



College of Engineering, University of Iowa
Department of Civil & Environmental Engineering
53:086 Civil Engineering Materials
Spring Semester, 2005

Homework Assignment #2

due: Tuesday, February 15, 2005

- 1) Briefly describe the role of the dislocations in plastic behavior. (13 pts)
- 2) Why is it that size effects often exist in plate steel, with thicker plates typically having lower strengths than thinner plates? (13 pts)
- 3) What physical differences would you expect to see in molten steel samples cooled from 1200°C to 20°C at rates of 25°C/hour, 1000°C/hour, and 40,000°C/hour? (13 pts). How would the mechanical properties differ with increasing cooling rate?
- 4) A steel pipe of length 1 m, outside diameter 0.2m, and wall thickness of 10 mm is subjected to an axial compression of 200 kN. (13 pts) Assuming $E = 200 \text{ Gpa}$ and $\nu = 0.30$, find:
 - a) The shortening of the pipe;
 - b) The increase in the outside diameter; and
 - c) The increase in wall thickness.
- 5) In as much detail as you can find, but no more than a paragraph for each, explain the significant differences between the following ASTM grades of structural steels in terms of their alloying compositions, heat treatments, etc. (48 pts)
 - A 242
 - A 514
 - A 572
 - A 573
 - A 588
 - A 633
 - A 678
 - A 852