ARCH 614. Assignment #4

Date: 2/12/13, *due 2/19/13* *Pass-fail work*

Problems: from Ambrose & Tripeny, Appendix A & Chapter 3, pgs 654, 662, and 123.
*Note: Problems marked with a * have been altered with respect to the problem stated in the text.*

(25%) ***Problem A.1.D.**** **USE METRIC UNITS.** Find the location of the centroid for the cross-sectional area shown in Figure A.3*d*. Use the reference axes indicated and compute the distances from the axes to the centroid, designated as c_x and c_y, as shown in Figure A.3*b*. *Also compute the moment of inertia about the centroid axes. (cross section properties)*

Partial answers to check with: $\hat{x} = 32.2$ mm, $\hat{y} = 85.2$ mm,
$I_x = 24.7 \times 10^6$ mm^4, $I_y = 4.3 \times 10^6$ mm^4.

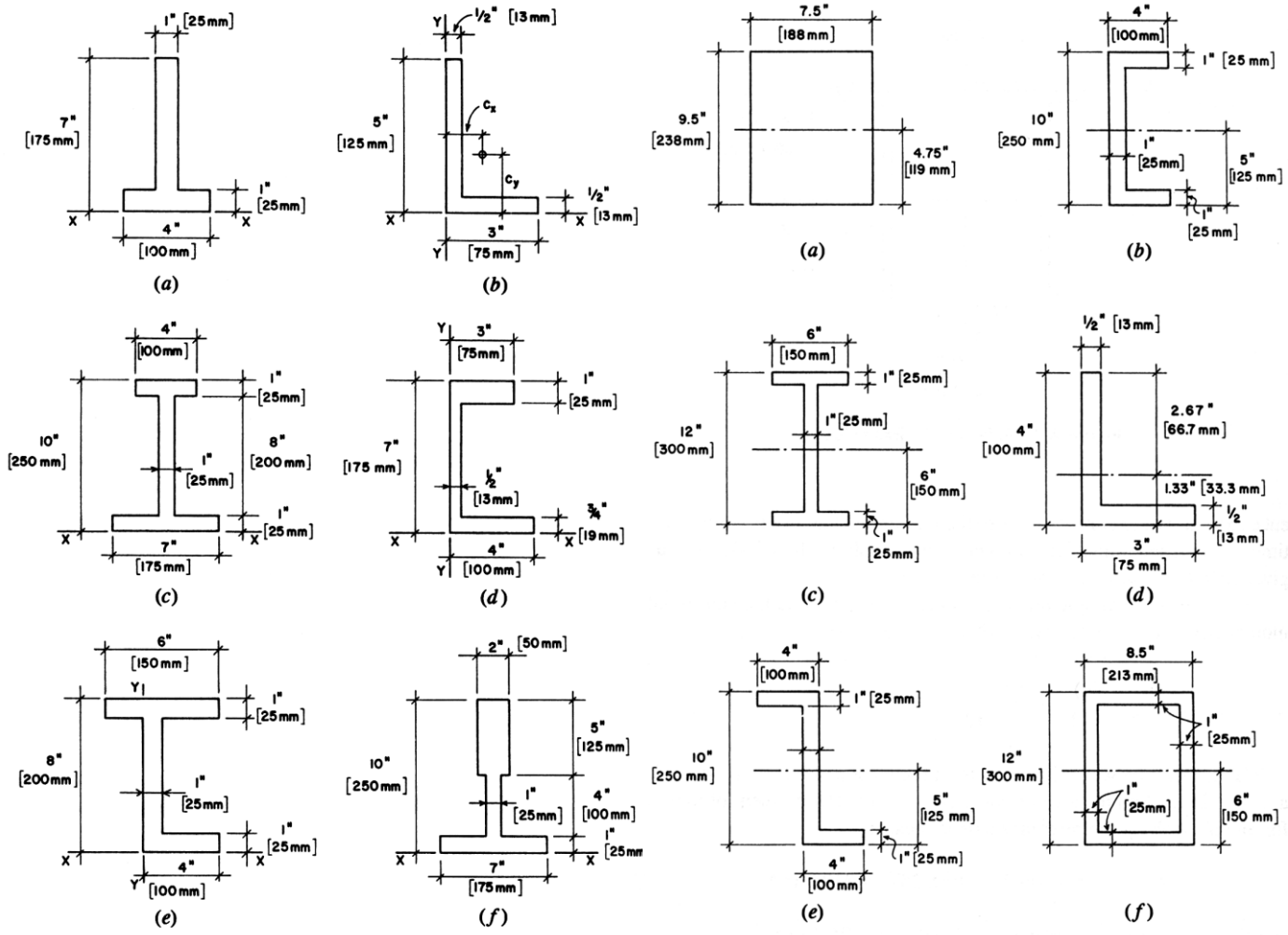

Figure A.3 Reference for Problem A.1.

Figure A.9 Reference for Problem A.3, part 1

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(10%) ***Problem A.3.G****. **USE US UNITS.** Compute the moments of inertia with respect to the centroidal X-X axes for the built-up sections in Figure A.10*g*. Make use of any appropriate data from the tables of properties for steel shapes. *Note: the plate at the bottom is the same as the top, and the W section is not in table A.3. Use a W 10 x 33. (cross section properties)*

Partial answers to check with: $I_x = 431.8\ in^4$.
Note: The centroid location is obvious

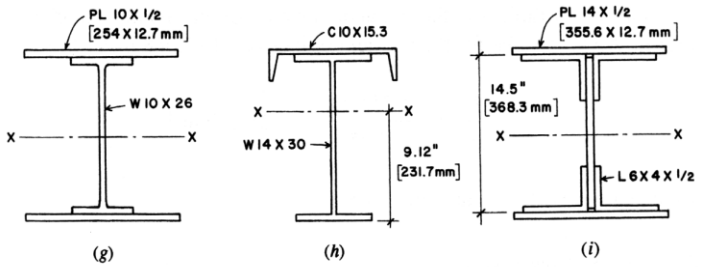

