M E 325 - Review for Exam 1

The Design Process

What are the steps involved?
What is the distinction between **analysis** and **synthesis**?
Where are there possibilities for iteration?

Factor of Safety

What is a **factor of safety**?
What kinds of questions should an engineer ask about a factor of safety?
How should an engineer interpret a factor of safety
How do you compute a factor of safety?

Materials and Processing

ductility
brittleness
fracture toughness
impact resistance
hardness
even materials -- uneven materials

can you interpret a stress-strain diagram
- what is a **proportional limit**?
  - where is it on a stress-strain diagram?
- can you tell if a material is ductile or brittle?
- where is the **yield point**
- where is the **ultimate tensile strength** point
- where is the **fracture point**

what are **quenching, tempering and annealing**
- what properties do these processes impart?

Optimization

single variable
multivariable -- no constraints and with constraints
- can you set up the appropriate **Hessian Matrix**?
- what is **+ definite**? **- definite**? **semi-definite**? why would an engineer care?

Finite Elements

what is the **fundamental governing equation** for FEA
what goes on inside an FEA program --what kinds of equations does it solve?
how does the **Galerkin method** work?
what is a stiffness matrix?
can you assemble a **global stiffness matrix** from **elemental stiffness matrices**?
can you schematically represent **elements and nodes**
can you explain the role of **superposition** in FEA?

Stresses

can you determine **principal stresses** at any point in a body?
can you draw a **stress patch** and correctly indicated **applied stresses**?
what are principal stresses? why do engineers care about principal stresses and **principal directions**?

Exam Information:

7:00 - 9:00 p.m. - 171 Durham

Open notes, open book.

Advice: **Do not memorize** the problems--**learn** how to do them.
Take your time! If you have time left over, go back and check your work.

Ask questions; **do not assume that I won't answer your questions during an exam**. If I feel that you pushing the envelope into an area of inappropriateness, I will tell you so--politely.

Optimize your chances for a good performance

rest, nutrition, and a positive attitude will complement your studying.