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B.E./B.Tech. - DEGREE EXAMINATIONS, NOV/DEC 2022

Fourth Semester

Electrical and Electronics Engineering

20EEPC404 - CONTROL ENGINEERING

(Regulations 2020)

Duration: 3 Hours | Max. Marks: 100

PART-A (10 × 2 = 20 Marks)

Answer ALL Questions

		Marks, K-Level,CO
1.	List the basic elements in control systems.	*2,K1,CO1*
2.	Compare open loop and closed loop system.	*2,K1,CO1*
3.	Assess the standard test signals employed for time domain studies.	*2,K1,CO2*
4.	Classify type and order of the system.	*2,K1,CO2*
5.	State Nyquist stability criterion.	*2,K1,CO3*
6.	What is characteristic equation?	*2,K1,CO3*
7.	Define phase margin and gain margin.	*2,K1,CO4*
8.	Define the terms: resonant peak and resonant frequency.	*2,K1,CO4*
9.	Identify the necessity for lag/lag-Lead compensation.	*2,K1,CO5*
10.	Compare Lag and Lead compensator.	*2,K1,CO5*

PART - B (5 × 13 = 65 Marks)

Answer ALL Questions

11. a) (i) Draw the force-voltage analogy and force current analogy for the mechanical system shown in Figure 1. *7,K2,CO1*

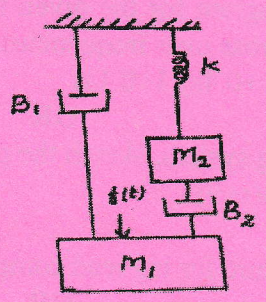

Figure 1

(ii) Explain armature controlled DC servomotor with relevant block diagram. *6,K2,CO1*

OR

b) Solve the transfer function using Mason's Gain formula for the system whose signal flow graph is shown in Figure 2. *13,K3,CO1*

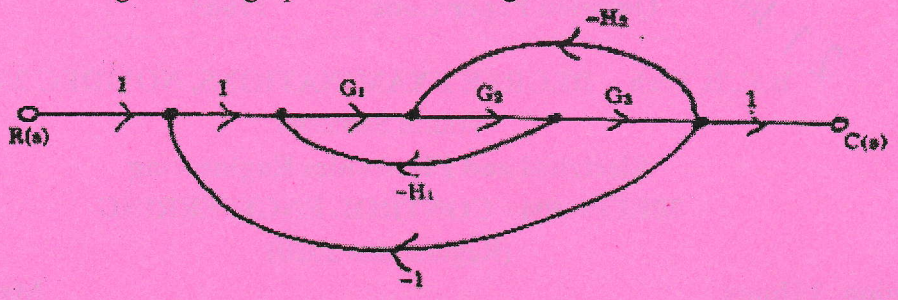

Figure 2

12. a) Derive the expression for second order system for under damped case and when the input is unit step. *13,K2,CO2*

OR

b) A unity feedback system us characterized by the open loop transfer function .G(S)=1/(s(0.5s+1)(0.2s+1)) *13,K3,CO*
(i) Write the closed loop transfer function C(s)/ R(s).
(ii) Find damping factor, natural frequency of the system.
(iii) Determine rise time, peak time and peak overshoot of the system.
(iv) Calculate steady state error due to unit step.

13. a) Sketch the root locus of the system whose open loop Transfer Function is given by . G(S)=K/s(s+2)(s+4).Find the value of K so that damping ratio of the system is 0.5. *13,K3,CO3*

OR

b) For each of the characteristics equation of feedback control system given, determine the range of K for stability. Examine the value of K so that the system is marginally stable and the frequency of sustained oscillations. *13,K3,CO3*
(i) $S^4+25S^3+15S^2+20S+K=0$
(ii) $S^3+3KS^2+(K+2)S+4=0$

14. a) Plot the bode diagram for the given transfer function and estimate the gain and phase cross over frequencies. *13,K3,CO4*
G(S)H(S)=10/s(1+0.4s)(1+0.1s)

OR

b) For the following system, sketch the polar plot. *13,K3,CO4*
G(S)=500/s(s+6)(s+9)

15. a) Write the procedure for lag lead compensator using bode plot in detail. *13,K2,CO5*

OR

b) The open loop transfer function of the uncompensated system is G(S)=K/S(S+2).Design a lag compensator for the system so that the static velocity error constant Kv is 10 sec-1 , the phase margin $\geq 60^0$. *13,K3,CO5*

PART - C (1 × 15 = 15 Marks)

16. a) Solve the given mechanical rotational system and write the differential equations governing the as shown in Figure 3. Draw the both electrical analogous circuits. *15,K3,CO1*

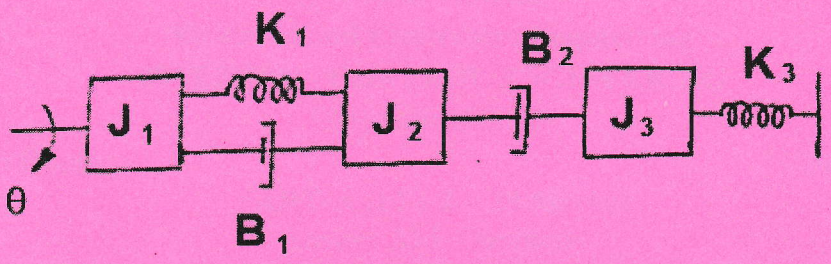

Figure 3

OR

b) Calculate the static error coefficients for a system whose transfer function is G(S)H(S)=10/S(1+S)(1+2S) And also Calculate the steady state error for $r(t)=1+t+(t^2/2)$. *15,K3,CO2*