INSTRUCTOR: Amir Borji, Room 211 (Ext. 4381, aborji@sharif.ir)

LECTURES SCHEDULE: Sat/Mon 7:30-9:00 in Alef 13

TUTORIALS SCHEDULE: Sat 12:00-13:30

CLASS WEBSITE: http://sharif.edu/~aborji/25762/

TEXT and REFERENCES:


In addition, the following books are strongly recommended:

4. Electromagnetic Waves and Antennas, by S. J. Orfanidis, an excellent online textbook at http://www.ece.rutgers.edu/~orfanidi/ewa, 2008, (Chapters: 1,2,3,5,6,7,9,10,12)

EVALUATION:

Mid-term exam: there will be two mid-term exams (40-50% total)
Final exam: 40-50%
Homeworks, quizzes, and attendance: 10-15%

Quizzes: There will be a short quiz at the end of each lecture

Attendance: If you are absent in 6 lectures, you fail the course with no exceptions. Students are not allowed in class 15 minutes after the lecture starts

“TENTATIVE” COURSE OUTLINE:

Introduction to Electromagnetic Waves and Their Applications

Maxwell’s Equations

◊ Maxwell’s equations, Faraday’s and Ampere’s law
◊ Phasor notation and Maxwell’s equations in frequency domain
◊ Constitutive relations and media parameters, lossy medium
◊ Boundary conditions
◊ Wave equation, simple electromagnetic wave
◊ Conservation of power and Poynting theorem
Lorentz gauge, retarded potentials, radiation field of a short dipole
(*) Relationship between field and circuit theory (KVL and KCL laws, inductors, capacitors, resistors)

Midterm exam 1: Wed 93/07/30

Transmission Lines

◊ Transmission line equations in time and frequency domain
◊ Transmission line equations from field theory, TEM waves
◊ Lossy transmission lines
◊ Voltages, currents, input impedance, reflection, transmission, characteristic impedance
◊ Impedance transformations, impedance matching, and Smith Chart
◊ Propagation of pulses on dispersionless transmission lines, zigzag diagrams
◊ Microstrip lines, coaxial lines, two wire lines: design equations
◊ Introduction to S-parameters, two-port microwave networks

Midterm exam 2: Wed 93/09/05

Plane Electromagnetic Waves

◊ Plane waves in unbounded medium
◊ Plane waves in lossy medium
◊ Polarization of plane waves
◊ Dispersion and wave velocities, pulse broadening
◊ What happens if \( \varepsilon \) and/or \( \mu \) is negative? Metamaterials and DNG
◊ Propagation in dispersive media, Drude model, Lorentz model
◊ Simple cases of propagation in a uniaxial medium, Faraday rotation

Reflection and Refraction of Plane Waves

◊ Normal incidence on conductors and dielectrics
◊ Oblique incidence on conductors and dielectrics
◊ Total reflection and critical angle, total transmission and Brewster angle
◊ Transmission line formalism, anti-reflection coating

Introduction to Waveguides

◊ Simplifying Maxwell’s equations for propagating modes in one direction
◊ General properties of electromagnetic modes: TEM waves, TM waves, TE waves
◊ Parallel plate waveguide: mode charts, losses, field distributions, dispersion relation
◊ Rectangular waveguide: mode charts, losses, field distributions, dispersion relation
◊ Circular waveguide: mode charts, losses, field distributions, dispersion relation
◊ (*) Dielectric waveguides: propagation in lossless dielectric slabs and optical fibers

(*) If time permits (*)