

ELEC 5760/6760 Exam 1 Study Guide

I. Sensor and Fabrication Terminology

Know terms such as: transducer, measurand, sensor, actuator, SOI wafer and structure, Young's Modulus, MEMS, transmissibility, resistivity, bimorph, Wheatstone bridge, strain gauge, piezoresistor, stiction, types of damping, synchronous demodulation, 2-point/4-point resistance measurement, EC sensing, gauge factor (GF), TIA, microfabrication lab tour class presentation, etc... Fabrication techniques will NOT be covered!

II. Sensor Structures

- Find k (spring constant) from a structure design
- Find $T(s)$ from a plot of $|T(j\omega)|$
- Know how to relate: m , c , k , Q , ζ , ω_n , f_n , displacement to a force

III. Op Amp Circuit and Sensor Interface Circuit Analysis (homework problems)

IV. Sensing Methods

- Conductivity
- Resistance (temperature effects, strain gauge, piezoresistor)
- Electrical Conductivity in aqueous solutions
- Capacitance (calculating $C_{nom}/max/min$, interface circuits)

V. I will provide:

- Constants: π , ϵ_0
- Material properties (E , etc.)
- Equations for: Gauge Factor, Resistivity as $f(\text{Temp})$, Resistance as $f(\text{resistivity})$, Spring Constant, Ring Oscillator Frequency, Phase Delay, Laplace Transforms (if needed), etc.

VI. You need to know equations for:

- Ohms law
- Impedance of a capacitor
- Capacitance of a parallel plate capacitor
- $T(s)$ as a function of m , c , k , Q , ζ , ω_n
- Relation between Q and ζ , and between f and ω
- Unit conversions (pF to F, $\Omega\text{-cm}$ to $\Omega\text{-m}$, μm to m , etc...)
- Units for m , k , c

VII. Things to watch out for:

- Units on answers and in the units asked for
- Answer all parts of questions
- Show calculations and do NOT round values given in the problem!
- Convert parameters to a common unit before calculating the answer
- Give numerical answers, not symbolic like $3\pi/13$

VIII. Test Is Closed Book, Closed Notes, No Laptop/Notebook PC's