ECE 4343/5343 - Introduction to Power Systems, Power Systems Engineering  
Spring 2020, TT 9:30 - 10:50 pm, Room: EC 110

Catalog Data:  ECE 4343: Introduction to Power Systems (3:3:0) Prerequisite: ECE 3341. For majors only or departmental consent. Electrical power transmission and distribution systems; power generation systems, system modeling, planning, management and protection.  
ECE 5343: Power Systems Engineering (3:3:0). Electrical power transmission and distribution systems; power generation systems; system modeling, planning, management and protection.


Instructor:  Dr. Michael Giesselmann, P.E., Professor & Chair of ECE.

Goals:  This course is designed to acquaint senior undergraduate and first year graduate students of electrical engineering with the electric utility industry and to provide them with good examples of how the fundamentals they have learned in previous courses can be applied to real world problems.

Support Files: Lectures & supplementary materials will be placed online with full access for local and Distance Ed students on the COE Distance Education Server, http://aln.coe.ttu.edu/ecw/.

Topics:
1. Electric Power Systems Overview, Power Computation (5h)
2. Polyphase Systems & Transformers (4h)
3. The “Per-Unit” System (4h)
4. Symmetrical Components (3h)
5. Transmission Lines, Determination of Parameters (4h)
6. Transmission Line Loadability and Operation (4h)
7. Power System load flow theory (1h)
8. Synchro-Phasors (2h)
9. Power System load flow modeling (Power-World) (3h)
10. Power System Operation and Stability (3h)
11. Power System Faults & Protection Systems (4h)
12. Renewable Energy Systems (3h)
13. Reviews, Tests, and Excursion (3h)

Excursion:  Site visit in the field of electrical power generation or distribution.

Grading:
- Homework: 20%.
- 3 Tests, 15% each: 45%.
- Final Project (Paper): 35%.

Contributions to professional component
This course includes engineering topics and engineering design.

Relationship of course to program outcomes
This course addresses new ABET Program Outcomes 1, 2 & 4. The Assessment is through quantitative evaluations of scores of Tests and the Final Project. The specific outcomes are:

(1) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
(2) An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors

(4) An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts

**Disability Policy:** Any student who, because of a disability, may require special arrangements in order to meet the course requirements should contact the instructor as possible to make necessary arrangements. Students must present appropriate verification from Student Disability Services during the instructor’s office hours. Please note that instructors are not allowed to provide classroom accommodation to a student until appropriate verification from Student Disability Services has been provided. For additional information, please contact Student Disability Services office in 335 West Hall or call 806-742-2405. Further details are provided by Texas Tech Operating Policy 10.08.

**Religious Holidays:** Any student absent for a religious holiday should make that intention known in writing to the instructor prior to the absence and will be permitted to make up missed exams in accordance with Texas Tech Operating Policy 34.19.

**Graduate Credit:** In accordance with University Operating Policy 34.11, assignments and tests for ECE 5391 will exceed the assignments for ECE 4391 quantitatively and qualitatively.

**Academic integrity:** It is the aim of the faculty Texas Tech to foster a spirit of complete honesty and a high standard of integrity. The attempt of students to present as their own any work that they have not honestly performed is regarded by the faculty and administration as a serious offense and renders the offenders liable to serious consequences, possibly suspension.

**Detailed Schedule:** “Topics and/or dates may be changed during the semester at the instructor’s discretion because of scheduling issues, developments in the discipline, or other contingencies.”

- **January 16, 2020:** Overview of the Class Content & Format, History of Power Systems, AC vs. DC.
- **January 21, 2020:** Power Systems, 3-Phase Power Systems, AC Generator Overview.
- **January 23, 2020:** MathCAD intro, RMS Value, Real, reactive, & apparent Power.
- **January 28, 2020:** Power Factor of Linear & Non-linear Loads, PF-Correction., Utility Rules
- **January 30, 2020:** 3-Phase Power, Y – Delta, 3-Phase Generation.
- **February 04, 2020:** Transformer Basics, 3-Phase Power advantages.
- **February 06, 2020:** 3-Phase Power Calculation, Y-D, coupled circuits, Transformer Construction.
- **February 11, 2020:** Transformer design, Transformer eq. circuit, BH-Curve, inrush current
- **February 13, 2020:** Intro to the per-unit system, Example for one line diagram with p.u. values
- **February 18, 2020:** Test 1, (tentative)
- **February 20, 2020:** Intro to Symmetrical Components, Visualization, Details, Examples.
- **February 25, 2020:** Detailed Examples of solving circuits with symmetrical components.
February 27, 2020: Intro to Transmission lines (TL). R & L Inductance calculations, Amp. law, GFI.

March 03, 2020: Inductance calculations for Transmission lines with mutual coupling, GMR.


March 10, 2020: Test 2 (tentative).

March 12, 2020: Comprehensive example for 765 kV TL. Work practices on TL.

March 14, 2020: Spring Break
March 22, 2020: Spring Break

March 24, 2020: Short, medium, long lines. Power transmission in DC & AC systems.

March 26, 2020: Stability of Power Transfer over long lines, Line Loadability. max. power trans.

April 02, 2020: Equivalent circuit for TL with Equivalent lumped param., voltage profiles.

April 07, 2020: Introduction to load flow and load flow modeling & visualization.

April 09, 2020: Derivation of detailed Theory of load flow analysis.


April 16, 2020: System operation, power flow control, modeling of large systems in Powerworld.

April 21, 2020: Transient phasor monitoring, Synchro-Phasor technology for system stability.

April 23, 2020: Introduction to system faults and system protection. Transient impedances. Assignment of take home test Test 3.

April 28, 2020: Detailed discussion of System faults, monitoring, modeling and example.

April 30, 2020: Introduction to Renewable Energy generation & potential, Examples

May 05, 2020: Excursion, visit Power System Installation.

May 11, 2020: Final Papers (constituting the Final Exam) due at 5:00 p.m.

May 15, 2020: Graduate Commencement

May 16, 2020: Undergraduate Commencement