元智大學 103 學年度研究所 **碩士班** 招生試題卷

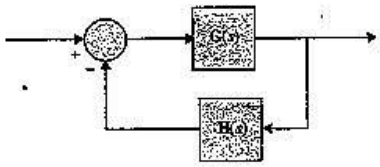
系(所)別：電機工程學系碩士班　組別：不分組　科目：控制系統　用紙第 1 頁共 1 頁

●不可使用電子計算機

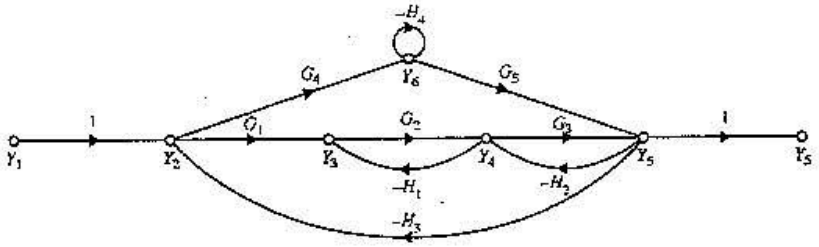
1. (20%) The block diagram of a multivariable feedback control system is shown in the following. The forward-path transfer function matrix and the feedback-path transfer function matrix of the system are

$$G(s)=\begin{bmatrix} \dfrac{1}{s+1} & \dfrac{-1}{s} \\ 2 & \dfrac{1}{s+2} \end{bmatrix} \quad H(s)=\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}.$$

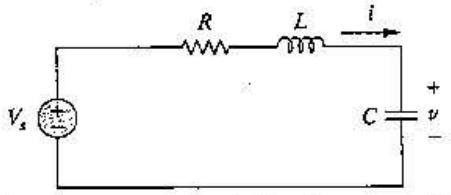
Find the close-loop transfer function matrix (or system transfer function matrix) of the system. (Please show the details of your work.)



2. (20%) Find the transfer function Y_5/Y_2 in the following signal-flow graph. (Please show the details of your work.)



3. (10%) The RLC network is shown in the following circuit. By assigning i and v as state variables, find the state equations for the network. (Please show the details of your work.)



4. (10%) State and define three commonly used performance criteria for the characterization of the transient response of a linear control system.
5. (5%) (a) Use a differential equation (DE) to describe a first-order system with the input signal f(t). Let y(t) denote the dependent variable in the DE.
   (10%) (b) Let f(t) be a unit-step input. Find Y(s), i.e., the Laplace transform of y(t).
   (10%) (c) Write y(t) as a sum of the transient response and the steady-state response.
6. (15%) Draw figures to explain the following terms used in oscillatory systems: underdamped, critically damped, overdamped, undamped, and negatively damped.

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