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# Question Paper Code : 91404

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2014.

Fourth Semester

Electronics and Communication Engineering

EC 2255/EC 46/EE 1256 A/ 080290023/10144 EC 406 — CONTROL SYSTEMS

(Regulation 2008/2010)

(Common to 10144 EC 406 – Control Systems for B.E. (Part-Time) Third Semester – ECE – Regulation 2010)

Time : Three hours                                                                 Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Differentiate open and closed loop control system.

2. Write Mason's gain Formula.

3. What are the various time domain specifications?

4. What is the effect of PI controller on the system performance?

5. Define Gain and phase margin.

6. State the usage of Nichol's chart in control system analysis.

7. Define BIBO stability.

8. What is meant by dominant pole?

9. Define state model of $n^{th}$ order system.

10. What are sampler and hold circuits?

PART B — (5 × 16 = 80 marks)

11. (a) Write the differential equations governing the mechanical translational system as shown in figure 11(a). Draw the Force – Voltage and Force – Current electrical analogous circuits and verify by mesh and node equations. (16)

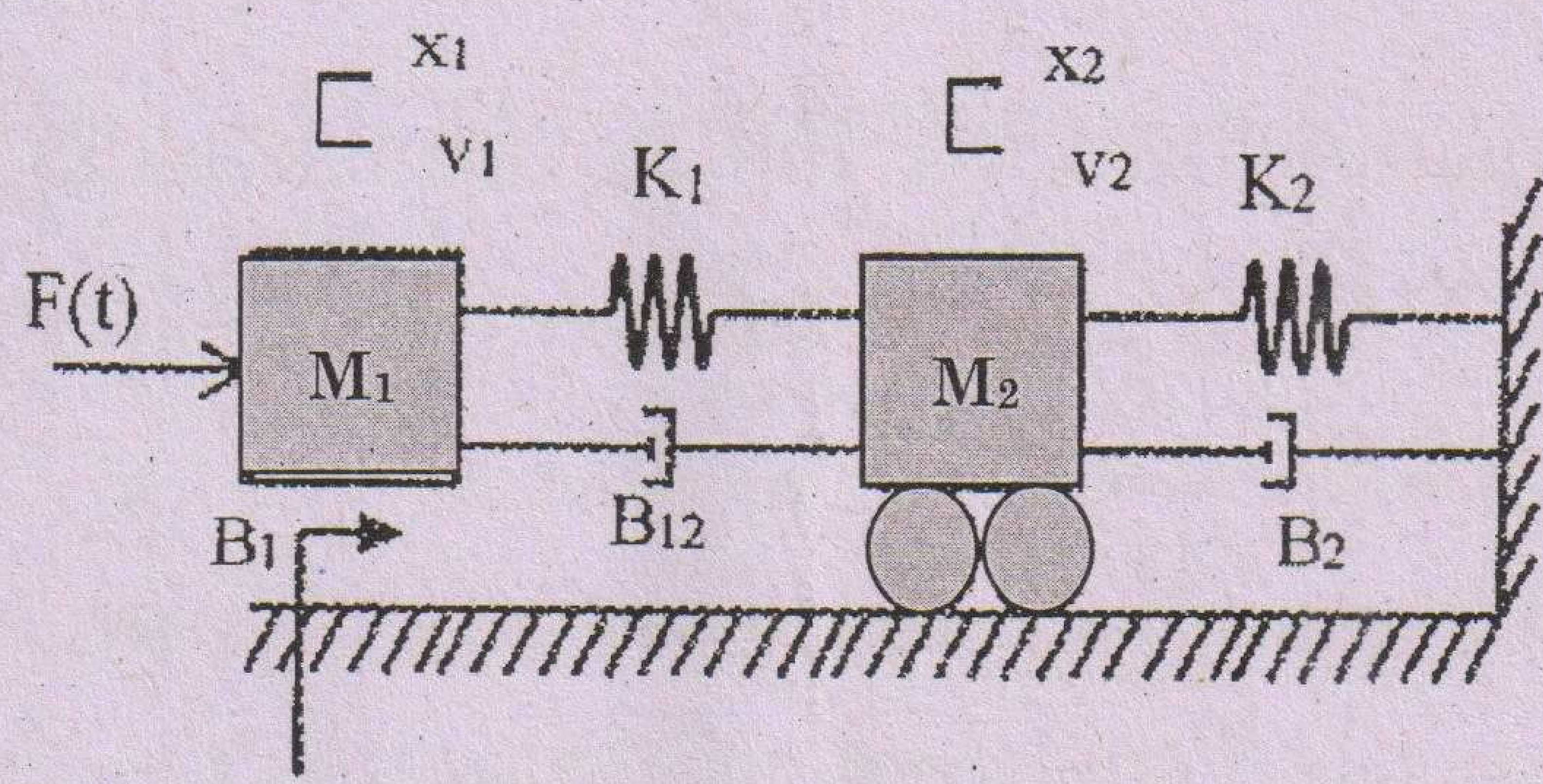


Fig.11(a)

