

Solid and Structural Mechanics

August 2007

Exam Number: -----

Department of Mechanical Engineering

Michigan State University

Solid and Structural Mechanics
Ph.D. Qualifying Examination

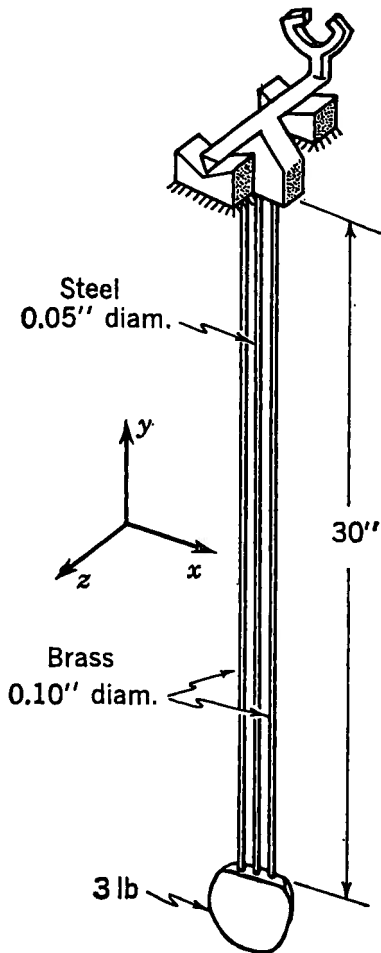
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Closed Book and Notes
All Questions are weighted equally.

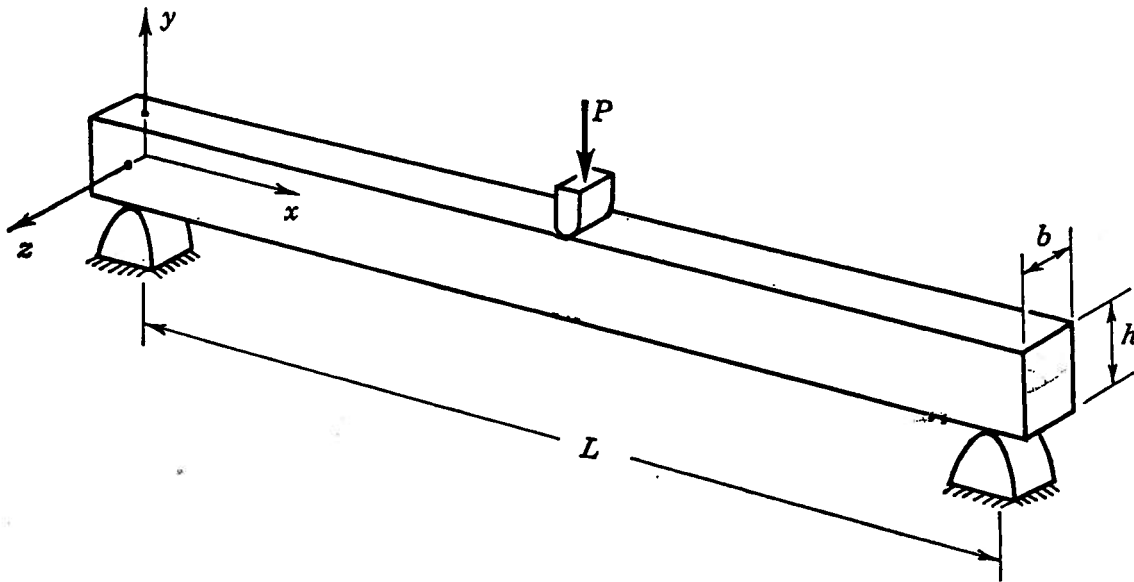
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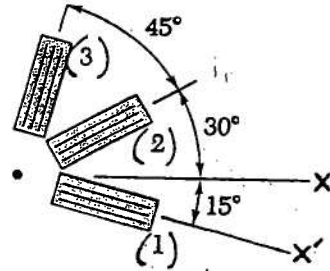
1. Shown in the figure is a pendulum of a clock which has a 3-lb weight suspended by three rods of 30-in. length. Two of the rods are made of brass ($E_B = 15 \times 10^6$ psi) and the third is steel ($E_S = 30 \times 10^6$ psi). Determine the following: (a) How much of the 3-lb suspended weight is carried by each rod. (b) The deflection of each rod.



2. A rectangular beam is carried on simple supports and subjected to a central load. Determine the ratio of maximum bending stress $(\sigma_x)_{\max}$ to the maximum shear stress $(\tau_{xy})_{\max}$.



The following strains have been determined by the strain rosette shown below. Use Mohr's circle to find the principal strains and the maximum in-plane shear strain, and their associated directions. $\epsilon(1) = 480 \times 10^{-6}$ $\epsilon(2) = -120 \times 10^{-6}$ $\epsilon(3) = 80 \times 10^{-6}$



For the beam and loading shown in the following diagram, determine the reaction at the roller support. No formula is provided. You must derive all the necessary formulae yourself and show them on your answer sheet.

