ENGR-325
Notes regarding the final exam

The final exam will be closed book, no on-line references, and no notes except one sheet of 8.5x11" paper on which you, personally, with pen or pencil have written by hand the notes you wish to have during the exam. No xeroxed or printed notes.

Topics we have studied and about which you should have knowledge:

- Basic circuits, i.e. ohms law and its application
- Voltage divider equation and its application   6.4, 6.5
- Loading error   Lab 1. 6.5
- Types of measurement errors   1.4, labs
- Uncertainty; Estimating precision uncertainty   5.1-5.7
- Propagation of uncertainty   5.8,labs, handout
- Amplifiers   6.6, handout
    - ideal op-amp and its characteristics
    - inverting and non-inverting op-amp application topologies
    - differential amplifier (instrumentation amplifier)
- Electrical noise coupling via currents in ground connections   Handout, lab 2, 6.9
- Data sampling & fourier analysis   7.1-7.5, lab 4
    - aliasing, what is it, how to avoid it
    - Nyquist sampling criteria; parameter(s) that determine frequency resolution, how to use the FFT (on the exam I don't expect you to hand calculate a Fourier Transform)
- Temperature sensors   8.1-8.5
    - RTD
    - Thermistor
    - Thermocouple   temperature reference, etc.
- 1st order response to step inputs   3.3
- 1st order response, steady state part, to sinusoidal excitation   3.3
- 2cd order response to step inputs   3.3
- 2cd order system response, steady state part, to sinusoidal excitation   3.3
- Measuring strain - strain gauges   11.1-11.6
    - Bridge circuits
    - Strain gauge placement on a structural member
        - considerations regarding temperature compensation
        - considerations regarding bending compensation
    - Assigning strain gauges to particular locations in the bridge circuit

- Sensing mechanisms
    variable resistor (voltage divider)
    variable inductance; for example, LVDT
    variable capacitance
    piezoelectric
    Hall-effect
- Anti-alias filters   6.8
    first order, higher order
    how to calculate the required filter order

While the exam will emphasize material about topics not covered on the midterm, it should be considered comprehensive in that knowledge from topics studied prior to the midterm will be required.

The exam has not yet been written, but I expect there could be questions about / or knowledge of:
- strain gauge placement; output from the bridge circuit for a certain strain, determining strain from voltage
- finding filter order required to achieve stated signal attenuation.
- A/D resolution
- correcting data from a transducer due to its first or second order response dynamics
- uncertainty determination and propagation (i.e. combining uncertainties)