

ECE 391 – Transmission Lines

Catalog Description: Transient and steady-state analysis of transmission line circuits with application to engineering problems.

Credits: 3 **Terms Offered:** Winter

Prerequisites: ENGR 203, MTH 254, MTH 256, ECE 322

Courses that require this as a prerequisite: ECE/PH 482, ECE/PH 483, ECE 484, ECE 485, ECE 593

Structure: Three 50-minute lectures per week.

Instructors: R. Traylor, A. Weisshaar

Course Content:

- Introduction to traveling waves, guided electromagnetic waves
- Wave propagation on infinite lossless line, wave equation, characteristic impedance, sinusoidal and non-sinusoidal waves
- Step waves and pulses on finite lossless line: reflection coefficient, single and multiple reflections, delay time, lattice diagram, Bergeron diagram
- Simulation and modeling of transmission line environments with SPICE analog simulator.
- Sinusoidal waves on infinite lossy line: general telegraphist's equations and Helmholtz equation, characteristic impedance, propagation constant, wavelength and electric length, general traveling wave solutions, phasor representation
- Sinusoidal waves on finite lossy line: reflection coefficient, voltage and current on line, standing waves, standing wave ratio, input impedance along line, quarter wave transformer
- Derivation and application of Smith Chart; impedance along terminated line, lines in tandem, stub matching designs, lossy lines

Measurable Student Learning Outcomes:

At the completion of the course, students will be able to...

1. **Identify** the characteristics of ideal transmission lines and transmission line circuits (ABET Outcomes: A, E, M, N)
2. **Analyze** lossless transmission line circuits with linear terminations (ABET Outcomes: A, E, K, M, N)
3. **Apply** the lattice diagrams to **determine** voltage step response of lossless transmission line circuits (ABET Outcomes: A, E, K, M, N)
4. **Determine** steady-state response of lossless and lossy transmission line circuits with different linear terminations (ABET Outcomes: A, E, M, N)
5. **Apply** the Smith chart to **analyze and design** transmission line matching circuits (ABET Outcomes: A, C, E, k, M)

Learning Resources:

- Umran S. Inan, Aziz S. Inan, *Engineering Electromagnetic*, ISBN 0-8053-4423-3, Prentice Hall, 1998 (required)
- Howard Johnson, Martin Graham, *High-Speed Digital Design: A Handbook of Black Magic*, ISBN 0-13-395724-1 (optional)
- Helpful links, notes, examples, and old tests posted online

Students with Disabilities:

Accommodations are collaborative efforts between students, faculty and Disability Access Services (DAS). Students with accommodations approved through DAS are responsible for contacting the faculty member in charge of the course prior to or during the first week of the term to discuss accommodations. Students who believe they are eligible for accommodations but who have not yet obtained approval through DAS should contact DAS immediately at 737-4098.

Link to Statement of Expectations for Student Conduct:

<http://oregonstate.edu/admin/stucon/achon.htm>

Revised: 7/24/09

Revised Prerequisites and Learning Resources: 2/15/11

Revised CLO Outcome Mappings: 9/15/14