B.Tech. SEM -V Electrical 2014 Course (CBCS) : SUMMER - 2019
SUBJECT: LINEAR CONTROL SYSTEMS

Day: Thursday
Date: 09/05/2019

S-2019-2662

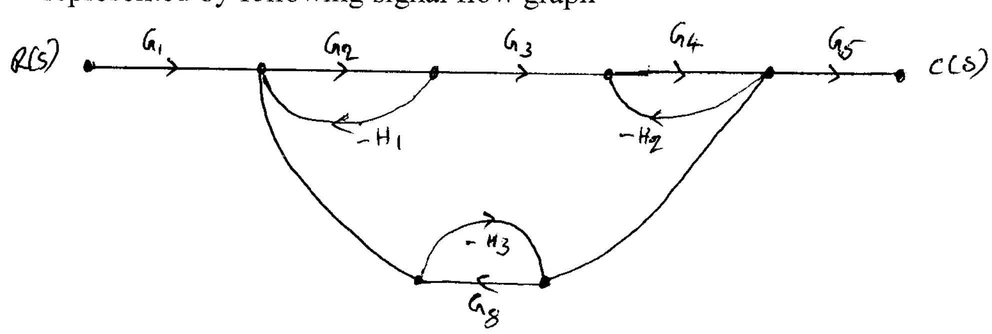
Time: 10.00 AM TO 01.00 PM
Max. Marks: 60

N.B:

1) All questions are **COMPULSORY.**
2) Figures to the right indicate **FULL** marks.
3) Assume suitable data **WHEREVER** necessary.
4) Use of **CALCULATOR** is allowed.

Q.1 a) Draw block diagram of open loop and closed loop system and give two examples of each. **(04)**

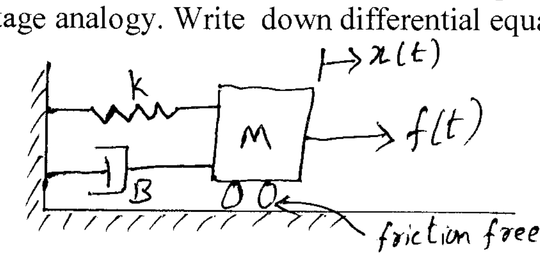
b) Using Mason's gain formula, obtain overall transfer function of a system represented by following signal flow graph **(06)**



OR

Q.1 a) Derive transfer function of separately excited DC servomotor. **(06)**

b) Draw analogous electrical equivalent of Mass, Spring, damper system using Force Voltage analogy. Write down differential equations **(04)**



Q.2 Consider unity feedback the system given below. Obtain closed loop transfer function and determine i) rise time ii)Peak time iii) Maximum overshoot iv) settling time v) delay time **(10)**

$$G(s) = \frac{136}{s^2 + 6s + 136}$$

OR

Q.2 a) Draw time response of standard second order system and explain time response specifications **(05)**

b) For a unity feedback system having open loop transfer function as **(05)**

$$G(s) = \frac{24(s+2)}{s(s^2 + 7s + 12)}$$

Determine

i) Type of the system
ii) Error constants K_p, K_v and K_a
iii) Steady state error for step input

P.T.O.

Q.3 Draw root locus for the following system .Also find range of values of K for which system is stable **(10)**

$$G(s) = \frac{K}{s(s+3)(s^2+2s+2)}$$

OR

Q.3 Using Routh Hurwitz criterion for the unity feedback control system with open loop transfer function $G(s) = \frac{K}{s\,(s+1)(s+2)(s+5)}$ **(10)**

i) Find range of K for stability

ii) Find the value of K for marginally stable and corresponding closed loop poles

Q.4 Consider a unity feedback system having open loop transfer function G(s)H(s)= $\frac{k}{s(s+5)}$ **(10)**

It is desired to limit peak overshoot to 10 % , natural frequency of oscillations 10rad/sec. Determine dominant root and angle provided by compensator on the sketch of root locus

OR

Q.4 A unity feedback system has open loop transfer function $G(s) = \frac{25}{s(s+5)}$ **(10)**

Now a PD controller with transfer function $G_c(s)$= 4+ 0.5s is introduced in the system

i) Draw block diagram

ii) Write down closed loop transfer function without and with PD control

iii) Calculate Damping ratio, overshoot without and with PD control

Q.5 Sketch Nyquist plot for $G(s) = \frac{64}{s(s+4)(s+8)}$ **(10)**

Determine Gain margin from the graph and comment about stability

OR

Q.5 Draw bode plot on semilog graph paper for the system with **(10)**

$G(s) = \frac{64}{s(s+4)(s+8)}$. Show Gain Margin ,Phase Margin on the graph and comment about stability

Q.6 Describe stepwise procedure for design of lead compensator using bode plot **(10)**

OR

Q.6 **a)** Describe use of SISO tool in MATLAB for design of compensator **(06)**

b) What is the effect of lag compensator on system response? **(04)**

* * * * *