Listing of possible topics for final exam by chapter-

**Chapter 8 Magnetic Forces, Materials, and Devices**
- Magnetic Circuits

**Chapter 9 Maxwell’s Equations**
- Faraday’s Law- Lenz’s Law, transformer, motional/flux-cutting, & both emfs
- Ampere’s Law & Displacement current
- Boundary conditions- electric and magnetic w/ time-varying fields
- Maxwell’s equations for time-harmonic case, e.g., $\mathbf{E} \leftrightarrow \mathbf{H}$, loss tangent, …

**Chapter 10 Electromagnetic Wave Propagation**
- Calculate propagation constant $\gamma$, attenuation constant $\alpha$, phase constant $\beta$, wavelength $\lambda$, period $T$, intrinsic impedance $\eta$, phase velocity $u$, skin depth $\delta$, loss tangent $\sigma/\omega\epsilon$, …
- $\mathbf{E} \leftrightarrow \mathbf{H}$ for UPWs
- Poynting vector- both instantaneous and time-average
- Reflection/transmission of plane waves at normal incidence to planar material interfaces

**Chapter 11 Transmission Lines (frequency-domain lossy)**
- Calculate distributed transmission line parameters $R, L, G, & C$ (i.e., per-unit-length) for common transmission lines such as coaxial, twin-wire, and planar line
- Calculate propagation constant $\gamma$, attenuation constant $\alpha$, phase constant $\beta$, wavelength $\lambda$, period $T$, characteristic impedance $Z_0$, phase velocity $u$, … for general as well as lossless, low loss, & distortionless cases
- Make calculations for lossy transmission line circuits, e.g., phasor currents and voltages, power, reflection coefficients, VSWR (lossless case), …
Chapter 11 Transmission Lines (Smith charts for frequency-domain lossless case)

- Use Smith chart to find $z_{in}/Z_{in}$, $y_{in}/Y_{in}$, $\Gamma_{in}$, $\Gamma_L$, VSWR, $r_{max}$, $r_{min}$, ... for lossless transmission line circuits
- Use Smith chart to match loads to transmission lines using: quarterwave transformers, parallel discrete loads ($L$ or $C$), series discrete loads ($L$ or $C$), and single parallel short or open circuit stubs

Chapter 11 Transmission Lines (time-domain)

- Analyze lossless transmission line circuits with resistive source & load impedances with step or pulse inputs
- Be able to draw and use bounce diagrams, e.g., $V_{init}$, $I_{init}$, $\Gamma_g$, $\Gamma_L$, transit time $T$, ... to find current or voltage at fixed location versus time AND current or voltage at fixed time versus location.
- Be able to find steady-state current or voltage for circuits with step input
- Time-domain reflectometer problems, e.g., find $l$ & $Z_L$ and/or $u$ & $Z_0$

Chapter 13 Antennas

- Given electric &/or magnetic fields, find power density/Poynting vector and power radiated $P_{rad}$, radiation intensity $U$ as function of angle, average, & maximum, directivity/directive gain as function of angle & maximum, and gain AKA: (power gain) as function of angle & maximum.
- Radiation efficiency, half-power beamwidth, and effective area
- Friis transmission formula problems
- RADAR equation and/or RADAR range equation problems