Reg. No. : | | | | | | | | | | |

Question Paper Code: 44603

B.E. / B.Tech. DEGREE EXAMINATION, DEC 2020

Fourth Semester

Instrumentation and Control Engineering

14UIC403 - LINEAR CONTROL SYSTEMS

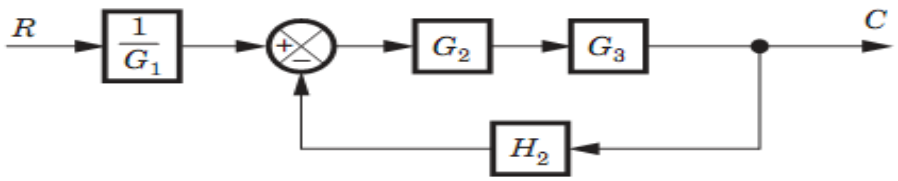
(Regulation 2014)

Duration: One hour Maximum: 30 Marks

PART A - (6 x 1 = 6 Marks)

(Answer any six of the following questions)

1. The transfer function for the feedback control system shown in figure below is



(a) $G_1G_2/(1+H_1G_1G_2G_3)$ (b) $G_2G_3/G_1(1+H_1G_2G_3)$
(c) $G_2G_3/(1+H_1G_1G_2G_3)$ (d) $G_2G_3/(G_1(1+H_1G_2G_3)$

2. A car is running at a constant speed of 50 *km/h*, which of the following is the feedback element for the driver?

(a) Clutch (b) Eyes
(c) Needle of the speedometer (d) Steering wheel

3. The damping ratio of a system having the characteristic equation $S^2+2S+8=0$ is

(a) 0.353 (b) 0.330 (c) 0.300 (d) 0.250

4. For a second order system settling time is Ts = 7 s and peak time is Tp = 3 s. The locations of poles are

(a)-0.97 ± j0.69 (b)-0.69 ± j0.97
(c)-1.047 ± j0.571 (d) -0.571 ± j1.047

5. A system with gain margin close to unity or a phase margin close to zero is

(a) Highly stable (b) Oscillatory
(c) Relatively stable (d) Unstable

66. For the transfer function, the phase cross-over frequency is

$$G(s)H(s) = \frac{1}{s(s+1)(s+0.5)}$$

(a) 0.5 rad/sec (b) 0.707 rad/sec
(c) 1.732 rad/sec (d) 2 rad/sec

7. The equation $2s^4 + s^3 + 3s^2 + 5s + 10 = 0$ has _____roots in the left half of s-plane.

(a) one (b) two (c) three (d) four

8. If the Nyquist plot of the loop transfer function *G(s) H(s)* of a closed-loop system encloses the *(-1 + j0)* point in the *G(s) H(s)* plane, the gain margin of the system is

(a) zero (b) greater than zero
(c) less than zero (d) infinity

9. The transfer function of $\frac{1+0.5S}{1+S}$ represents a

(a)Lag network (b)Lead network
(c)lag Lag–lead network (d) Proportional controller

10. Introduction of the lag compensator shifts the gain cross over frequency to the _____ frequency region of Bode plot

(a) Low

PART – B (3 x 8= 24 Marks)

(Answer any three of the following questions)

11. Write the differential equations governing the mechanical system shown in figure 1 below and develop the transfer function. (8)

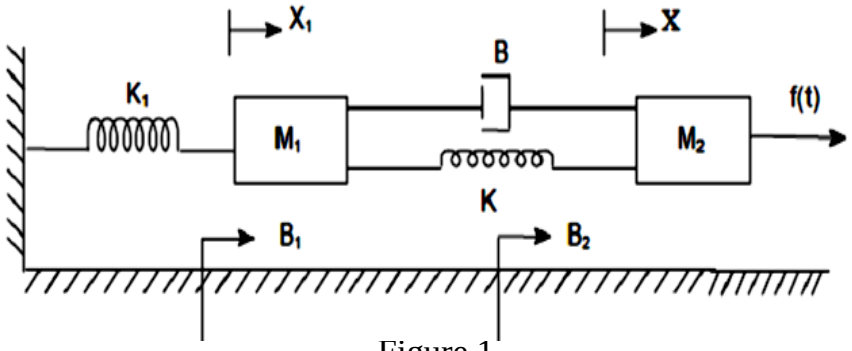


Figure 1

12. A unity feedback control system is characterized by the following open loop transfer function G(s) = (0.4S+1) / S(S+0.6). Determine its transient response for unit step input and sketch the response. Infer the maximum overshoot and the corresponding peak time. (8)

13. Sketch the polar plot of $G(s) = \frac{1}{[s(1+0.5s)(1+0.02s)]}$ and determine the phase cross over frequency. (8)

14. Sketch the root locus of the system whose open loop transfer function is $G(s) = \frac{K}{s(s+2)(s+4)}$ .Interpret the value of K so that the damping ratio of the closed loop system is 0.5. (8)

15. A unity feedback system has an open loop transfer function$G(s) = \frac{K}{s(1+2s)}$. Design a suitable lag compensator so that phase margin is 40^{o} and the steady state error for ramp input is less than or equal to 0.2. (8)