VASAVI COLLEGE OF ENGINEERING (Autonomous), HYDERABAD B.E. (E.E.E.) III Year I-Semester Supplementary Examinations, May/June-2017

Linear Control Systems

Time: 3 hours

Max. Marks: 70

Note: Answer ALL questions in Part-A and any FIVE from Part-B

Part-A $(10 \times 2 = 20 \text{ Marks})$

- 1. Differentiate between open loop and closed loop control systems with some example from daily life.
- 2. What are the similarities and differences between AC servomotor and 2 phase induction motor?
- 3. Transient response is determined only for a step input but steady state response is determined for all inputs. Explain the reason.
- 4. The block diagram of a unity feedback system is shown in figure1, determine the second undershoot time.

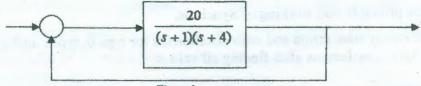
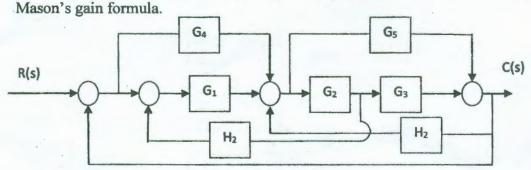


Figure 1

- 5. What is principle of argument?
- 6. Draw the polar plot for the following system: G(s) = 2/(s+1)(s+2)
- 7. Is it possible to represent a purely resistive circuit with state model? Explain the reason.
- 8. Define Observability.
- 9. Explain the relation between S-plane and Z-plane.
- 10. What is the difference between continuous system, discrete time system and digital system?

Part-B $(5 \times 10 = 50 \text{ Marks})$

- 11. a) Derive the transfer function for armature controlled DC servo motor.
 - b) Determine the transfer function C(s)/R(s) of the system shown in figure below by using [6]



- 12. a) Explain the two special cases of Routh-Hurwitz stability criteria.
 - b) Draw the root locus of the unity feedback system whose open loop Transfer function is $G(s) = \frac{K}{s(s+4)(s^2+8s+32)}$

[4]

[4]

13. a) Explain the need for compensation and procedure to design a lead compensator. [5] b) Determine the stability of the following system using Nyquist stability criteria. [5] $GH(s) = \frac{k(s+2)}{s^2(s+1)}$ 14. a) Define state, state variable and state space. [3] b) Find $x_1(t)$, $x_2(t)$ and y(t) of the system described by $\begin{bmatrix} \dot{x}_1(t) \\ \dot{x}_2(t) \end{bmatrix} = \begin{bmatrix} -3 & 1 \\ -2 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 1 \\ 0 \end{bmatrix} u$ [7] and $y = \begin{bmatrix} 0 \\ 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$ where initial conditions are $\begin{bmatrix} x_1(0) \\ x_2(0) \end{bmatrix} = \begin{bmatrix} 1 \\ -1 \end{bmatrix}$, u is unit step input. 15. a) Write Z-domain specifications. [5] b) Determine the stability condition of the discrete data system that is represented by following characteristic equation. [5] $z^3 + 3.3z^2 + 3z + 0.8 = 0$ 16. a) Explain the principle and working of Synchros. [5] b) Determine steady state errors and error coefficients for type 0, type 1 and type 2 systems and write your conclusions after finding all values. [5] 17. Write short notes on any two of the following: a) Determining transfer function from Bode plot. [5] b) Controllability and observability. [5] c) Pulse transfer function. [5]