INSTRUCTIONS

Read these instructions and the questions carefully before answering.

Assume all figures shown are accurate to 3 significant figures.

This final exam is open-book and open-notes.

It is due in the mailbox outside my office at 5:00 PM Thursday 7 Dec 2000.

Each problem is graded equally.

You may not collaborate in any way with anyone else.

Grading and presentation guidelines are the same as on homework: 4 points for the correct answer, 4 points for documenting your solution, and 2 points for style. Regarding proper documentation, show your work and include a sample of any repetitive calculation. Regarding style, use engineering computation pad for hand-written calculations, white copy paper for computer calculations. Write neatly, and either underline or box your answers. Show the appropriate number of significant figures in final answers. Write your name, the date, page number, and title on each page, and staple the pages together.

I will be available by email or telephone throughout the week to clarify any ambiguities in the problem statements.
PROBLEM 1: THE TRUSS PROBLEM

GIVEN
The plane truss shown is symmetric about the line BK.

REQUIRED
The force in member IL. (Hint: use section a-a.)
PROBLEM 2: THE SAFETY DEVICE

GIVEN, REQUIRED
A safety device used by workers climbing ladders fixed to high structures consists of a rail attached to the ladder and a sleeve that can slide on the flange of the rail. A chain connects the worker’s belt to the end of an eccentric cam that can rotate about an axle attached to the sleeve at C. Determine the smallest allowable common value of the coefficient of static friction between the flange of the rail, the pins at A and B, and the eccentric cam if the sleeve is not to slide down when the chain is pulled vertically downward.
**PROBLEM 3: THE CABLE PROBLEM**

**GIVEN**

The total mass of cable AC is 25 kg. Assume the mass of the cable is distributed uniformly along the horizontal. (If the dimensions in the figure are not clear, from top to bottom they are 2.5m, 2.5m, 3m, 450kg, and 5m.)

The diagram shows a cable with points A, B, and C, with dimensions and masses indicated.

**REQUIRED**

The sag $h$ and the slope of the cable at $A$. 
**PROBLEM 4: THE QUICK-ACTING GATE**

**GIVEN, REQUIRED**

The quick-acting gate $AB$ is 0.7m wide, and is held in its closed position by a vertical cable and by hinges located along its top edge $B$. For a depth of water $d = 1.8m$, determine the minimum tension required in cable $AC$ to prevent the gate from opening.
**PROBLEM 5: THE FRAME**

**GIVEN**

![Beam Diagram](image)

**REQUIRED**

Draw the internal shear and internal couple diagrams for the beam AB (i.e., for that portion of the frame).