332:345 – Exam-1 Review Topics – Fall 2009

- Concepts of linearity and time-invariance. Examples of nonlinear and non-time-invariant systems.
- Differential equation descriptions of linear systems and their solutions. Separation of solution into "homogeneous" plus "particular" solutions, or, into "zero-state" plus "zero-input" parts.
- Discretization schemes for simple first-order differential equations (forward/backward Euler, trapezoidal, zero-order-hold).
- Deriving the differential equation descriptions of simple circuits involving resistors, inductors, and capacitors. Use of voltage-divider method.
- Typical signals such as delta functions, unit-steps, rectangular and triangular pulses. Approximation of delta-functions by normal functions.
- Convolution. Derivation from linearity and time-invariance. Causal versus non-causal systems and signals.
- Convolving two signals of simple shapes, such as rectangular or triangular pulses,or exponential signals. Basic method is to set up two inequalities for the variables τ and $t-\tau$ appearing in the convolution formula $y(t) = \int h(t-\tau)f(\tau)d\tau$, and then finding the range of t and the precise limits of integration over τ.
- Discrete-time convolution by the convolution table method.
- Laplace transforms and their properties.
- Performing convolution via the Laplace transform.
- Inverse Laplace transforms.
- Second-order notch filters and their impulse response.
- Solving the differential equations of linear systems using Laplace transforms, including the case of arbitrary initial conditions.
- Solving for simple circuits using Laplace transforms. Transient responses from opening & closing switches, and AC responses.

Reading Materials:

All class material and Textbook chapters 1,2,4,6.

Practice Problems:

Textbook problems (assigned or not assigned) from above chapters.
Examples in text.
Sample exam problems (solutions are not available).
Matlab programming ideas in labs 1 & 2.