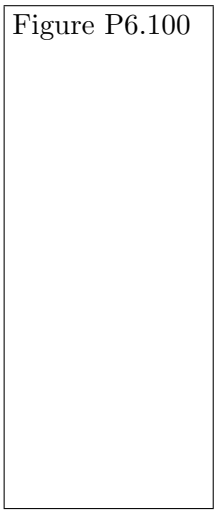
ME 212, Engineering Mechanics: Statics Final Exam, Fall 2004

1. *Read each problem carefully and make sure you answering the question that is being asked.*

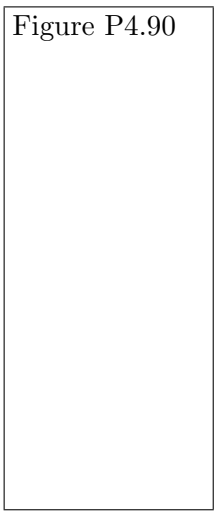
Closed book, closed notes. Use one $8\frac{1}{2} \times 11$ formula sheet, front and back. Test books will be provided. Do all work on the exam pages with the exception of the full length problems.

Problems are 20 points each.

1. For the frame and loading shown, determine the components of the forces acting on member ABC at B and C.



2. A 10 kg slender rod of length L is attached to collars which can slide freely along the guides shown. Knowing that the rod is in equilibrium and the $\beta = 25°$, determine a) the angle θ that the rod is in equilibrium and b) the reactions at A and B.



3. For the beam and loading shown, draw the shear and bending moment diagrams, and determine the maximum absolute values of the shear and bending moments. Use either method (or both to check!). Circle your final answers.

$$\frac{dV}{dx} = -w, \qquad V_2 - V_1 = -\int_{x_1}^{x_2} w(x)dx$$

$$\frac{dM}{dx} = V, \qquad M_2 - M_1 = -\int_{x_1}^{x_2} V(x)dx$$

Figure P7.148

4. For the area shown below:

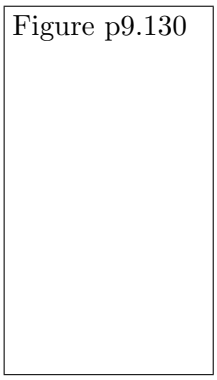
   (a) Determine the location of the centroid of the region

   (b) Determine I_{xx} and I_{yy} for the region about axes *through the point O*

   (c) Determine $I_{x'x'}$ and $I_{y'y'}$ for the region about axes through the *centroid of the region*

Figure P9.48

5. Shown is the cross section of an idler roller. Determine its moment of inertia and radius of gyration with respect to the axis AA'. The density of bronze is 8580 kg/m^2; of aluminum, 2770 kg/m^2; and of neoprene, 1250 kg/m^2.



Extra Credit (5%): Find the principle axes for an area with $I_{xx} = 2$, $I_{xy} = 1$, and $I_{yy} = 2$. Write them as $\hat{\lambda}$ vectors.