※ 考生請注意：本試題不可使用計算機

1. (50 %)The closed-loop transfer function of the system is

$$\frac{Y(s)}{U(s)} = \frac{(s-1)}{(s^3 + 2s^2 - s - 2)}$$

　　a. Can you check its controllability or observability from above information? Why? (10 points)

　　b. Realize the system to be a controllable canonical form dynamic equation. (10 points)

$$\dot{x}(t) = Ax(t) + Bu(t)$$
$$y(t) = Cx(t)$$

　　c. One claims that the dynamic equation of (b) is unobservable system. Is he or she correct? Why? (5 points)

　　d. Using state feedback $u(t) = r(t) + Kx(t)$ to relocate the eigenvalues of dynamic equation of (b) to be -1, -1, -1. (10 points)

　　e. How to check the stability of the system from the transfer function of a system? (5 points)

　　f. Realize the system to be Jordan form dynamic equation (10 points)

$$\dot{x}(t) = Ax(t) + Bu(t)$$
$$y(t) = Cx(t)$$

2. (20%) Please explain how to define the following:

　　a. Relaxed system (5 points)

　　b. Linear system (5 points)

　　c. Causal system (5 points)

　　d. Time invariant system (5 points)

※ 考生請注意：本試題不可使用計算機

3.　(15%)Three different systems can be described as (a) s (b) $\dfrac{1}{s}$ (c) e^{-s}.

　　The signal $f(t)$ is described as following：
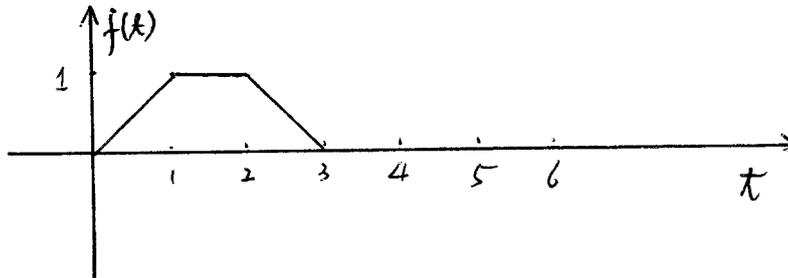
　　If the signal $f(t)$ passing through above systems, please plot the output signals, respectively. (5 points each)

4.　(15%) Explain the following terminologies;

- a.　Analog&Digital signals (3 points)
- b.　Continous&discrete signals (3 points)
- c.　A/D &D/A conversion (3 points)
- d.　PID controller (3 points)
- e.　Variable Structure System(VSS) (3 points)