Figure A.10 Reference for Problem A.3, G-I.

(25%) ***Problem 3.7.A****. **USE US UNITS.** A beam has an I-shaped cross section with an overall depth of 16 in. [400 mm], a web thickness of 2 in. [50 mm], and flanges that are 8 in. wide [200 mm] and 3 in. [75 mm] thick. Compute the critical *bending and* shear stresses ~~and plot the distribution of shear stress on the cross section~~ if the beam sustains *a bending moment of 175 k-ft [237.3 kN-m] and* a shear force of 20 kips [89 kN]. *(bending and shear stresses)*

Partial answers to check with: $f_b = 7.53\ ksi$, $I_x = 2230.7\ in^4$, $Q_{max} = 181\ in^3$.
Note: The centroid location is obvious, and the negative area method is quicker for finding I_x.

(40%) ***Problem 3.7.B****. **USE METRIC UNITS.** A T-shaped beam cross section has an overall depth of 18 in. [450 mm], a web thickness of 4 in. [100 mm], a flange width of 8 in. [200 mm] and a flange thickness of 3 in. [75 mm]. Compute the critical *bending and* shear stresses ~~and plot the distribution of shear stress on the cross section~~ if the beam sustains *a bending moment of 300 k-ft [406.8 kN-m] and* a shear force of 12 kips [53.4 kN]. *And if there is one connector for the T joint to the stem with a capacity of 6.5 kN, determine the maximum required pitch spacing. (bending and shear stresses, and shear connectors)*

Partial answers to check with: $\bar{y} = 251.8\ mm$, $I_x = 988.0 \times 10^6\ mm^4$, $f_b = 103.6\ MPa$
$f_v = 1.7\ MPa$, $p = 49.9\ mm$.