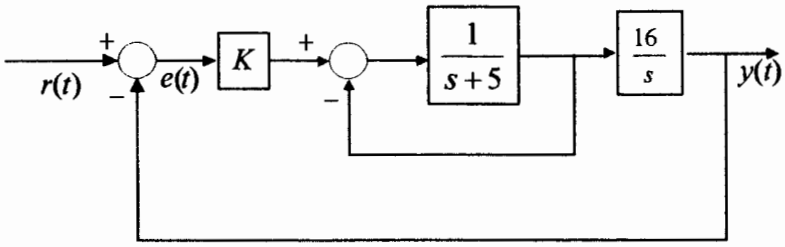
※ 考生請注意：本試題不可使用計算機

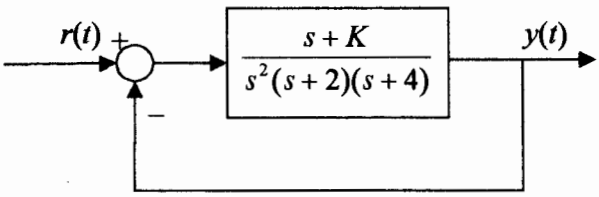
1. 一控制系統之方塊圖如下。

(a). 試決定會使得閉迴路控制系統之 damping ratio 為 $\frac{\sqrt{2}}{2}$ 之 K 值。 (10%)

(b). 假設輸入 $r(t)=(2t+6)$ for $t\geq 0$ ；定義系統誤差為 $e(t)=r(t)-y(t)$ 。 求系統之穩態誤差，即 $\lim_{t\to\infty} e(t)$ (10%)



2. 一控制系統之方塊圖如下。試決定會使得閉迴路控制系統為穩定之 K 值範圍。



(10%)

3. 若描述一系統之微分方程式為

$\frac{dy^3(t)}{dt^3}+7\frac{dy^2(t)}{dt^2}+14\frac{dy(t)}{dt}+8y(t)=r(t)$，其中 $y(t)$ 為輸出，$r(t)$ 為輸入，並假設系統初始條件為 0。

(a). 求該系統之 transfer function。 (6%)

(b). 將之表示為狀態空間表示法之 controllable canonical form。 (7%)

(c). 將之表示為狀態空間表示法之 observable canonical form。 (7%)

(背面仍有題目,請繼續作答)

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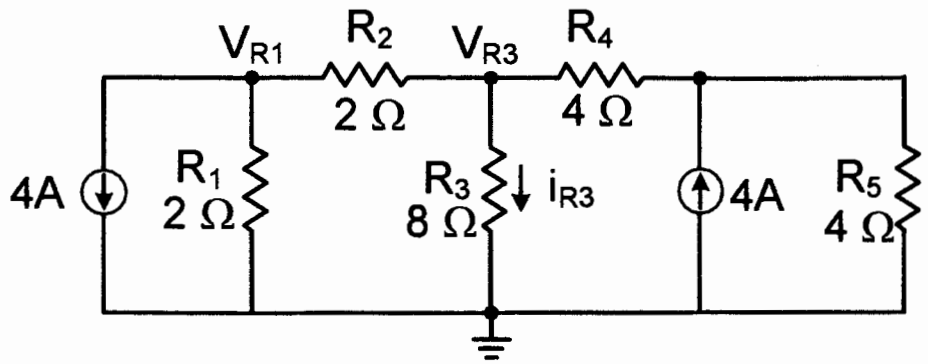
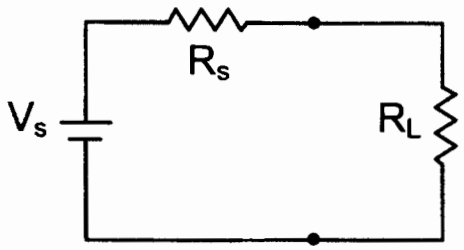
4. (a) What is the principle difference between a synchronous machine and an induction machine? (5%)

   (b) What components compose the excitation current of a transformer? How are they modeled in the transformer's equivalent circuit? (10%)

5. Please compute V_{R1}, V_{R3}, and i_{R3} shown in the following circuit. (15%)



6. The following circuit shows that a non-ideal power source provides power to load R_L. Please prove the Theorem: When load R_L equals to R_s the V_s will provide the maximum power to load R_L. (10%)



7. A voltage Vc shown in the following figure applies to an 8nF capacitor. Please determine the current flowing through capacitor ic. (10%)