

國立臺灣科技大學  
113學年度碩士班招生  
試題

系所組別：0742電機工程系碩士班丁二組

科目：信號與系統

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國立臺灣科技大學 113 學年度碩士班招生試題

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- (10%) Give examples for linear time-invariant, linear time-varying, nonlinear time-invariant, and nonlinear time-varying continuous and discrete dynamic systems. (Note: There are 8 systems in total.)
- (10%) Find the transfer function of  $\theta_{22}/\theta_{11}$ . The system block diagram is shown in Fig. P2.

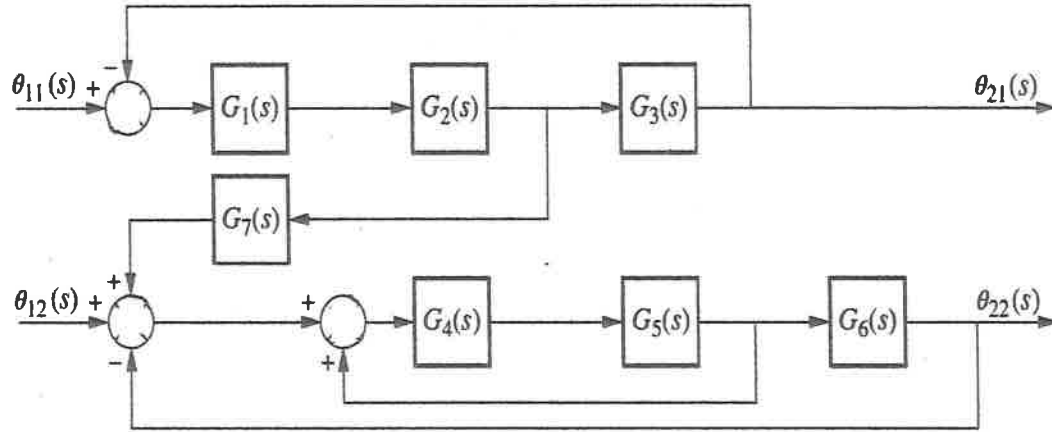


Fig. P2. Block diagram.

- (15%) Let  $Y(s) = \frac{1.3s + 11.5}{s^2 + 9.2s + 33.1}$ . Find  $y(t) = L^{-1}\{Y(s)\}$ . (Hint: inverse Laplace transform)
- (15%) For a negative unit feedback system with its open-loop system described by the Bode plot shown in Fig. P4. Find an approximated open-loop transfer function and its close-loop transfer function.

