Ticket Number:

Code No. : 31305 S

VASAVI COLLEGE OF ENGINEERING *(Autonomous)*, HYDERABAD

B.E. (E.C.E.) III Year I-Semester Supplementary Examinations, May/June-2017

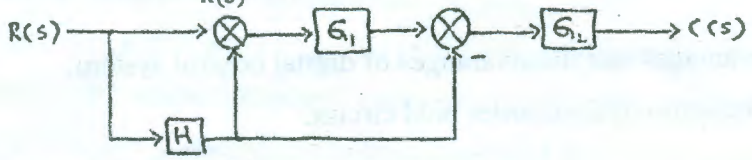
Automatic Control Systems

Time: **3** hours Max. Marks: **70**

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

Part-A (10 × 2 = 20 Marks)

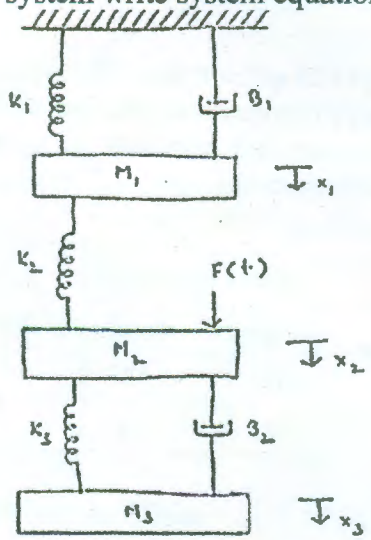
1. Determine transfer function $\frac{C(s)}{R(s)}$ for a given block diagram.



2. Distinguish between AC and DC servomotors.
3. The loop transfer function of a system is given by $G(s)H(s) = \frac{K}{S(S+1)(S+2)}$. Identify the type, order of the system and also find steady state error for unit step input.
4. The open loop transfer function of a unity feedback system is given by $G(s) = \frac{K}{S(S+4)}$. Determine the value of 'K' such that damping ratio is 0.5.
5. Define Gain margin and Phase margin with formulas.
6. Draw the polar plot for phase lag compensator.
7. The characteristic equation of discrete data system is given by $F(z) = Z^2 - Z + 1$. Check the stability of the system.
8. Prove that for a sample data system $G_1G_2(z) \neq G_1(z)G_2(z)$ where G_1 and G_2 are gains of individual blocks of a system.
9. Determine the characteristic equation if system matrix is given by $A = \begin{bmatrix} -5 & 1 & 0 \\ 0 & -5 & 1 \\ 0 & 0 & -5 \end{bmatrix}$ and also comment on stability.
10. Determine state transition matrix if the system matrix is given by $A = \begin{bmatrix} -4 & 0 \\ 1 & -1 \end{bmatrix}$.

Part-B (5 × 10 = 50 Marks)

11. a) For the given mechanical system write system equations. [3]



b) Draw the electrical equivalent circuit using Force-Voltage and Force-Current analogy for the system shown above. [7]

Contd... 2

12. a) The open loop transfer function of a unity feedback system is given by $G(s) = \frac{16}{S(S+4)}$. Determine time domain specifications for a unit step input. [5]

    b) Determine the number of right half plane poles in the closed loop system whose transfer function is given by $T(s) = \frac{10}{S^5 + 7S^4 + 6S^3 + 42S^2 + 8S + 56}$. [5]

13. a) Sketch the bode plot of a system with transfer function $\frac{512(S+3)}{S(S^2+16S+256)}$ and comment on system stability. [7+3]

14. a) What are the advantages and disadvantages of digital control system. [6]

    b) Derive transfer function of Zero order hold circuit. [4]

15. a) Obtain a state model for a system with transfer function $\frac{C(s)}{R(s)} = \frac{2S^2+6S+5}{(S+1)^2(S+2)}$. [5]

    b) Obtain a state model for a system with transfer function $\frac{C(s)}{R(s)} = \frac{2S^3+7S^2+12S+8}{(S^3+6S^2+11S+9)}$ using signal flow graph method. [5]

16. a) Derive the transfer function for field controlled D.C servomotor. [5]

    b) Sketch the root locus for a given loop transfer function $G(s)H(s) = \frac{k(s+2)}{s^2}$. Determine the range of 'k' for the system to be stable. [5]

17. Write short notes on any ***two*** of the following:

    a) Nyquist stability criteria [5]

    b) Controllability and Observability [5]

    c) Pulse transfer function. [5]