ME 305 Fall 2014

Lab 1: Tension

Grading Rubric

**Introduction (10 points)**

* What is a tensile test? (4 points)
* What does a tensile test allow you to find? (4points)
* Why is a tensile test important? How is it relevant for engineer/scientists? (2 points)

**Theory (15 points)**

* ; ; with explanations (5 points)
* Engineering vs. true stress/strain – which one are we using? (2 points)
* Instron provides load and displacement data, but we need stress and strain data for stress vs. strain curve (5 points)
* What does a stress vs. strain curve do? What can you get from it? (3 points)

**Measurements (15 points)**

* *Equipment (3 points)*
  + Dogbone samples – 4 materials
  + Instron
  + Strain gauge
  + Caliper/ruler
  + Computer/data acquisition software
* *Procedure (12 points)*
  + Measure sample with calipers – width, thickness, and gauge length (2 points)
  + Zero position and align bottom grip (2 points)
  + Load sample in the grips (2 points)
  + Place strain gauge on the sample (2 points)
  + Calibrate load and strain (2 points)
  + Start test, end test after fracture, remove strain gauge and broken pieces, observe fracture edge, compare (2 points)

**Results and Analysis (25 points)**

* Table with all measurements of the samples (2 points)
* Stress vs. strain graph for each material (4 points each)
  + Full stress strain curve (1point)
  + Line fitting for elastic region, display slope (Young’s modulus, E) (1point)
  + Show 0.2% offset line (1 point)
  + Label young’s modulus and yield stress (1 point)
* Plot with all four stress vs. strain curves (4 points)
* Table with E, σy, and ultimate stress (σult) for all materials along with percent errors (3 points)

**Discussion and Conclusion**

* *Discussion (20 points)*
  + Question 1: Sources of error (8 points)
    - Strain gauge size
    - Alignment of grips/strain gauge
    - Deformations/cracks on sample
    - Measurements of dimensions
    - Sampling size/location for linear fit to find E

How to improve lab?

* + Question 2: Comparison between experimental and theoretical/accepted (4 points)
  + Question 3: Comparison between materials/fracture surfaces (8 points)
    - Ductility of each material
    - How can you tell if material is brittle/ductile?
      * Fracture surface
      * Sound made at fracture
      * Stress vs. strain curve – plastic region
    - What material(s) would be best for aerospace/mechanical applications?
* *Conclusion (5 points)*
  + Did the lab achieve its purpose?
  + What did you learn?
  + Key results of the lab?
  + Why is this experiment useful?