

First Half

Attempt **question No. 1 and any two from** the rest of this half

1. (a) Consider a system having the following transfer function:

$$G(s) = \frac{(s+25)}{(s^2+6s+25)(s+15)}$$

- (i) Compute the dc gain (in dB) of the system.
 - (ii) What is the high-frequency attenuation rate (in dB/decade) of the bode magnitude plot?
 - (iii) Locate the dominant poles of the system.
 - (iv) Estimate the approximate percentage overshoot and settling time of the unit step response.
- (b) Find the transfer function of a first-order system with unity d.c. gain and 100 rad/s bandwidth.
- (c) Find the transfer function of a second-order system having unity d.c. gain, 12.3 % overshoot and 1 sec. settling time under unit step input.

[(1+1+1+2)+3+3=11]

2. Consider the tracked vehicle turning control system shown in Fig. 1. Select K and a such that the system is stable and the steady state error under ramp input is within 24% of the command magnitude.

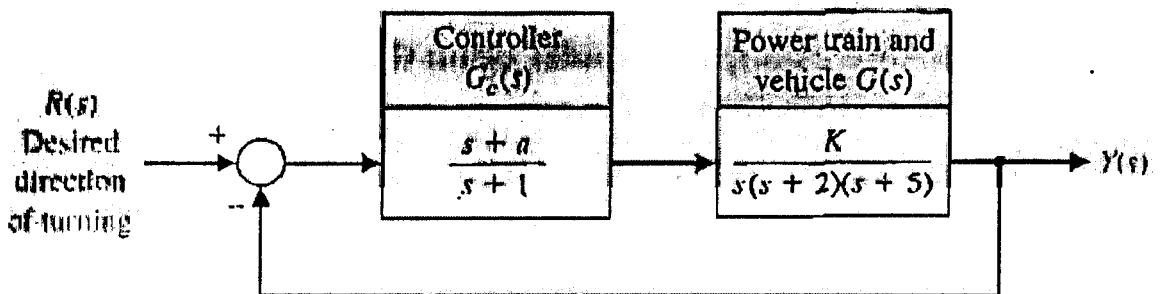


Figure 1

[12]

3. The open-loop transfer function of a unity feedback system is

$$G(s) = \frac{K(s^2 + 8s + 25)}{s^2(s + 4)}$$

We desire the dominant poles to have the damping ratio 0.707. Find the gain K when this condition is satisfied. Also show that the dominant poles are $-4 \pm j4$ at this gain.

[12]

4. Consider the block diagram shown in Fig. 2. Using block diagram reduction technique, show that the closed-loop transfer function of the system is

$$G(s) = \frac{Y(s)}{R(s)} = \frac{G_1 G_2 G_3 G_4}{1 - G_3 G_4 H_1 + G_2 G_3 H_2 + G_1 G_2 G_3 G_4 H_3}$$

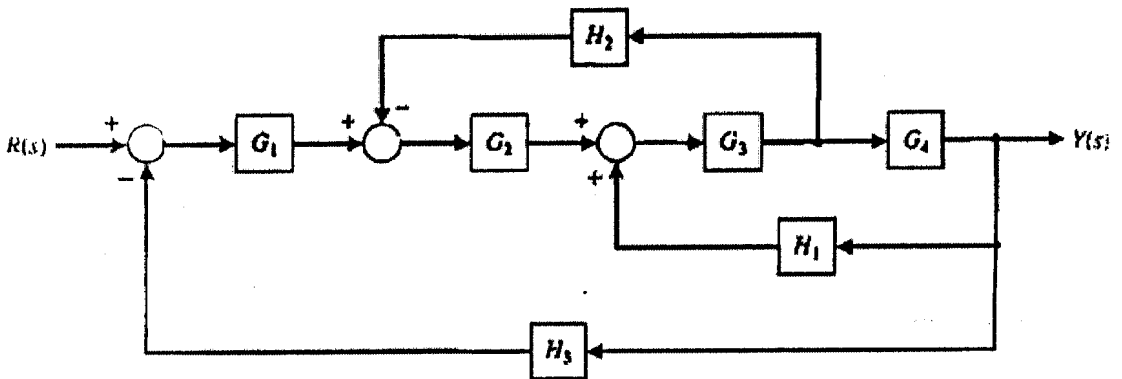


Figure 2

[12]

5. Obtain the values of K_1 and K_2 for the system shown in figure 3 to meet the following specifications: steady-state error component due to unit step disturbance $D(s)$ is -1.2×10^{-5} and the steady-state error component due to unit ramp input $R(s)$ is 0.003.

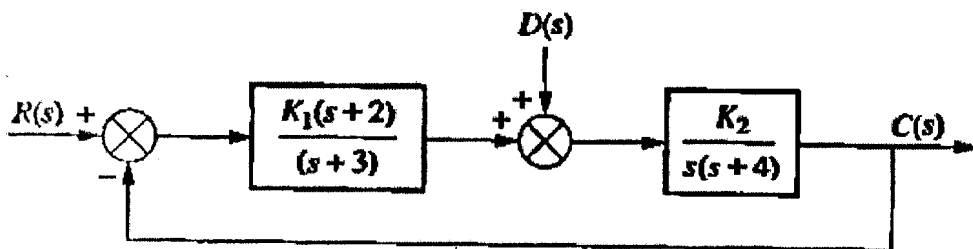


Figure 3

[12]

Subject: Measurement and Control (ME-404), May, 2014

SECOND HALF

Attempt any Three questions.

All questions carry equal marks.

- 6 ✖ (a) Define (i) Roughness (ii) Waviness and (iii) Lay .
(b) Which symbol is used to indicate Roughness in drawing and which values are generally used to indicate Roughness?
(c) With neat sketch explain the method of surface roughness measurement by Tomlinson surface meter.
- 7 ✖ (a) Discuss about the standard of temperature.
(b) Explain the method of measurement of temperature by resistance thermometer. What are the advantages and disadvantages of this thermometer?
- 8 ✖ (a) State the different methods of measurement of low pressures. With a neat labeled sketch explain the method of low pressure measurement by means of a McLeod gauge.
(b) The volume of bulb of a McLeod gauge is $160 \times 10^{-6} \text{ m}^3$ and the diameter of the capillary tube is 0.25 mm. Calculate the gauge reading for a pressure of 25 micron of mercury.
- 9 ✖ (a) What is meant by sensitivity of analytical balance? Derive an expression for it.
(b) Write short note on the effect of buoyancy during the measurement of force by using analytical balances.
- 10 ✖ Write short notes on any three of the following:
(a) Pneumatic load cell.
(b) Simple two liquid manometers.
(c) Mechanical roughness indicator.
(d) Metal bellows.
(e) Capacitive fluid pressure transducer.