國 立 臺 北 科 技 大 學

九十九學年第一學期電機系博士班資格考試

控制系統(大學部) 試題

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注意事項：

1. 本試題共【5】題，配分共 100 分。
2. 請按順序標明題號作答，不必抄題。
3. 全部答案均須答在試卷答案欄內，否則不予計分。
4. 考試時間:二小時。

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1. Consider the RLC network shown in Fig. 1.

   (a) Derive the dynamic equation of this network, provided that $v_R(t)$ is the output. (10%)

   (b) Let $v_s(t)$ be a unit step function. Solve $v_R(t)$. (10%)
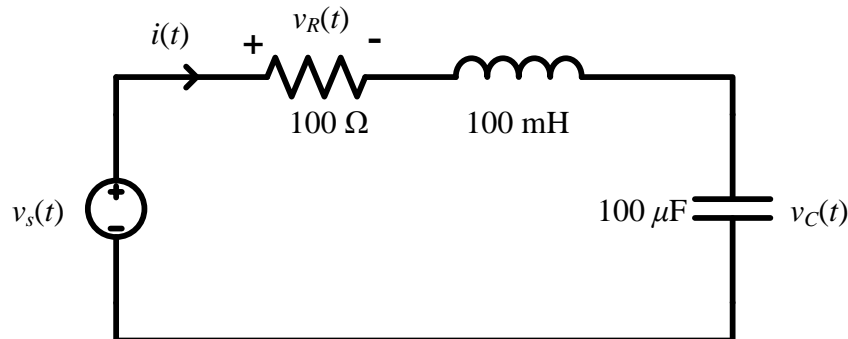

Fig. 1

2. Consider the closed-loop system shown in Fig. 2(a) with an input $r(t) = 2u_s(t)$ where $u_s(t)$ is a unit-step function. Determine the values of K

and T from the corresponding output response shown in Fig. 2(b). Note that the system takes 3 seconds to reach the peak value 2.51.
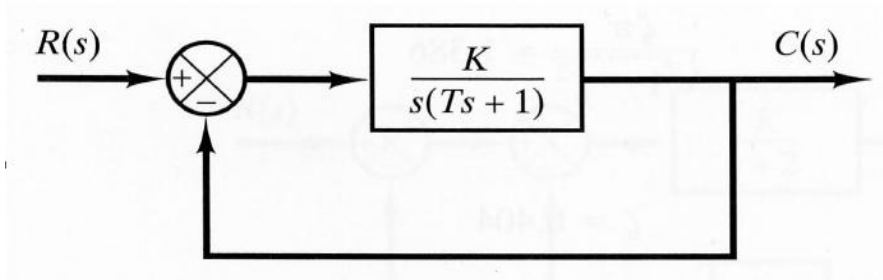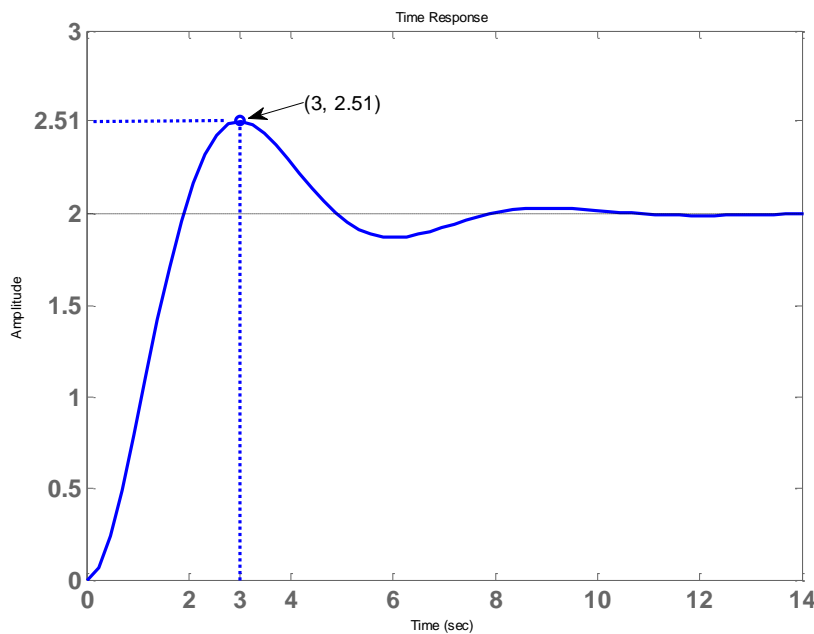

Fig. 2(a)

Fig. 2(b)

3. For the polynomial $s^5 + 6s^4 + 15s^3 + 30s^2 + 44s + 24 = 0$, determine whether there are any roots on the $j\omega$ axis or in the right half plane and find the oscillation frequency if there are roots on the $j\omega$ axis. (20%)

4. Draw the asymptotic Bode magnitude and phase plots for the system $\dfrac{s-1}{s+1}$. (20%)

5. Consider the ideal OP-amp circuit realization shown in Fig. 3.

   (a) Find the transfer function. (10%)

   (b) Find the relationship among the components R_1, R_2, C_1, and C_2 if the circuit works as a phase-lag controller. (10%)
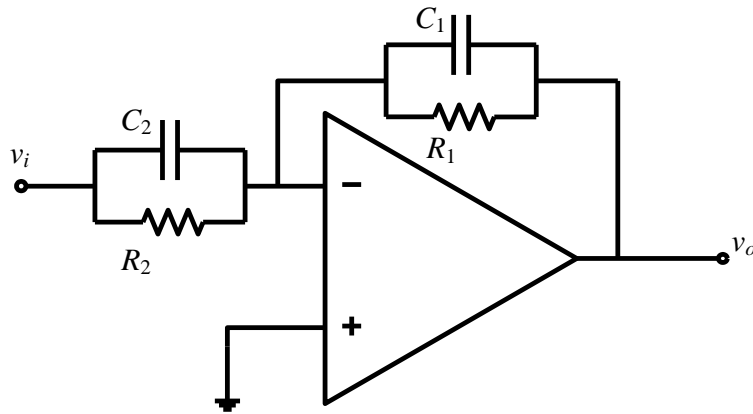

Fig. 3