1. An L-shaped beam \( \text{RST} \) shown below has a diameter \( d \) of 2” and is parallel to x-y plane. If the beam is fixed at \( R \) and loaded with a force \( P = 100 \text{ lbs} \) parallel to z-axis at \( T \). Find the stresses (in terms of \( \pi \)) at points A and B on the cross-section 10” from the fixed end.

\[
\sigma = \frac{My}{I} \quad \tau = \frac{VQ}{Ib} \quad \tau = \frac{Tr}{J} \\
I = \pi r^4/4 \quad J = \pi r^4/2 \quad Q = 1^{st} \text{ moment of area}
\]

Stress element for point A on xz plane  \hspace{2cm} Stress element for point B on xy plane
2. The critical load to cause buckling in a column can be calculated based on \( P_c = \frac{\pi^2 E I}{(kL)^2} \) where \( E \) is Young’s modulus, \( I \) is the second moment of area, \( L \) is the effective length of the column while \( k \) is a constant depending on the boundary condition. Given below is a summary of \( k \) values under various boundary conditions.

\[
\begin{align*}
  k &= 2 \text{ for columns with one end free and the other fixed} \\
  k &= 1 \text{ for columns with both ends simply-supported} \\
  k &= 0.7 \text{ for columns with one end simply-supported and the other fixed} \\
  k &= 0.5 \text{ for columns with both ends fixed}
\end{align*}
\]

Find the critical buckling load for the following column which is made of a material with \( E = 10^7 \) psi and effective dimensions \( L = 10" \), \( H = 3" \) and \( W = 6" \). Both the top and the bottom ends are pin-clamped as shown in the diagram.
3. The strains determined by the use of the rosette shown during the test of a machine element are $\varepsilon_1 = +600 \mu$, $\varepsilon_2 = +450 \mu$, and $\varepsilon_3 = -75 \mu$.

- Determine the in-plane principal strains: $\varepsilon_x$, $\varepsilon_y$, and $\gamma_{xy}$.

- Determine the in-plane maximum shearing strain.
4. For the beam shown, determine the reaction at the roller support when $w_o=65$ kN/m.