1. Two rigid bars AB and BC of negligible weight are attached to a rotational spring of constant $K$ at point B. The rotational spring obeys the Hooke’s law, $M = K\theta$, where $M$ is an applying moment and $\theta$ the deformed angle. The spring is undeformed when the bars are horizontal. Two equal and opposite, horizontal forces $P$ and $-P$ are applied at both ends A and C. Determine the range of the magnitude $P$ for which the equilibrium of the system is stable in the position shown.

![Diagram 1](image1)

(16 %)

2. The structure shown is composed of eight two-force members of equal length $\ell$ and a rigid frame BCD of length $2\ell$. All members in the structure are pin-connected together and their weights are ignored. If the structure is subjected to a vertical downward force $P$ at joint G, determine the axial force in member CG.

![Diagram 2](image2)

(16 %)
3. The 0.6-kg circular disk and attached shaft rotate at a constant speed of 10,000 rev/min. If the center of mass of the disk is 0.05 mm off center, determine the magnitudes of the horizontal forces A and B supported by the bearings.

\[
\text{(17 \%)}
\]

4. The 10-kg rod AB shown in the figure is confined so that its ends move in the horizontal and vertical slots. The spring has a stiffness of \( k = 800 \text{ N/m} \) and is unstretched when \( \theta = 0^\circ \). Determine the angular velocity of AB when \( \theta = 0^\circ \), if AB is released from rest when \( \theta = 30^\circ \). Neglect the mass of the slider blocks.

\[
\text{(17 \%)}
\]
5. The hoop is cast on the rough surface such that it has an angular velocity $\omega = 4 \text{ rad/s}$ and an angular deceleration $\alpha = 5 \text{ rad/s}^2$. Also, its center has a velocity of $v_0 = 5 \text{ m/s}$ and a deceleration $a_O = 2 \text{ m/s}^2$. Determine the acceleration of point $B$ at this instant.

\[ \text{ (17\%)} \]

\[ \omega = 4 \text{ rad/s} \]
\[ a_O = 2 \text{ m/s}^2 \]
\[ \alpha = 5 \text{ rad/s}^2 \]

6. A small particle of mass $m$ is attached to two highly tensioned wires of length $d$ and negligible mass each in the horizontal direction; hence, the particle is located between the two wires. Determine the system natural frequency for small vertical oscillations if the tension $T$ in both wires is assumed to be constant.

\[ \text{ (17\%)} \]