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)

- $\sigma = \frac{F}{A}$; $\varepsilon = \frac{\Delta L}{L}$; $\sigma = E\varepsilon$ 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, σ_y, and ultimate stress (σ_{ult}) 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?