UNIVERSITY OF ARKANSAS

Ph.D. Qualifying Exam – Statics, Dynamics, & Vibrations (Fall 2010)

Closed books & closed notes

(Time: 2 hours)

Name:_____

ID #:_____

1. Determine the axial forces F_{AB}, F_{BC}, and F_{FG} in members *AB*, *BC*, and *FG* of the compound truss as shown in Fig. 1. Use *T* or *C* to indicate whether each of these forces is a *tensile* force or *compressive* force.

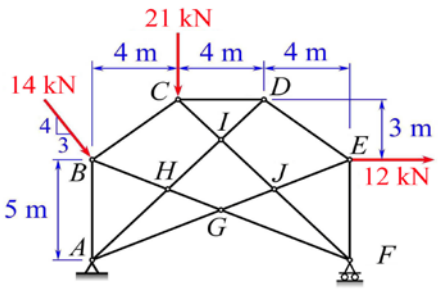

Fig. 1

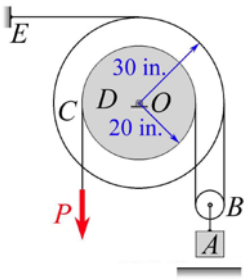

Fig. 2

2. Two drums *C* and *D* are rigidly fastened together and are free to rotate about the bearing at *O* as shown in Fig. 2. The coefficient of static friction μ_s is 0.12 between the belt and all surfaces of the drums. Determine the minimum magnitude $P_{\min}$ of the applied force **P** required to prevent the 80-lb block *A* from falling down to the ground.

3. A section of pipe weighing 48.3 lb rolls without slipping with angular velocity $\boldsymbol{\omega}_1$ before falling into a 14-in. gap (a pot hole) as shown in Fig. 3. If impact at the gap is perfectly plastic and the pipe rolls with $\boldsymbol{\omega}_2$ = 4 rad/s ↻ after having climbed up the gap to the other side, determine its angular velocities (*a*) $\boldsymbol{\omega}''$ just after impact, (*b*) $\boldsymbol{\omega}'$ just before impact, (*c*) $\boldsymbol{\omega}_1$.

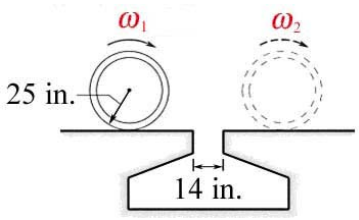

Fig. 3

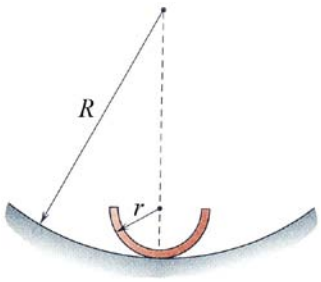

Fig. 4

4. A section of thin semicircular shell of mass *m* and mean radius *r* rests at the bottom of a cylindrical surface of radius *R* as shown in Fig. 4. If the shell rocks without slipping on the surface, determine its frequency of small-amplitude vibration.