1. Find all the time domain specifications for a unity feedback control system whose open loop transfer function is given by .
2. The closed loop transfer function of a unity feedback control system is given by . Determine (i) Damping ratio, (ii) Natural undamped response frequency (iii) Percentage peak overshoot, (iv) Expression for response & (v) Expression for error response.
3. A servo mechanism is represented by the equation  . Where E=C-0.5y is the actuating signal. Find the value of damping ration, damped and undamped frequency of oscillations. Draw the block diagram of the system by the above equation.
4. The open loop transfer function of a feedback control system is given by . Determine the error co-efficient and errors due to the unit positional input, unit ramp input and unit parabolic input; if K=10 & T=4.
5. Evaluate the error series for a unity feedback system having a forward path transfer function . Estimate the steady sate error of the system for the input r(t) given by r(t)=1+2t+t2.
6. A feedback system employing output rate damping shown in figure 1.

-

+

-

+

ϴR

ϴC

sK0

1/s(s+2)

KA=10

Figure 1

* 1. In the absence of derivate feedback (K0=0), determine the damping factor and natural frequency of the system. What is the steady state error resulting from unit ramp input?
  2. Determine the derivative feedback constant K0, which will increase the damping factor of the system to 0.6. What is the steady state error resulting from unit ramp input with this setting of the derivative feedback constant?

1. A control system shown in figure 2 has the following characteristics: K=10 V/rad, H=10 V/rad & G(s)=100/s(s+1).

-

+

R(s)

C(s)

H

G(s)

K

Figure 2

Determine the sensitivity of the system’s transfer function T with respect to input transducer K, H & G respectively.

1. In a position control system the forward path transfer function is 100/s(1+s) and feedback path transfer function is 10. Determine the sensitivity of T with respect to the feed forward & feedback elements respectively in the vicinity of ω=1 rad/sec.

**Answers:**

1. tr=0.55 sec, tp=0.785 sec, Mp=9.5 % & ts=1.33 sec (2%basis)
2. ξ=0.9, ωd=0.98, Mp=0.15%, 1-e-4.6tsin(0.98t+25.84), & e-4.6tsin(0.98t+25.84)
3. For block diagram G(s)=144/s2+4.8s & H(s)=0.5, ξ=0.281, ωn=8.48 rad/sec, ωd=8.14 rad/sec
4. Kp=inf, Kv=10, Ka=0, ess=0, 0.1, inf
5. E(s)=0.2sR(s)-0.02s2R(s), e(t) =0.2r’(t)-0.02r’’(t), 
6. (a) ξ=0.316, ess=0.2 rad (b) K0=1.792, ess=0.38 rad
7. 
8. 

**Refer Books**

1. Problems & Sol of Control System by A.K. Jairath, CBS Publication.
2. Automatic Control System by Hasan Saeed, Kataria Publication