

國立臺灣科技大學  
九十三學年度碩士班考試試題

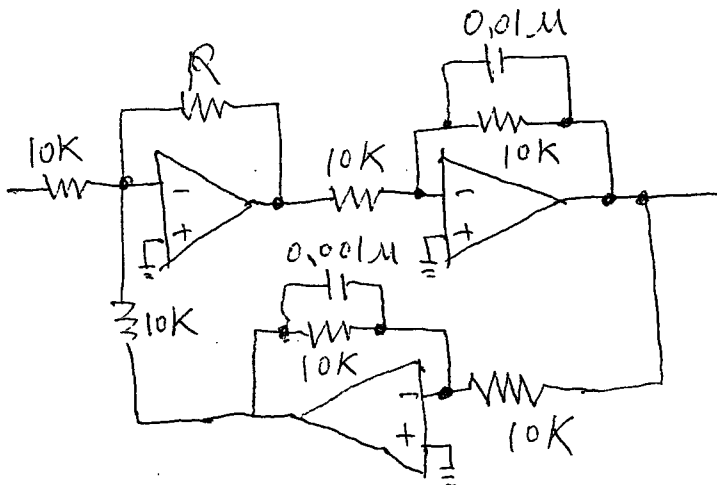
系所組別：機械工程系丁組  
科目：線性系統控制

1. In speed closed-loop control system, the load is driven by an armature controlled d.c. motor with a proportional amplifier. The system constants are:  
Moment of inertia of motor and load =  $2 \text{ kg}\cdot\text{m}^2$ .  
Motor torque constant =  $2 \text{ N}\cdot\text{m}/\text{Amp}$ .  
Motor armature resistance =  $1 \Omega$ .

總分 100 分

Determine that:

- (1) motor time constant  $\tau_m$ . (10%)
  - (2) motor gain constant  $K_m$ . (10%)
  - (3) the amplifier gain  $K_a$  [volt/rad/s] to produce speed error 1% under constant speed operation. (10%)
  - (4) In case of (3), find motor speed step response  $\omega(t)$  from standstill to 10 rad/s (10%)
2. In an operational amplifier circuit
- (1) if  $R=100\text{K}\Omega$ , find the system damping ratio  $\xi$ . (10%)
  - (2) if  $R=100\text{K}\Omega$ , find steady state error percentage  $e_{ss}$  for constant voltage input. (10%)
  - (3) find the  $R$  value to get a critical damping system (10%)



3. If a plant with transfer function  $C(s)/U(s)=1/(S^2+1)$ ,
- (1) if state variable are  $c(t)$  and  $dc(t)/dt$ , find the state equation (10%)
  - (2) using state feedback  $u(t)=[K_1 \ K_2][c(t) \ dc(t)/dt]^T$ . If the close loop poles are chosen as  $-1$  and  $-2$ , find  $K_2$  value (10%)
  - (3) in case of (2), if desired output  $r(t)$  is added,  $u(t)=[K_1 \ K_2][c(t) \ dc(t)/dt]^T + K_3 r(t)$ , find  $K_3$  value to produce zero steady-state error under step change. (10%)

