

EE 382 Applied Electromagnetics

Lecture Notes

Keith W. Whites
Spring 2017



Laboratory for Applied Electromagnetics and Communications
Department of Electrical and Computer Engineering
South Dakota School of Mines and Technology

Course Notes:
EE 382 *Applied Electromagnetics*

Table of Contents

Lecture	Title
1	Magnetic circuits.
2	Faraday's law of induction. Lenz's law.
3	Faraday's law examples.
4	Faraday's law and moving circuits.
5	Displacement current and Ampère's law.
6	Maxwell's equations, boundary conditions.
7	Sinusoidal steady state, phasors.
8	Maxwell's equations and electrical circuits.
9	Ideal transformer.
10	Non-ideal behavior of physical circuit elements. Skin effect.
11	Transmission lines and distributed l and c .
12	Time domain solutions to TL wave equations.
13	TL termination, reflections. Current waves.
14	Bounce diagrams.
15	Pulse propagation on TLs.
16	Reactive terminations on TLs. Time domain reflectometry.
17	Sinusoidal steady state excitation of lossless TLs.
18	Termination of TLs. Load reflection coefficient.
19	Input impedance of TLs. Excitation and source conditions.
20	Generalized reflection coefficient. Crank diagram. VSWR.
21	Lossy TLs. Dispersionless TLs. Special cases for general TLs.
22	Smith chart.
23	TL matching. Quarter-wave transformers. Resistive pads.
24	Single-stub tuner I – Analytical solution.
25	Single-stub tuner II – Smith chart solution.
26	Uniform plane waves. Infinite current sheets.
27	Uniform plane waves in lossy materials. Skin depth.
28	Poynting's theorem. Power flow and plane waves.
29	Uniform plane waves normally incident on a lossless half space.
30	Example of a normally incident UPW on a lossless half space.
31	Electromagnetic radiation and antennas.
32	Hertzian dipole antenna.
33	Near and far fields of the Hertzian dipole antenna. Radiation resistance.
34	Antenna radiation patterns. Directivity and gain.
35	Antenna effective aperture. Friis equation.