※ 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+30⁰) V, C=0.002 F, L= 10 mH，R=10 Ω。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%]
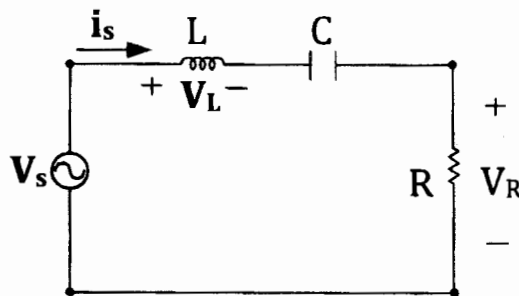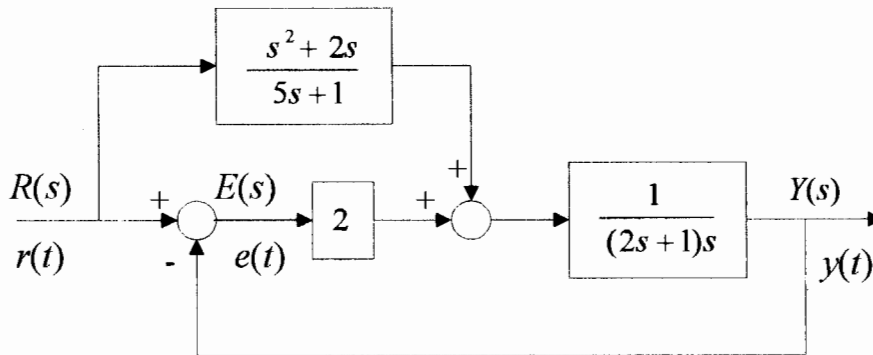

Figure 1

3. 一系統之狀態空間表示式如下：

$$\frac{d\mathbf{x}(t)}{dt} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -1 & -2 & -3 \end{bmatrix}\mathbf{x}(t) + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}\mathbf{u}(t)$$
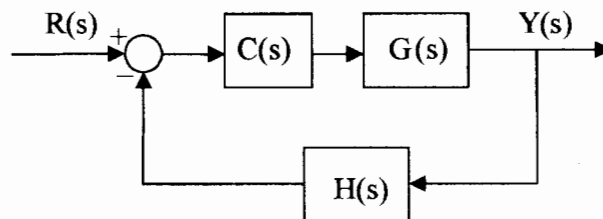
$$\mathbf{y}(t) = [6 \quad 5 \quad 4]\mathbf{x}(t)$$

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 $\lim_{t \to \infty} e(t)$。 **(15%)**

5. 若 $C(s)=\dfrac{K}{s}$， $G(s)=\dfrac{1}{s^2+2s+2}$ ，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 $G(s)=\dfrac{4}{s+1}$，系統之輸入為 2sin(3t)，求該系統之 steady state output。 **(10%)**