

※ 考生請注意：本試題不可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. Short answer questions: [35]

- a. Please describe the reasons why the core in AC motor is constructed with lamination type. [5%]
- b. Please draw the equivalent circuit model of transformer. [5%] Please also explain the meaning of each component. [5%]
- c. Please describe the differences between the real power and apparent. [5%] Please also express the definition and meanings of power factor. [5%]
- d. Please describe the reasons why capacitor can't be applied with the abrupt voltage change condition. [5%]
- e. Please describe the reasons why inductor can't be applied with the abrupt current change condition. [5%]

2. The circuit shown in Figure 1 with the parameters: $V_s=100 \sin(40t+30^\circ) \text{ V}$, $C=0.002 \text{ F}$, $L=10 \text{ mH}$, $R=10 \Omega$. When this circuit is operated at steady state condition, please calculate : a) The average current flows through capacitor C. [5%] b. The average voltage on the inductor L. [5%] c. The average current on resistor R. [5%]

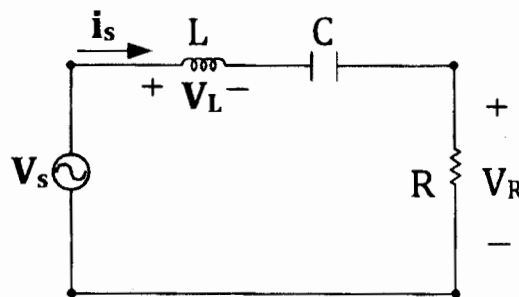


Figure 1

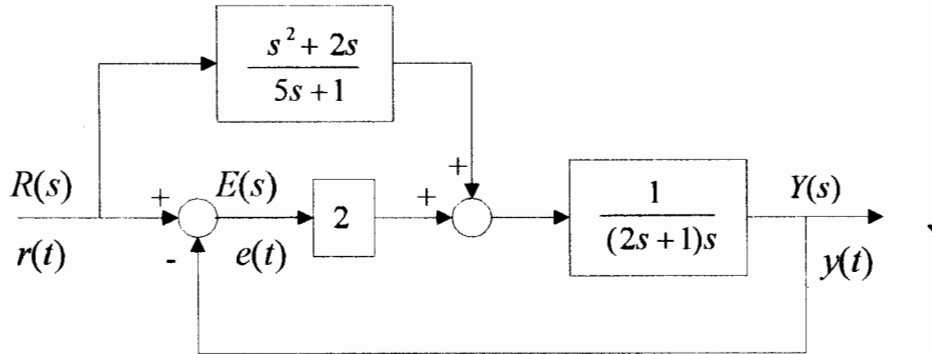
3. 一系統之狀態空間表示式如下：

$$\frac{dx(t)}{dt} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -1 & -2 & -3 \end{bmatrix} \mathbf{x}(t) + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} \mathbf{u}(t)$$

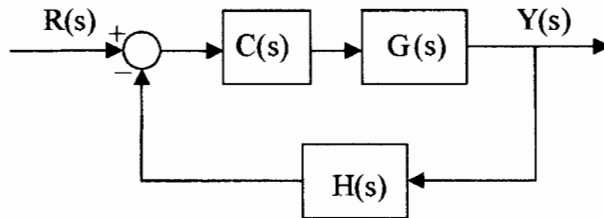
$$\mathbf{y}(t) = [6 \ 5 \ 4] \mathbf{x}(t)$$

求該系統之 transfer function。 (15%)

4. 一控制系統之方塊圖如下所示，其中誤差 $e(t) = r(t) - y(t)$ 。計算當輸入 $r(t) = t$ 時 ($t \geq 0$)，系統之穩態誤差 $\lim_{t \rightarrow \infty} e(t)$ 。(15%)



5. 若 $C(s) = \frac{K}{s}$ ， $G(s) = \frac{1}{s^2 + 2s + 2}$ ， $H(s) = 1$ 。試決定使閉迴路控制系統為穩定之增益 K 範圍。(10%)



6. 假設一系統之 transfer function 為 $G(s) = \frac{4}{s+1}$ ，系統之輸入為 $2\sin(3t)$ ，求該系統之 steady state output。(10%)