

Total No. of Questions : 8]

SEAT No. :

**P1716****[5058]-349**

[Total No. of Pages : 4

**T.E. (Electrical)****CONTROL SYSTEM - I****(2012 Course) (303147) (End Sem-Semester - II)****Time : 2.30 Hours]****[Max. Marks : 70****Instructions to the candidates:**

- 1) Answer all questions.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.

**Q1) a) Distinguish between [6]**

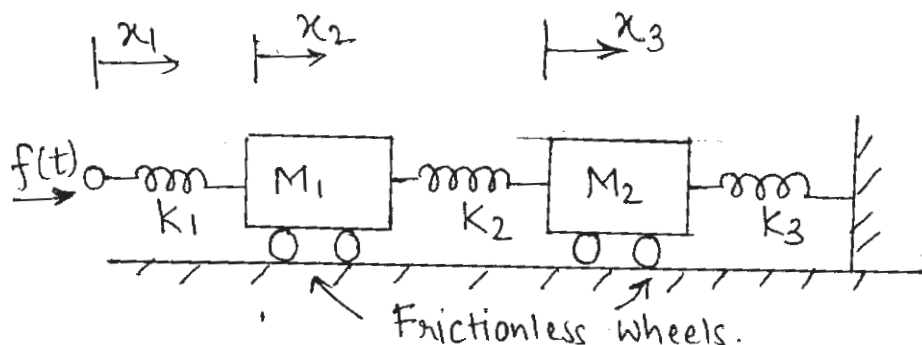
- i) Open loop and closed loop system.
- ii) Feedback and feedforward system

**b) Write a short note on tachogenerator. [6]****c) A unity feedback system characterised by the open loop transfer function.**

$$G(s) = \frac{1}{s(0.5s+1)(0.2s+1)}$$

Determine the steady state errors for unit step, unit ramp and unit acceleration inputs. [8]

OR

**Q2) a) Draw mechanical equivalent network of a given system and also draw the electrical analogous circuit using F-V analogy. [8]****P.T.O.**

- b) State and explain Mason's Gain Formula. [5]  
 c) Define and explain time domain specification. [7]

- Q3)** a) State and explain Routh Hurwitz stability criterion. [6]  
 b) A unity feedback control system has an open loop transfer function.[10]

$$G(s) = \frac{K}{s(s^2 + 4s + 13)}$$

Sketch the root locus plot of the system by determining the following:

- i) Centroid, number and angle of asymptotes.
- ii) Angle of departure of root loci from the poles.
- iii) Breakaway point if any
- iv) The value of K and the frequency at which the root loci cross the  $j\omega$  - axis.

OR

- Q4)** a) Sketch the root locus for the open-loop transfer function of a unity feedback control system given below and determine  
 i) The value of K for  $\xi = 0.5$   
 ii) the value of K for marginal stability. [9]

$$G(s) = \frac{K}{s(s+1)(s+3)}$$

- b) The open-loop transfer function of a unity feedback system is given by

$$G(s) = \frac{K}{(s+2)(s+4)(s^2 + 6s + 25)}$$

By applying the Routh Criterion discuss the stability of the closed loop system as a function of K. Determine the value of K which will cause sustained oscillation in the closed loop system. What are the corresponding oscillation frequencies? [7]

- Q5) a)** Explain the terms gain margin, phase margin, Gain cross over frequency, phase cross over frequency. [8]
- b)** Sketch the bode plot of the transfer function and determine PM and GM from the plot.

$$G(s)H(s) = \frac{30}{s(1+0.5s)(1+0.08s)} \quad [10]$$

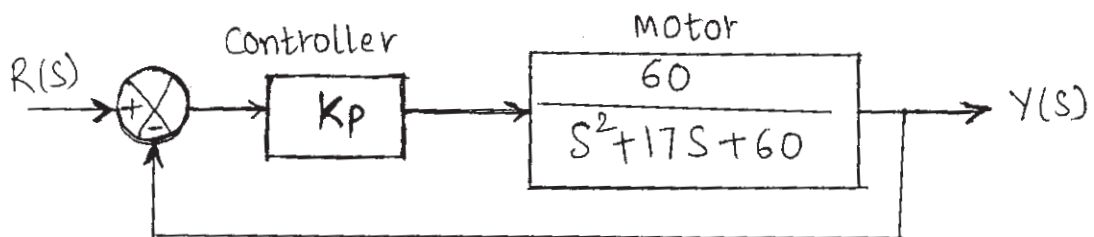
OR

- Q6) a)** Explain Nyquist stability criteria. [8]
- b)** A control system with closed loop transfer function

$$G(s)H(s) = \frac{K(s-1)}{s(s+1)}$$

Plot Nyquist plot and comment on stability. [10]

- Q7) a)** Draw block diagram of PID controller and discuss the effect of increasing  $K_p$ ,  $K_i$ ,  $K_d$  on rise time overshoot and stability. [8]
- b)** The system given below is so design to have damping ratio 0.707. Determine the required value of  $K_p$  for the given damping ratio. [8]



OR

- Q8)** a) Explain Ziegler Nichols method of tuning PID controller. [8]
- b) An open loop test of a temperature control system yields the reaction curve shown below. The system open loop transfer function is given by

$$G(s) = \frac{1}{(20s+1)(50s+1)}$$

Used Ziegler Nichols method to determine  $K_p$ ,  $K_i$ ,  $K_d$ ? For a quarter step response PID control system. [8]

