Application of ABET CRITERION (2002)

King Saud University
Electrical Engineering Department
EE 430: Introduction to Electrical Machine Dynamics
Second Semester 1424/25 (2003/2004)

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Textbook: "**Electrical Machines: Steady State Theory and Dynamic Performance**" By **Mulukutla S. Sarma**

Published by West Publishing Company 1994.

Description: Basic dynamic equations; DC machine dynamics: dynamic models, dynamic analysis; Synchronous machine transients and dynamics: transformation to direct and quadrature axis variables, sudden 3 phase short circuit, synchronous machine dynamics: the swing equation, steady state and transient stability; Induction machine dynamics and transients: starting transients, sudden load changes, 3 phase faults.

Prerequisite: EE 331.

Course Objectives: Learn modern techniques and analytical methods for dealing with and solving operational problems in electrical machines.

Topics Covered: Introduction to electrical machine dynamics, Dc machine dynamics; Synchronous machine modeling in d-q reference frame. Synchronous machine dynamics: swing equation, steady state and transient stability; Induction machine modeling: starting transients, Sudden load changes, 3-phase faults.

Class/Tutorial Schedule: Class is held three times per week in 50-minute lecture sessions. There is also a 50-minute weekly tutorial associated with this course.

Professional Component Contributions: Students learn the modern methods and technologies associated with electrical machines dynamics. They acquire the basic skills of how to approach and deal with real-life operating situations; perform assessments and make assumptions, evaluate and compare alternative solutions, solve simple simulated operating problems. Students must also utilize knowledge of mathematics, physics, systems, control, circuits and basic engineering sciences in order to effectively analyze a diverse set of operational problems.

Relationship to Program Objectives: This course contributes to the general objectives listed for an Electrical Engineering Department.

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Objective A: By teaching students how to formulate basic operating problems and model the associated configurations, circuits and systems, this course supports the objective of producing graduates with a strong foundation in basic science.

Objective B: By teaching students how to deal with electrical machines and solve machines operating problems, the course helps in the department's production of students with a strong foundation in electrical engineering.

Objective C: By encouraging students to participate in class, acquire basic group dynamics skills and provide personal assessments on alternative solutions to operating problems and discuss such alternatives among themselves, this course supports the objective of producing graduates with good communication skills.

Objective D: By encouraging students to learn pertinent ethical and professional standards in dealing with real-life operating situations and acquire mutual respect for diverse opinions relating to solving system operation problems, this course supports the objective of providing graduates with a broad-based education so that they can appreciate diversity of opinion, better understand ethical issues and develop a more global perspective of the profession.

Objective E: By teaching students how to design simple operating control to enhance power system stability, this course supports the objective of producing graduates with the relevant engineering design experience.

Evaluation: There are graded home works, two 2-hour mid-term exams and a three-hour **final exam:** The course grade distribution is as follows:

20% Attendance, in-class quizzes and tutorial home-work
40% Two Midterm Exams
40% Final Examination

Challenges and Actions Taken to Improve the Course: Some basic background and prerequisite-type material are often reviewed during this course, notably those related to vector/matrix operations and numerical integration methods. Some additional background material is often handed to students to review some basic technical material.

Weekly Teaching Plan

Weeks	Teaching plane
1	Basic dynamic equation
2-3	DC machine dynamics: dynamic models, dynamic analysis
4	Synchronous machine transients and dynamics
5-6	Transformation to direct and quadrature axis variables
7	Sudden 3 phase short circuit
8-9	Synchronous machine dynamics: the swing equation, steady state and transient stability
10-11	Induction machine dynamics and transients
12-13	Starting transients sudden load changes, 3 phase faults

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