IV.3
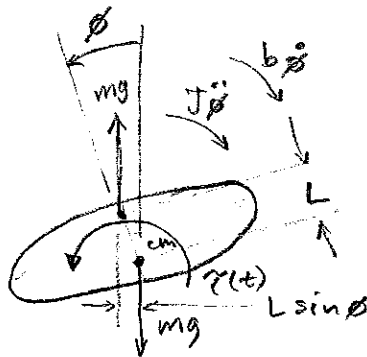
(a)

F.B.D.

$$\Sigma M^*_{cm} = 0 : \boxed{J\ddot{\phi} + b\dot{\phi} + mgL \sin\phi = \tau(t)}$$

(b) $\dot{\phi} = \Omega \longrightarrow J\dot{\Omega} + b\Omega + mgL\sin\phi = \tau(t)$

$$\boxed{\begin{array}{l} \dot{\Omega} = -\dfrac{b}{J}\Omega - \dfrac{mgL}{J}\sin\phi + \dfrac{1}{J}\tau(t) \\[2mm] \dot{\phi} = \Omega \end{array}}$$