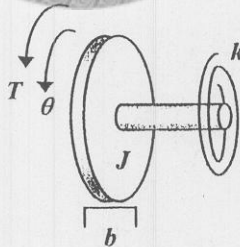
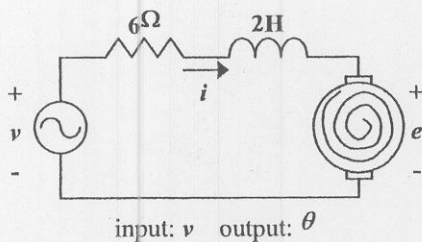


※ 注意：請於答案卷上標明題號，並依序作答。

- 簡答題(請先回答下列敘述正確與否，再加以簡要說明。僅回答正確與否，但未加以說明者，不予給分) (20%)
 - For a dynamical system, there exists one transfer function model, but many state variable models.
 - For a Type-I system $G(s)$, the poles of $G(s)$ all lie in the left-half-plane (LHP).
 - By Nyquist criterion, a closed-loop system is stable if the encirclement of origin for the Nyquist plot of the open-loop transfer function $G(s)$ is zero.
 - A lead compensator with a gain of k can always enlarge the bandwidth of the unity-feedback closed-loop system.
- 試比較 Open-loop control 及 Closed-loop control 之優點(至少 3 點)及缺點(至少 2 點)，並說明二者之使用時機。(10%)
- 請求出下列直流馬達系統之 Dynamic equations 及其 Transfer function。(10%)
 - 依據(a)所求出之模式，並請化簡為 2 階系統後，求得其 Rise-time、Overshoot 及 Settling-time。(10%)



motor parameters:

$$G_{emf} = 3(\text{v} \cdot \text{sec})$$

$$C_{torque} = 4(\text{NT} \cdot \text{m/A})$$

$$J_{inertia} = 2(\text{NT} \cdot \text{m} \cdot \text{sec}^2)$$

$$b_{friction} = 2.8(\text{NT} \cdot \text{m} \cdot \text{sec})$$

$$k_{spring} = 8(\text{NT} \cdot \text{m})$$

- 請分別就 P, I, D 各項說明 PID Control 之控制器設計原則。(10%)
 - 請說明 Integrator-windup 現象發生之原因及解決之方法。(10%)

5. 依據如下之兩組 Bode Plot，

- (a) 請求出 Open-loop transfer functions $G_1(s)$ ，並加以說明。(10%)
- (b) 假設 $G_1(s)$ 以 k_1 為 feedback gain，請以 Root Locus 方法求出 k_1 滿足 closed-loop system 為穩定之範圍。(10%)
- (c) 同(b)，請畫出 Nyquist Plot，並以 Nyquist 方法求出 k_1 滿足 closed-loop system 為穩定之範圍。(10%) (※ 注意：請作答於答案卷上)

