$Y = [1 \quad -1]X$.

Subject to the initial conditions

$X(0) = \begin{bmatrix} 1 \\ -2 \end{bmatrix}$.

Or

(b) (i) Explain sampling theorem (6)

(ii) Determine the controllability of the system. (10)

$$\dot{X} = \begin{bmatrix} -1 & 0 & 2 \\ 2 & 1 & 4 \\ 0 & 3 & 5 \end{bmatrix} X + \begin{bmatrix} 1 \\ -1 \\ 2 \end{bmatrix} U$$

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B.E./B.TECH. DEGREE EXAMINATIONS,NOV/DEC– 2011

REGULATIONS 2008

FOURTH SEMESTER

EC 46 – CONTROL SYSTEMS

ELECTRONICS AND COMMUNICATION ENGIEERING

(Common to Computer Science and Engineering)

Time: Three Hours Maximum:100 marks

ANSWER ALL QUESTIONS

PART–A (10×2=20 marks)

1. Give examples for Open loop systems.
2. State Mason's Gain Formula.
3. What are the different 'Standard Test Signals'?
4. Write equations for steady-state error constants.
5. Define Phase Margin and Gain Margin
6. Draw the pole zero locations for (i) Lead and (ii) Lag compensators.
7. What are 'Dominant Poles'?
8. State Nyquist stability criterion.
9. What is the need for sample and Hold circuit in Discrete control systems?
10. Define Observability.

PART–B (5×16=80 marks)

11. (a) Derive the transfer function $\frac{X_1(S)}{F(S)}$ for the following system show in fig.1. Also obtain its electrical analogous system. (16)

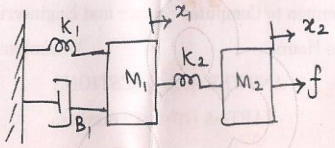

fig.1

Or

(b) Determine C(S)/R(S) for the signal flow graph shown in fig.2 (16)

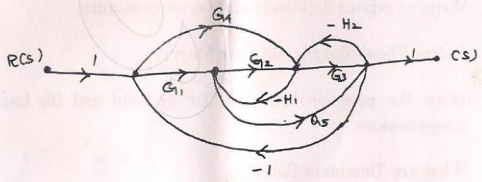

fig.2

12. (a) Determine the damping ratio, natural frequency peak time, peak overshoot, and setting time for the unity feedback system with $G(s) = \frac{12(s+1)}{s(s+4)}$. (16)

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Or

(b) What is the need for compensators? Explain the PI, PD and PID Compensators. With neat characteristics. (16)

13. (a) Sketch Bode plots for the unity feedback system with $G(s)H(s) = \frac{12(s+2)}{s(s+1)(s+4)(s+6)}$ (16)

Or

(b) Given a unity feedback system with $G(s)H(s) = \frac{K}{s(s+2)(s+3)}$. Design a lead-lag compensator to have (16)

(i) overshoot ≤ 10%

(ii) phase margin ≥ 40°

(iii) K_v = 15.

14. (a) Construct the root locus for the unity feedback system with (16)

$$G(s)H(s) = \frac{K}{s(s+1)(s+4)(s+8)}$$

Or

(b) Check the stability of the unity feedback system whose open loop transfer function is $\frac{12(s+2)}{s(s^2+16)}$, by Nyquist stability criterion. (16)

15. (a) Obtain the solution of state equation for following state space model. (16)

$$\dot{X} = \begin{bmatrix} -8 & 6 \\ -6 & 4 \end{bmatrix} X + \begin{bmatrix} 4 \\ -6 \end{bmatrix} U(t).$$

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