.

Minimum Student Material: Textbook, class handouts, scientific calculator, and an access to a personal computer.

Minimum College Facilities: Classroom with whiteboard and projection display facilities, library, computational facilities with MATLAB.

Course Objectives: This is an introductory course to Power systems stability provided by the department of Electrical Engineering for the Electrical Engineering students. It is designed to achieve the following objectives:
- Introduce the concept of power system stability problem.
- Study the synchronous machine internal and external characteristics.
- Understand the basics of power systems control.
- Solve simulation-based stability and control problems.

Course Learning Outcomes and Relation to ABET Student Outcomes:

Upon successful completion of this course, a student should:

1. Understand the stability problem and its importance to the system availability (stability). [e, j]
2. Realize the relationship between the stability problem and power system relaying. [e]
3. Review the basic concepts in state space control and matrices transformation. [a]

4. Be familiar with power system components: the generator, excitation systems, controllers, loads, and relaying systems. [d, e]
5. Be able to design excitation system stabilizers. [k]

6. Be familiar with synchronous machine external and internal problems. [c]
7. Recognize the concept of AGC control. [e]
8. Recognize the concepts of a power system stabilizer. [e]

Course Topics:

	Topic Description	Hrs
1.	Synchronous machine charecteristics: Steady-state and transients analysis, Parks' transformation, transient phenomena, balanced three phase short circuit, unbalanced short circuit.	**6**
2.	Introduction to power system stability problem: Rotor angle stability, voltage stability, long and short term stability.	**3**
3.	Stability problem: Swing equation, steady state stability, small disturbances, transient stability: Equal area criterion.	**9**
4.	Numerical solution for the swing equation, multi-machine systems, multi machine transient stability.	**6**
5.	Power system control: Introduction to basic control loops.	**3**
6.	Load frequency control: generator model, load model, prime mover model, governor model. Automatic generation control (AGC): AGC in a single area system, AGC in multiarea systems.	**9**
7.	Reactive power and voltage control: Amplifier model, exciter model, generator model, excitation system stabilizer rate feedback. Exciatation system stabilizer PID controller.	**3**
8.	Wind generators types, charecteristics and wind generators stability.	**6**

Ground Rules:

Attendance is Mandatory and highly encouraged. To that end, attendance will be taken every lecture. All exams (including the final exam) should be considered **cumulative**. Exams are closed book. No scratch papers are allowed. You will be held responsible for all reading material assigned, even if it is not explicitly covered in lecture notes.

Assessments:

Exams and Projects

Grading policy:

Homeworks and project	**20 %**
First Exam	**20 %**
Second Exam	**30%**
Final Exam	**50 %**
Total	**110%**

Last Updated:

January, 28th 2018