Or

(b) (i) The signal flow graph for a feedback control system is shown in figure 11(b)(i). Determine the closed loop transfer function $C(s)/R(s)$. (12)

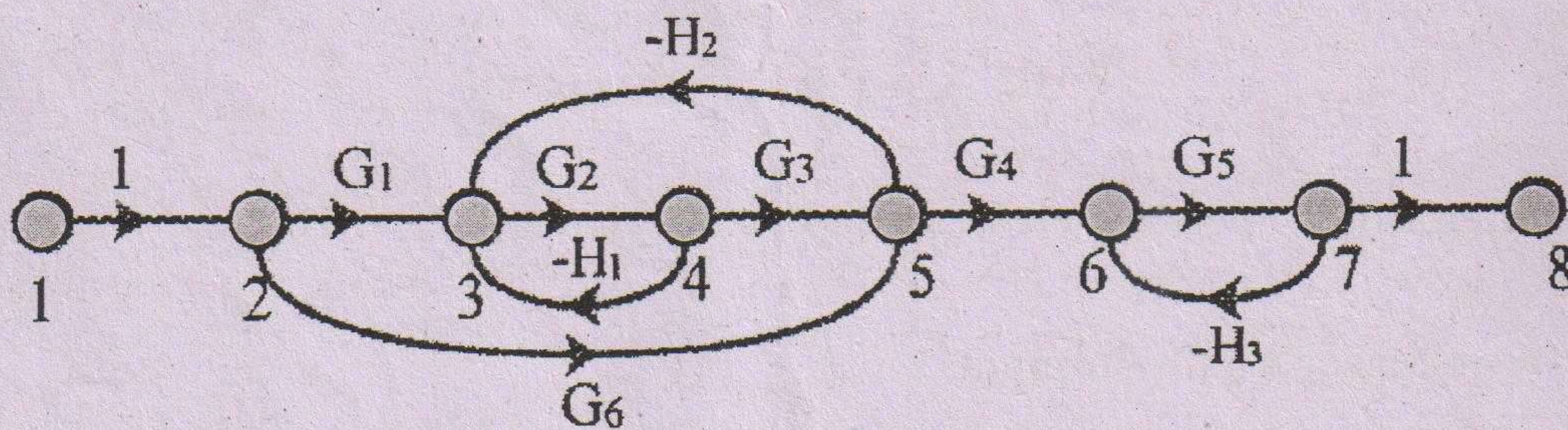


Fig.11(b)(i)

(ii) State any four block diagram reduction rules. (4)

12. (a) (i) What are the various standard test signals? Draw the characteristic diagram and obtain the mathematical representation of all. (8)

(ii) Calculate the following parameters for the system whose natural frequency of oscillations is 10 rad/sec and damping factor is 0.707

(1) Delay time

(2) Rise time

(3) Peak overshoot

(4) Settling time. (8)

Or

(b) (i) Determine the steady state errors for the following inputs 5u(t), 5tu(t), $5t^2u(t)$ to a system whose open-loop transfer function is given by $G(s)=\frac{[100(s+2)(s+6)]}{[(s(s+3)(s+4))]}$. (8)

(ii) With its block diagram explain the concepts of PI and PD compensation. (8)

13. (a) The open loop transfer function of a unity feedback system is given by $G(s)=1/[s(1+s)(1+2s)]$.

Sketch the polar plot and determine the gain and phase margin. (16)

Or

(b) (i) Describe about Lead-lag compensators design procedure. (8)

(ii) Write short notes on constant M and N circles. (8)

14. (a) (i) Obtain Routh array for the system whose characteristic polynomial equation is

$$s^6+2s^5+8s^4+12s^3+20s^2+16s+16=0$$

Check the stability. (8)

(ii) Define Nyquist stability criterion and explain the different situations of it. (8)

Or

(b) Sketch the root locus for the open loop transfer function of unity feedback control system given below. (16)

$$G(s)=k/[s(s^2+4s+13)]$$

15. (a) Test the controllability and observability of the system whose state space representation is given as (16)

$$\begin{bmatrix} X_1 \\ X_2 \\ X_3 \end{bmatrix} = \begin{bmatrix} 0 & 0 & 2 \\ -2 & -3 & 0 \\ 0 & 2 & -3 \end{bmatrix} \begin{bmatrix} X_1 \\ X_2 \\ X_3 \end{bmatrix} + \begin{bmatrix} 0 \\ 2 \\ 0 \end{bmatrix} u$$

$$y=\begin{bmatrix} 1 & 0 & 0 \end{bmatrix} \begin{bmatrix} X_1 \\ X_2 \\ X_3 \end{bmatrix}.$$

Or

(b) (i) State and explain sampling theorem. (4)

(ii) A discrete system is described by the difference equation (12)

$$y(k+2)+5y(k+1)+6(yk)=u(k)$$

$$y(0)=y(1)=0;\ T=1\,\text{sec}.$$

Determine the state model in canonical form. Draw the block diagram.

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