SATYAM COLLEGE OF ENGG & TECHNOLOGY
ARALVOIMOZHY 629 301
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Reg. No. :

Question Paper Code : 31360

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2013.

Fourth Semester

Electronics and Communication Engineering

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

(Regulation 2008/2010)

(Bode plot, Graph sheet, Semi – log, Nichol's chart are permitted)

Time : Three hours — Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define Transfer function.

2. Define resistance and capacitance of liquid level system.

3. What are the units of K_p, K_v and K_a?

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

5. Define phase margin.

6. State Nyquist stability criterion for a closed loop system when the open loop system is stable.

7. What are constant M and N circles?

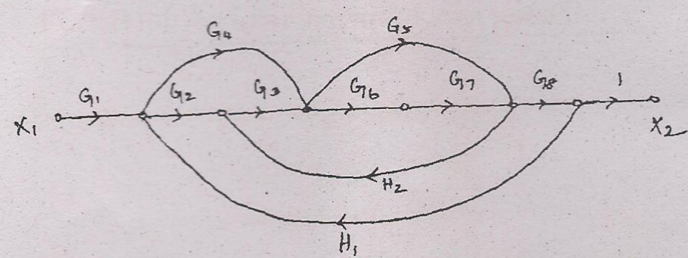
8. State the property of a lead compensator.

9. Define state equation.

10. Give the concept of controllability.

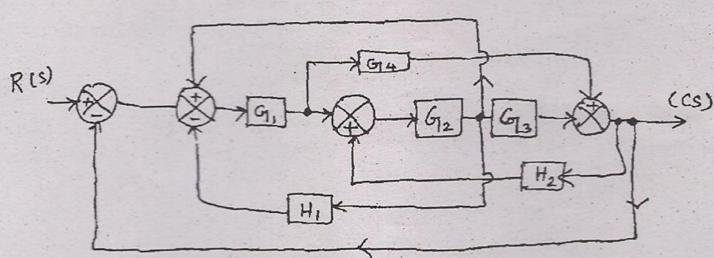
PART B — (5 × 16 = 80 marks)

11. (a) State Mason's Gain formula using Mason's Gain formula to find $\frac{X_2}{X_1}$.

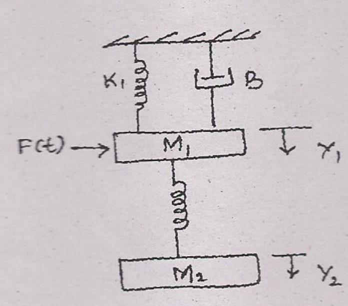


Or

(b) Use Mason's Gain formula to obtain C(S)/ R(S) of the system shown below.



12. (a) Determine the transfer function $\frac{y_2(s)}{F(s)}$ of the system shown in figure.



Or

(b) A unity feed back system is characterized 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 unit. Also determine the damping ratio and natural frequency of the dominant roots.

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13. (a) For the following transfer function draw bode plot and obtain gain cross – over frequency.

$$G(s)=\frac{20}{s(1+3s)(1+4s)}.$$

Or

(b) Discuss in detail about lead and lag networks.

14. (a) Sketch the root locus for $GH(s)=\frac{k(s+2)(s+3)}{(s+1)(s-1)}$.

Or

(b) The open loop transfer function of a unity feedback control 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.

15. (a) For the given state variable representation of a second order system given below find the state response for a unit step input and $\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\end{bmatrix}=\begin{bmatrix}0 & 1\\ -2 & -3\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix}+\begin{bmatrix}0\\ 2\end{bmatrix}[u]\begin{bmatrix}x_1 & (0)\\ x_2 & (0)\end{bmatrix}=\begin{bmatrix}0\\ 1\end{bmatrix}$ by using the discrete – time approximation.

Or

(b) Consider the system with the state equation.

$$\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\\ \dot{x}_3\end{bmatrix}=\begin{bmatrix}0 & 1 & 0\\ 0 & 0 & 1\\ -6 & -11 & -6\end{bmatrix}\begin{bmatrix}x_1\\ x_2\\ x_3\end{bmatrix}+\begin{bmatrix}0\\ 0\\ 1\end{bmatrix}u.$$

Check the controllability of the system.
