Course Syllabus

<table>
<thead>
<tr>
<th>Course Title: Power system Stability</th>
<th>Course code: 610578</th>
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</thead>
<tbody>
<tr>
<td>Course Level: Fifth Year</td>
<td>Course prerequisite: power system 1 (610481)</td>
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<tr>
<td>Credit hours: 3 hours / week</td>
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</tbody>
</table>

Academic Staff

<table>
<thead>
<tr>
<th>Name</th>
<th>Rank</th>
<th>Office Number and Location</th>
<th>Office Hours</th>
<th>E-mail Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr. Mohammed Towfeeq</td>
<td>Associated Professor</td>
<td>822-Electrical Engineering Dept.</td>
<td>9.00-11.00(Sunday Tuesday and Thursday)</td>
<td><a href="mailto:drmohamadtofik@yahoo.com">drmohamadtofik@yahoo.com</a></td>
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</tbody>
</table>

Course module description:
The course examines in detail the theoretical and computational aspects of steady-state stability and dynamic stability of power systems. Various component models such as generators, transmission systems and loads, will be discussed and several techniques for small- and large-perturbation stability analyses will be studied. The course will includes:

1. Power Systems Review: Review of basic concepts- per unit systems, ac circuits, phasors, power system structure and topology
2. System Modeling: From Detailed to Approximate Including Their Controls
   - Generation: generator, exciter, voltage and frequency regulators, prime-mover
   - Transmission systems: transformers and lines, including distributed parameter models.
   - Loads: RL, motor drives and aggregated models.
3. Small Perturbation Stability
   - Basic nonlinear system stability concepts: Eigen value analysis and stability regions.
• Continuation power flows.
• Voltage stability and System oscillations.

4. Large Perturbation Stability
Transient stability: Time domain simulations and direct stability analysis techniques (extended equal area criterion).

Course module objectives:
At completing this course the student should be able to:

1. Model the main power system components, including their controls, from phasor analysis to electromagnetic transients.
2. Understand basic analytical techniques for small and large perturbation stability studies such as voltage and transient stability analyses.
3. Discuss basic concepts, approximations used in standard mathematical tools for stability analyses.

Course/module components

• Text Book:
• Support material (s) (vcs, acs, etc).
• Study guide (s) (if applicable)
• Homework and laboratory guide (s) if (applicable).

Teaching methods:

• Lectures (3 per week) are used to describe and develop the concepts listed above.
• Supervisions are used to solve problems set (tutorials) by various exercises.

Learning outcomes:
• Knowledge and understanding

Having successfully completed the course, the student will be able to demonstrate knowledge and understanding of:

• The main types of stability problems in a power system.
• The modeling of the power system components for stability studies.
• The use of different available techniques for solving stability problems.
• The linearization of second order differential equations for steady state stability analysis.
• Type of disturbances in a power system.
• The use of equal area criteria for solving transient stability problems.

• Cognitive skills (thinking and analysis).
  Students are allowed to make seminars on various subjects in power system stability subjects with comprehensive discussions.
• Communication skills (personal and academic).

Having successfully completed the module, student will be able to:

• Appreciate the importance of stability studies in a power system.
• Compare and contrast the operation of various mathematical models used for stability analysis.
• Derive equations related to the different types of perturbations.
• Formulate relevant equivalent circuits of the synchronous machines to calculate their actual behavior during disturbances.
• Identify different types of faults causing major disturbances and their effects.
• Analyze simple problems related to stability analysis.

• Practical and subject specific skills (Transferable Skills).

Having successfully completed the module, the student will be able to:

• Choose among the different methods and techniques to solve the stability problems in a power system.
• Explain the operation and performance of the power system under small and large perturbations.
• Apply engineering studies for different types of stability of power system.
• Interpret results and correlate them with theoretical predictions
• Write a technical reports

Assessment instruments

• Short reports and/ or presentations, and/ or Short research projects
• Quizzes.
• Home works
• Final examination: 40 marks

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<tr>
<th>Assessment Instruments</th>
<th>Mark</th>
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<tbody>
<tr>
<td>First examination</td>
<td>20 Marks</td>
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<tr>
<td>Second Examination</td>
<td></td>
</tr>
<tr>
<td>Final examination</td>
<td>40 Marks</td>
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<tr>
<td>Reports, research projects, Quizzes, Home works, Projects</td>
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<tr>
<td>Total</td>
<td>100 Marks</td>
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Documentation and academic honesty
• Documentation style (with illustrative examples)
  • Hand written and typed lecture notes including solved examples and tutorial problems are prepared from various references related to the topics. The student shall try to solve these tutorial problems by himself while answers are given individually. The solution of these problems is given to the student before the final examination.

• Protection by copyright
• Avoiding plagiarism.

**Course/module academic calendar**

<table>
<thead>
<tr>
<th>week</th>
<th>Basic and support material to be covered</th>
<th>Homework/reports and their due dates</th>
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<tbody>
<tr>
<td>(1)</td>
<td>Power Systems Review: Review of basic concepts-per unit system</td>
<td></td>
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<tr>
<td>(2)</td>
<td>ac circuits, phasors, power system structure and topology</td>
<td>Homework No.1</td>
</tr>
<tr>
<td>(3)</td>
<td>ac circuits, phasors, power system structure and topology</td>
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<tr>
<td>(4)</td>
<td>System Modeling: From Detailed to Approximate Including Their Controls</td>
<td>Homework No.2</td>
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<tr>
<td>(5)</td>
<td>Generation: generator, exciter, voltage and frequency regulators, prime-mover</td>
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<tr>
<td>(6)</td>
<td>Transmission systems: transformers and lines, including distributed parameter models</td>
<td>Homework No.3</td>
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<tr>
<td>(7)</td>
<td>Transmission systems: transformers and lines, including distributed parameter models</td>
<td>Report No.1</td>
</tr>
<tr>
<td>(8)</td>
<td>Loads: RL, motor drives and aggregated models</td>
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<tr>
<td>(9)</td>
<td>Loads: RL, motor drives and aggregated models</td>
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<tr>
<td>(10)</td>
<td>Small Perturbation Stability</td>
<td>Homework No.4</td>
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<tr>
<td>(11)</td>
<td>Basic nonlinear system stability concepts: Eigen value analysis</td>
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<tr>
<td>(12)</td>
<td>Continuation power flows</td>
<td>Homework No.5</td>
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<tr>
<td>(13)</td>
<td>Voltage stability and System oscillations</td>
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<tr>
<td>(14)</td>
<td>Large Perturbation Stability</td>
<td>Homework No.6</td>
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<tr>
<td>(15)</td>
<td>Transient stability: Time domain simulations and direct stability analysis techniques (extended equal area criterion).</td>
<td>Report No.2</td>
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<tr>
<td>(16)</td>
<td>Final Examination</td>
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Expected workload:

On average students need to spend 2 hours of study and preparation for each 50-minute lecture/tutorial.

Attendance policy:

Absence from lectures and/or tutorials shall not exceed 15%. Students who exceed the 15% limit without a medical or emergency excuse acceptable to and approved by the Dean of the relevant college/faculty shall not be allowed to take the final examination and shall receive a mark of zero for the course. If the excuse is approved by the Dean, the student shall be considered to have withdrawn from the course.

Module references

Books

ReferenceBooks


Journals

IEEE Transactions on Power Apparatus and Systems

Websites

www.wikipedia.org