

Total No. of Questions : 8]

SEAT No. :

P3611

[5560]-566

[Total No. of Pages : 3

T.E.(Electrical)

CONTROL SYSTEM - I
(2015 Course) (Semester - II)

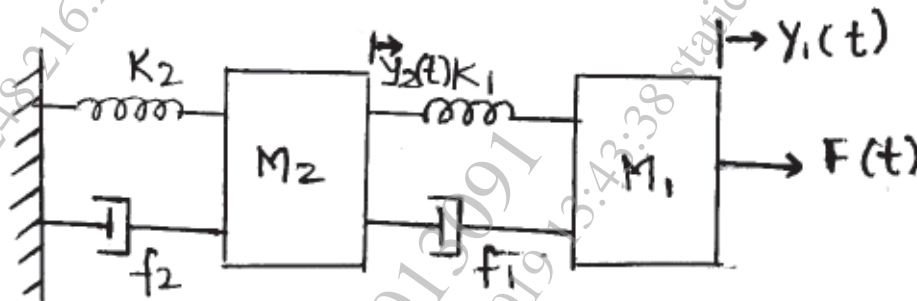
Time : 2½ Hours]

[Max. Marks : 70

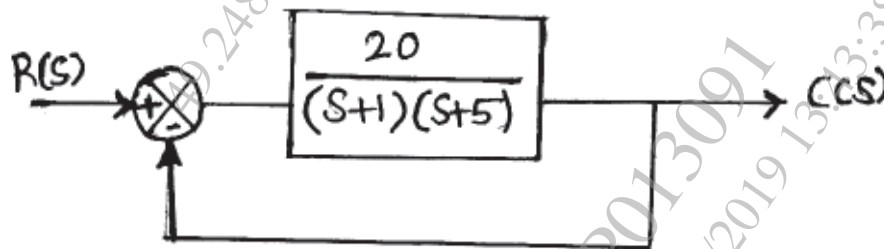
Instructions to the candidates:

- 1) Answer any one question from each pair of questions : Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Figures to the right indicate full marks.

Q1) a) Draw the electrical analogous network and write the equation [7]



- b) The poles of a real rational transfer function are given as 0, -1 and -4. There is a single zero (of order 2) at $S = (-3)$. Determine the transfer function and plot pole zero on S-plane. [5]
- c) The block diagram of a unity feedback control system shown in figure below. [8]



Determine the characteristic equation of the system ω_n , ξ , ω_d , t_p , M_p the time at which the first overshoot occurs, the time period of oscillation.

OR

P.T.O.

Q2) a) Define the following: [7]

- i) Time response
- ii) Transient response
- iii) Steady state response
- iv) Delay time
- v) Rise time
- vi) Peak time
- vii) Settling time

b) A characteristic equation of a feedback control system is given by $s^5 + s^4 + 4s^3 + 4s^2 + 2s + 1 = 0$ comment on stability. [4]

c) A unity feedback control system has an open loop transfer [9]

$G(s) = \frac{K}{s(s^2 + 4s + 13)}$ Sketch the root locus of the system by determining the following

- i) centroid and angle of asymptotes
- ii) Angle of departure from the poles
- iii) The value of K and the frequency at which the root locus crosses the imaginary axis.

Q3) a) Define and write formula [8]

- i) Resonant frequency
- ii) Resonant Peak
- iii) Band width
- iv) Plot M_r , M_p versus ξ for a second order system

b) A unity feedback system has open loop transfer function

$G(s) = \frac{(s + 2)}{(s + 1)(s - 1)}$ using nyquist criterion determine whether the closed loop system is stable or not. [8]

OR

Q4) a) Briefly state the nyquist criterion. [6]

b) Sketch the bode plot for the system whose open loop transfer function

is given by $G(s) = \frac{20(0.1s + 1)}{s(0.5s + 1)(0.3s + 1)}$ and find GM, PM, ω_{gc} , ω_{pc} . [10]

Q5) a) Define Gain margin, phase margin, phase crossover frequency, gain crossover frequency. [6]

b) Sketch the asymptotic plot for open loop transfer function given by

$$G(s) = \frac{2(s+0.25)}{s^2(s+1)(s+0.5)}$$

from bode diagram determine GM, PM, ω_{gc} , ω_{pc} . [12]

OR

Q6) a) Sketch bode diagram showing gain margin and phase margin for [6]

- i) Stable system
- ii) Unstable system

b) Using nyquist criterion investigate the stability of a closed loop control system whose open loop transfer function is given by [12]

$$G(s) = \frac{K}{s(sT_1+1)(sT_2+1)}$$

Q7) a) Write short note on [8]

- i) Lead compensator
- ii) AC Tachometer

b) Explain the features of the following [8]

- i) P-Controller
- ii) PI-Controller
- iii) PID-Controller

OR

Q8) a) Write short notes on synchros. [6]

b) For the system shown below, design PID controller using Zigler Nichol tuning rule [10]

