

**III B. Tech I Semester Supplementary Examinations, May - 2016**

**CONTROL SYSTEMS**  
(Common to ECE and EIE)

Time: 3 hours

Maximum Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B**)  
2. Answering the question in **Part-A** is compulsory  
3. Answer any **THREE** Questions from **Part-B**  
(Normal and semi & polar graph sheet are the supplied)

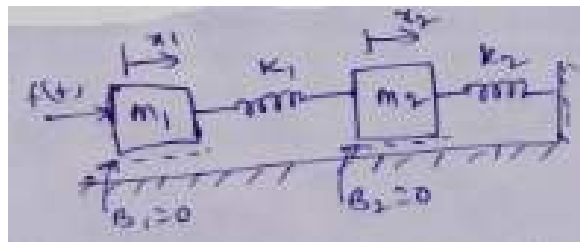
\*\*\*\*\*

**PART -A**

- 1 a) What are the characteristics of negative feedback? [3M]
- b) Compare the AC and DC servomotor. [4M]
- c) What is the effect on system performance when a proportional controller is introduced in a system? [4M]
- d) What are asymptotes? How will you find the angle of asymptotes? [4M]
- e) What is phase and gain crossover frequency? [3M]
- f) Why compensation is necessary in feedback control system. [4M]

**PART -B**

- 2 a) Define open loop and closed loop systems. Mention their merits and demerits. [8M]
- b) Draw the free body diagram and write the differential equations describing the dynamics of the system shown in below figure and obtain the transfer function  $\frac{X_2(s)}{F(s)}$  [8M]



- 3 a) For the system represented by the given equations find the transfer function  $x_5/x_1$  by the help of signal flow graph technique. [8M]

$$x_2 = a_{12}x_1 + a_{13}x_3 + a_{14}x_4 + a_{15}x_5$$

$$x_3 = a_{23}x_2$$

$$x_4 = a_{34}x_3 + a_{35}x_5$$

$$x_5 = a_{45}x_4 + a_{46}x_6$$

Where  $x_1$  is input variable and  $x_5$  is output variable.

- b) Derive the transfer function of field controlled AC Servo motor. [8M]



- 4 a) What is meant by step input, ramp input and impulse input? How do you represent them graphically? [6M]
- b) The open loop transfer function of a unity feedback system is given by [12M]
- $$G(s) = \frac{K}{s(1+Ts)}$$
- Where K and T are positive constant. By what factor should the amplifier gain K be reduced so that the peak overshoot of unit step input of the system is reduced from 75% to 25%.
- 5 a) Draw the root locus plot for a system having open loop transfer functions is [8M]
- $$G(s) = \frac{K}{S(S+1)(s+5)}$$
- b) Using Routh criterion investigate the stability of a unity feedback control system [8M] whose open loop transfer function is given by.
- $$G(S) = \frac{e^{-sT}}{S(S+2)}$$
- 6 a) Construct Bode plot for the system whose open loop transfer function is given below and determine (i) the gain margin (ii) the phase margin and (iii) the closed loop stability [8M]
- $$G(S)H(S) = \frac{4}{S(1+0.5S)(1+0.08S)}$$
- b) Sketch Nyquist plot whose open loop transfer function is given by [8M]
- $$G(S)H(S) = \frac{KS^2}{S^3 + 4S + 4}$$
- and examine closed loop stability in terms of parameter K.
- 7 a) The open loop transfer function of a unity feedback control system is given by [8M]
- $$G(S) = \frac{K}{S(1+0.2S)}$$
- design a suitable compensator such that the system will have  $K_v=10$  and P.M =  $50^\circ$ .
- b) The transfer function of a control system is given by [8M]
- $$\frac{Y(S)}{U(S)} = \frac{S+2}{S^3 + 9S^2 + 26S + 24}$$
- check for controllability and observability.

\*\*\*\*\*

