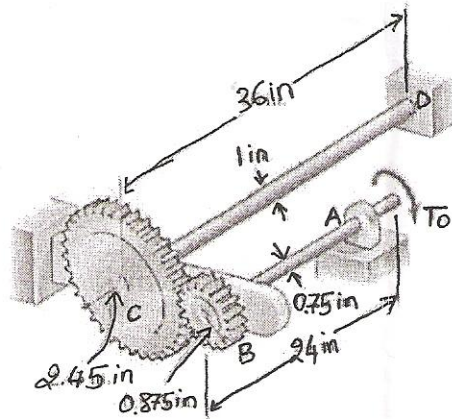


Mechanics of materials (MECH320)-QUIZ II (1h30)-Summer 2011

Instructor: Dr. Nassereddine M

Problem 1. (35 pts) Two solid steel shafts are connected by the gears shown. Knowing that for each shaft $G = 11.2 \times 10^6$ psi and that the allowable shearing stress is 8 ksi, determine a) the largest torque T_0 that may be applied to end A of shaft AB. (b) the corresponding angle through which end A of shaft AB rotates.

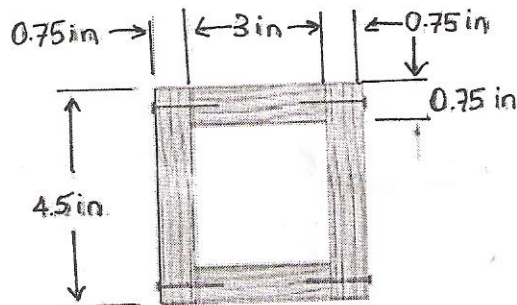


Formulas:

$$r_b \phi_b = r_c \phi_c$$

$$\phi = \frac{TL}{JG} \quad \tau = \frac{rC}{J}$$

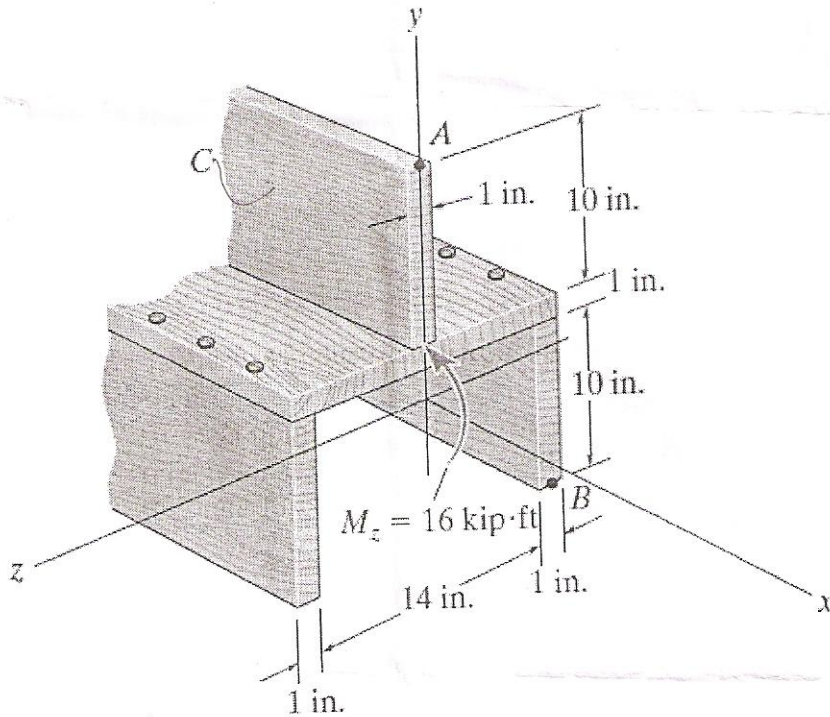
Problem 2 (30 pts). A square box beam is made of two 0.75×3 in planks and two 0.75×4.5 in planks, nailed together as shown in the figure below. Knowing that the spacing between nails is 1.75 in. and that the beam is subjected to a vertical shear of magnitude $V = 600$ lb, determine the shearing force in each nail.



$$= 37.69230769$$

Problem 3 (35 pts). The beam is constructed from four boards as shown. If it is subjected to a moment of $16 \text{ kip}\cdot\text{ft}$, then:

- Determine the stress at points A and B .
- Sketch a three-dimensional view of the stress distribution.
- Determine the resultant force the stress produces on the top board C .



$1 \text{ in} = 12 \text{ ft}$ $1 \text{ ft} = 12 \text{ in}$

Formulas: $I = \frac{1}{12} a^4$ for a rectangular square of side a about a centroidal axis

$$I = \Sigma \bar{I} + Ad^2$$

$$q = \frac{VQ}{I}$$

$$\bar{y} = \frac{\Sigma \bar{y}A}{\Sigma A}$$

$$Q = A'\bar{y}$$

$$\sigma = \frac{My}{I}$$

Good luck
infinite