Reg. No.												

Question Paper Code	12792

B.E. / B.Tech. - DEGREE EXAMINATIONS, APRIL / MAY 2024

Fourth Semester

Electrical and Electronics Engineering

20EEPC404 - CONTROL ENGINEERING

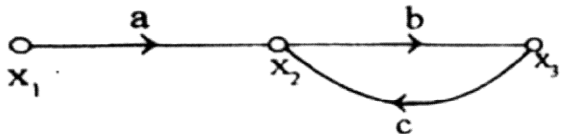
Regulations - 2020

(Use of *Semilog and Polar Graphs* are permitted)

Duration: 3 Hours — Max. Marks: 100

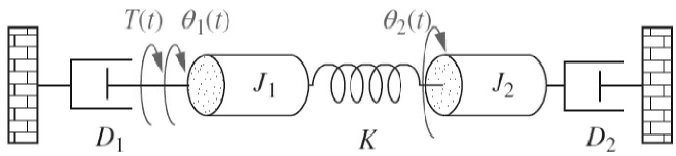
PART - A (10 × 2 = 20 Marks)

Answer ALL Questions

No.	Question	*Marks*	*K – Level*	*CO*
1.	Distinguish between open-loop and closed-loop control systems.	2	K2	CO1
2.	Determine the transfer function by using the signal flow graph 	2	K2	CO1
3.	What is the effect of adding a Proportional controller into the system?	2	K2	CO2
4.	Determine the damping factor and natural frequency for the given second-order closed-loop systems transfer function $G(s) = \frac{100}{S^2+10S+100}$.	2	K2	CO2
5.	Write the necessary and sufficient condition for the stability in Routh Stability criterion.	2	K2	CO3
6.	How will you find the root locus on the real axis?	2	K2	CO3
7.	Define Phase Margin and Gain Margin.	2	K1	CO4
8.	State Nyquist stability Criterion.	2	K1	CO4
9.	Draw the pole-zero plot of lead compensator.	2	K3	CO5
10.	List the effects of adding lag compensator in the system.	2	K1	CO5

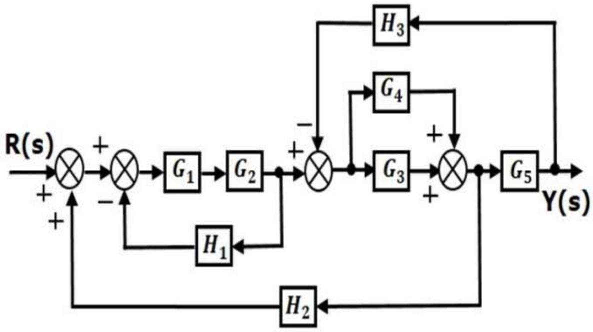
PART - B (5 × 13 = 65 Marks)

Answer ALL Questions

No.	Question	*Marks*	*K – Level*	*CO*
11. a)	Write the differential equation governing the mechanical rotational systems and find the transfer function, $\frac{\theta_2(s)}{T(s)}$. 	13	K3	CO1

OR

b) Determine the closed loop transfer function C(S)/R(S) of the system whose block diagram is shown below. *13 K3 CO1*



12. a) Derive the expressions for the second order system for underdamped response and when the input is a unit step. *13 K3 CO2*

OR

b) A unity feedback system has the forward transfer function $G(s) = \frac{K(2s+1)}{s(5s+1)(1+s)^2}$. The input r(t)=(1+6t) is applied to the system. Determine the minimum value of K if the steady-state error is to be less than 0.1. *13 K3 CO2*

13. a) Construct the root locus and determine the stability of the system whose characteristic equation is $s^7 + 9s^6 + 24s^5 + 24s^4 + 24s^3 + 24s^2 + 23s + 15 = 0$. Also determine the number of roots lying onright half of s-plane, left half of s-plane and on imaginary axis. *13 K3 CO3*

OR

b) The open loop transfer function of a unity feedback system is given by $G(s) = \frac{K(s+9)}{s(s^2+4s+11)}$. Sketch the root locus of the system. *13 K3 CO3*

14. a) Sketch the Bode plot and hence find the gain cross over frequency, phase cross over frequency, gain margin and phase margin. *13 K3 CO4*

$$G(s) = \frac{10(1+0.1s)}{s(1+0.01s)(1+s)}$$

OR

b) Sketch the polar plot for the following transfer function and find the gain margin and phase margin. *13 K3 CO4*

$$G(s) = \frac{400}{s(s+2)(s+10)}$$

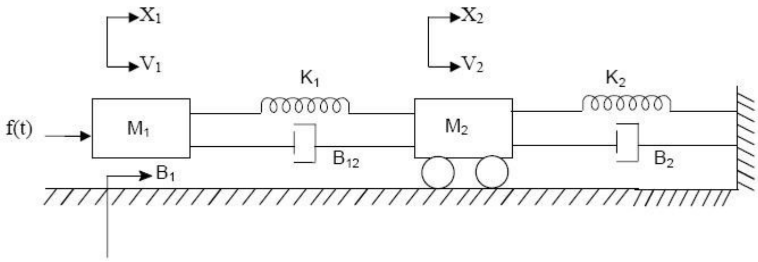
15. a) The open loop transfer function of the uncompensated system is $G(s) = \frac{K}{s(s+2)}$. Design a lag compensator for the system so that thestatic velocity error constant K_v is 10/sec, the phase margin ≥ 60°. *13 K3 CO5*

OR

b) The open loop transfer function of the uncompensated system is $G(s) = \frac{K}{s(s+1)(s+2)}$. Design a suitable lead compensator for thesystem so that the static velocity error constant K_v = 10/sec, the phase margin = $50^0$and the gain margin ≥10db. 13 K3 CO5

PART - C (1× 15 = 15 Marks)

16. a) Write the differential equation governing the mechanical translational systems and find the transfer function, $\frac{X_1(s)}{F(s)}$. Draw the force voltage electrical analogous circuit. 15 K5 CO1



OR

b) Determine the transfer function of the given system using mason's gain formula by converting block diagram representation into signal flow graph. 15 K5 CO1