Department of Electrical Engineering
Major-Exam, Spring Session-2019

Subject: Control System (ELE-407) B. Tech. (CSE & ECE) (4th Sem) **Date:** 20-06-2019
Duration: 3 hours **Max Marks:** 60

[Attempt any four questions] [Assume missing data if required]

Q. N.	Descriptions of the question	Full Marks
1. (a)	Enlist the comparison between open loop and closed loop control system.	[5] [CO1]
(b)	Explain the effect of parameter variations in a closed loop system shown below in Fig. 1.	[5] [CO1]

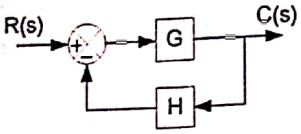

Fig. 1

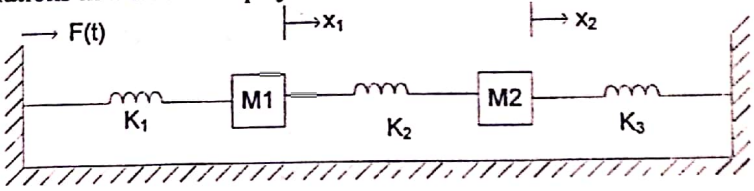

Fig. 2

(c)	Draw the equivalent mechanical network, write the system equations and find $\frac{F(s)}{X_2(s)}$ of the system in Fig. 2.	[1+2+2=5]
2. (a)	Determine C/R using block reduction technique for the block diagram given below in Fig. 3:	[5] [CO2]

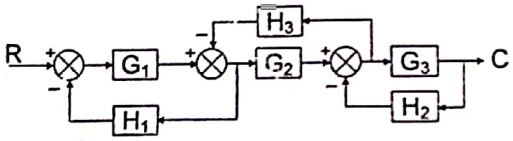

Fig. 3

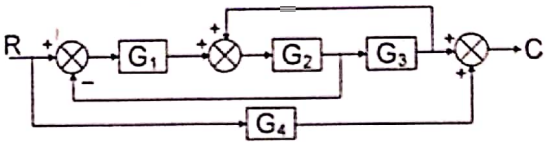

Fig. 4

(b)	Draw the signal flow diagram of Fig. 4 and then obtain the transfer function C/R using signal flow graph (Mason's gain formula).	[2+5=7] [C

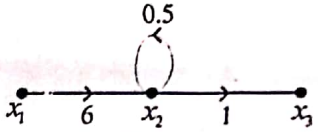

Fig. 5

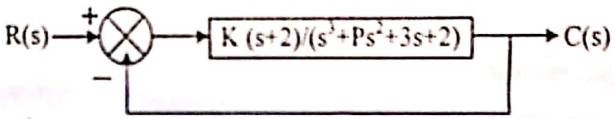

Fig. 6

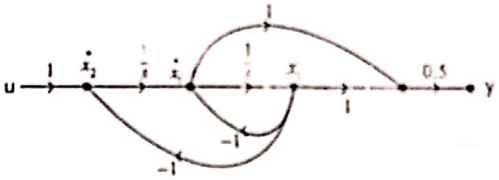

Fig. 7

(c)	Find the value of x_3/x_1 for the given signal flow graph in Fig. 5.	[3] [CO2]
3. (a)	The system shown in Fig. 6 has the oscillation of 2.5 rad/sec. Determine the values of K_{mar} and P. There are no poles in right half of s-plane.	[3+3=6] [C
(b)	Write the state and output equations and find the A, B, C and D matrices for the Fig 7. Where, x_1 & x_2, y and u are the states, output and input variables, respectively.	[5] [CO5]
(c)	Explain mathematically the following industrial controllers (i) PI and (ii) PID.	[4] [CO5]
4. (a)	The open loop transfer function of a control system is given by $G(s)H(s) = \frac{k}{s(s+6)(s^2+4s+13)}$ Sketch the root locus and also determine the range of k for the stability conditions.	[7+3=10] [C
(b)	Derive the expression for lead compensator.	[5] [CO5]
5. (a)	Draw the polar plot of following system: (i) Type 0 and Order 3 and (ii) Type 2 and Order 2.	[4] [CO4]
(b)	Enlist the five advantages of the bode plot.	[5] [CO4]
(c)	Explain the mapping theorem and the Nyquist stability criterion.	[3+3=6] [C

Course Objectives:

CO1: Introduction to control systems, compare and contrast open and closed loop, automatic and manual systems and their applications. To study the effect of feedback system. To determine the mathematical modelling of the physical system.
CO2: Introduction to transfer functions, developing and analyzing block diagrams, evaluating signal flow graphs.
CO3: To determine and analyze the time response of first and second order systems to various standard test inputs.
CO4: Investigate, evaluate and analyze the stability of control systems, compare and contrast absolute and relative stability.
CO5: Study and design of PID controllers, lead-lag Compensators and modeling of dynamic systems in state space.