Reg. No. :

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B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2016.

Fourth Semester

Electronics and Communication Engineering

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

(Regulations 2008/2010)

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

Time : Three hours   Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. What is the main advantages of closed loop system over open loop systems?
2. Write the mathematical expressions for step input and impulse input.
3. How do you find the type of a system?
4. Find the unit impulse response of system $H(S) = 5/(s + 4)$ with zero initial conditions.
5. What is meant by 'Corner frequency' in frequency response analysis?
6. What is Nichols chart?
7. Write the necessary and sufficient condition for stability in Routh stability criterion.
8. Define Nyquist stability criterion.
9. Define state equation.
10. Give the concept of controllability.

PART B — ($5 \times 16 = 80$ marks)

11. (a) Derive the transfer function of a RLC series circuit.

Or

(b) With a neat diagram, derive the transfer function of a field controlled dc motor.

12. (a) (i) For the system shown in figure 12(a)(i) find the error using dynamic error coefficient method for input $r(t) = 5 + 4t + 7t^2$.

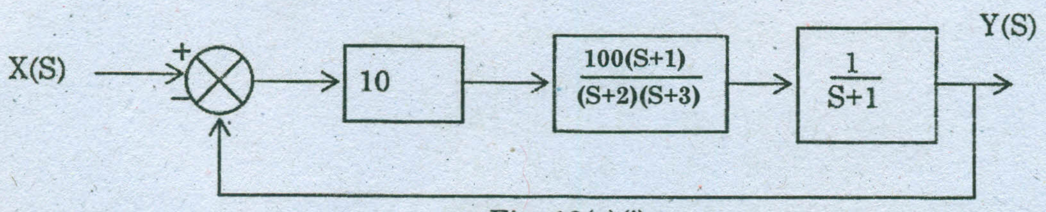

Fig. 12(a)(i)

(ii) Briefly discuss about transient response specifications.

Or

(b) (i) For the system shown in fig. 12(b)(i) find the effect of PD controller with Td = 1/10 on peak overshoot and settling time when it is excited by unit step input.

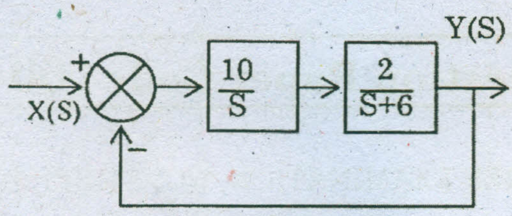

Fig. 12(b)(i)

(ii) Discuss the effect of PI controller in the forward path of a system.

13. (a) Consider a unity feedback open loop transfer function $G(s)=\dfrac{100}{s(1+0.1s)(1+0.2s)}$. Draw the Bode plot and find the phase and gain cross over frequencies, phase and gain margin and the stability of the system.

Or

(b) Explain in detail the design procedure of lead compensator using Bode plot.

14. (a) (i) Determine the range of K for stability of unity feedback system whose open loop transfer function is $G(s)=\dfrac{K}{s(s+1)(s+2)}$ using Routh stability criterion. (6)

(ii) Draw the approximate root locus diagram for a closed loop system whose loop transfer function is given by $G(s)H(s)=\dfrac{K}{s(s+5)(s+10)}$ Comment on the stability. (10)

Or

(b) Sketch the Nyquist plot for a system with open loop transfer function $G(s)H(s)=\dfrac{K(1+0.4s)(s+1)}{(1+8s)(s-1)}$ and determine the range of K for which the system is stable. (16)

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.

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