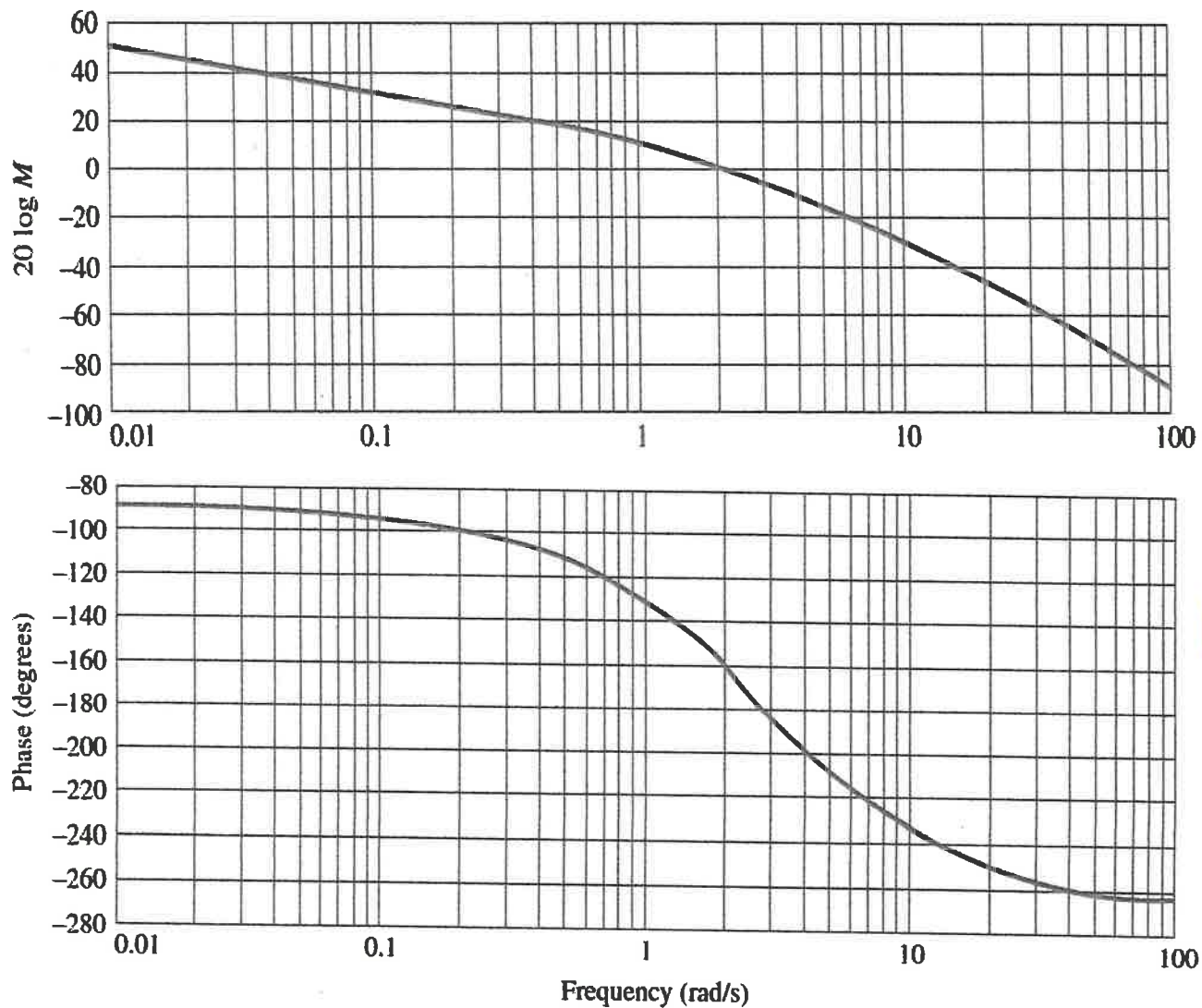


Fig. P4. Bode plot of the open-loop system.



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(總分為 100 分；所有試題務必於答案卷內頁依序作答，否則不予計分)

5. (20%) Consider a periodic signal  $x(t)$  with its period equal to  $T$ . The waveform of  $x(t)$  is shown in Fig. P5. Its peak values  $A$  are located at  $t = \dots, -T, 0, T, \dots$  and its minimum values 0 are located at  $t = \dots, -3T/2, -T/2, T/2, 3T/2, \dots$ . Between the adjacent peak point and minimum point, the signal  $x(t)$  is defined by a line segment connecting them. Please find the Fourier series coefficients of  $x(t)$ .

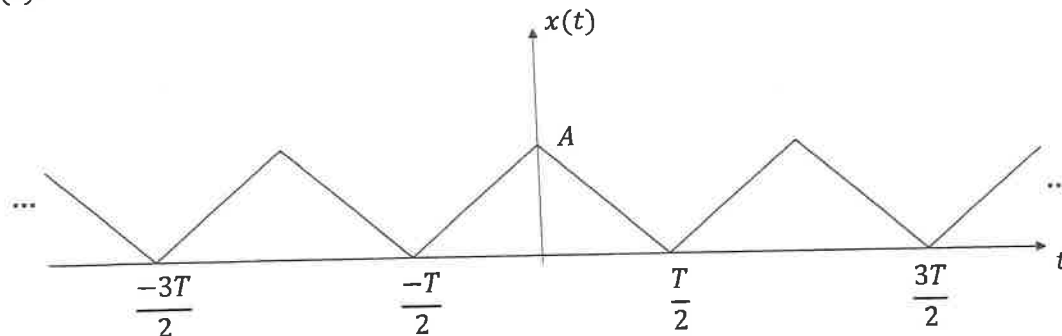


Fig. P5.

6. (15%) Let  $X(\omega)$  be the discrete-time Fourier transform of a signal  $x[n]$  and  $X(\omega)$  be differentiable everywhere. Prove that the discrete-time Fourier transform of  $nx[n]$  is  $j \frac{dX(\omega)}{d\omega}$ .
7. (15%) Let the z-transform of a discrete-time signal  $x[n]$  be

$$X(z) = \frac{1 + 3z^{-1} + \frac{13}{8}z^{-2} + \frac{1}{4}z^{-3}}{1 + \frac{3}{4}z^{-1} + \frac{1}{8}z^{-2}}$$

The region of convergence of  $X(z)$  is  $|z| > 1/2$ . Please derive the expression of  $x[n]$ .

