The Final Exam must be done on engineering paper and/or solved on this Final Exam using a pencil.

Please turn in the Final Exam to me, in person, by 8 PM on 4 May 2017 in the Fluids Laboratory or to Ms. Chenhua Yang in the Architectural Office (Torrence Hall 2nd Floor) by 4 PM on 4 May 2017. Please feel free to e-mail me to set up a time (after 4 PM) to obtain the Final Exam from you in person.

Please remember to show your work and assumptions for all problems.

Name:

Solve the following problems:

1) Determine the stiffness matrix $K$ for the truss. Take $A = 0.75 \, \text{in}^2$, $E = 29(10^3) \, \text{ksi}$. (Hibbeler 572)

2) Determine the horizontal displacement of joint 1 and the force in member 2. Take $A = 0.75 \, \text{in}^2$, $E = 29(10^3) \, \text{ksi}$. (Hibbeler 572)

Use the figure below to solve problems 1) and 2).
3) Determine the vertical displacement of joint A. The cross-sectional area of each member is indicated in the figure. Assume the members are pin connected at their end points. \( E = 29(10)^3 \) ksi. Use the method of virtual work. (Hibbeler 363)

4) Solve Problem 3) using Castigliano’s theorem. (Hibbeler 363)

Use the figure below to solve problems 3) and 4).

5) Determine (approximately) the force in only members \( EB \) and \( DC \) of the truss. Assume the diagonals can support either a tensile or compressive force. (Hibbeler 268)

6) Solve Problem 5 assuming that the diagonals cannot support a compressive force. (Hibbeler 268)

Use the figure below to solve problems 5) and 6).
7) Draw the influence line for (a) the moment at B, (b) the shear at C, and (c) the vertical reaction at B. Solve this problem using the basic method of Sec. 6-1. Hint: The support at A resists only a horizontal force and a bending moment. (Hibbeler 225)
8) The cable supports the loading shown. Determine the magnitude of the horizontal force $P$ so that $x_B = 6$ ft. (Hibbeler 190)

![Diagram of a cable system with a horizontal force $P$ and a load of 30 lb at point C.]

9) Determine the internal normal force, shear force, and bending moment at point D. Assume the reactions at the supports A and B are vertical. (Hibbeler 147)

![Diagram of a beam with a distributed load of 1.5 kN/m and a concentrated load of 0.5 kN/m at point D.]

![Diagram of a beam with a distributed load of 1.5 kN/m and a concentrated load of 0.5 kN/m at point D.]
10) Determine the equation of the deflection curve for a simply supported beam loaded by a couple $M_1$ at its left end, as shown in the figure below. (Nash 229-230)

11) Assume that the beam of Problem 10) is made of steel for which $E = 30 \times 10^6$ lb/in$^2$ and has a rectangular cross section, 2 in by 3 in. Its length is 8 feet. Determine the location of the point of maximum deflection and the amount of this deflection when the applied moment $M_1 = 90,000$ lb-in. (Nash 230)

Use the figure below to solve problems 10) and 11).

12) For the beam and loading shown below, determine the reaction at each support. (Olia 201)
13) For the figure shown below, determine the tension in cable $BC$ and the reaction at $A$ (neglect the weight of the beam). (Olia 201)

14) Determine the force in member $BD$ of the structure shown below. Also determine the components of reaction at point $C$. (Olia 201)

Use the figure below to solve problems 13) and 14).

15) Determine the components of all forces acting on member $AC$ of the frame shown. (Olia 206-207)
EXTRA CREDIT

1) Determine the stiffness matrix $K$ for the truss. Take $A = 0.75 \text{ in}^2$, $E = 29(10^3) \text{ ksi}$.

Solve using a numerical computation application (see http://www.ecoccs.com/tsuteach.html#computapps) OR a structural analysis application (see http://www.ecoccs.com/tsuteach.html#cven3410_res) [Hibbeler 572]

2) Determine the horizontal displacement of joint 1 and the force in member 2. Take $A = 0.75 \text{ in}^2$, $E = 29(10^3) \text{ ksi}$.

Solve using a numerical computation application (see http://www.ecoccs.com/tsuteach.html#computapps) OR a structural analysis application (see http://www.ecoccs.com/tsuteach.html#cven3410_res) [Hibbeler 572]

Use the figure below to solve problems 1) and 2).

![Truss Diagram]

Works Cited

