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

Automatic Control Systems

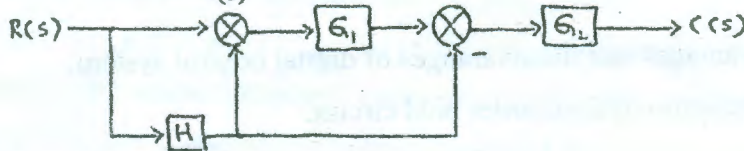
Time: 3 hours

Max. Marks: 70

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

Part-A (10 × 2 = 20 Marks)

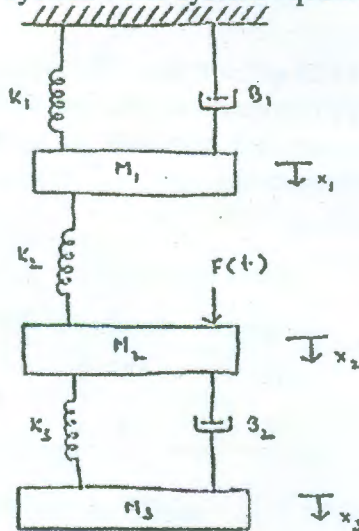
- Determine transfer function $\frac{C(s)}{R(s)}$ for a given block diagram.



- Distinguish between AC and DC servomotors.
- 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.
- 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.
- Define Gain margin and Phase margin with formulas.
- Draw the polar plot for phase lag compensator.
- The characteristic equation of discrete data system is given by $F(z) = Z^2 - Z + 1$. Check the stability of the system.
- 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.
- Determine the characteristic equation if system matrix is given by $A = \begin{pmatrix} -5 & 1 & 0 \\ 0 & -5 & 1 \\ 0 & 0 & -5 \end{pmatrix}$ and also comment on stability.
- Determine state transition matrix if the system matrix is given by $A = \begin{pmatrix} -4 & 0 \\ 1 & -1 \end{pmatrix}$.

Part-B (5 × 10 = 50 Marks)

- 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]

12. a) The open loop transfer function of a unity feedback system is given by $G(s) = \frac{16}{s(s+4)}$. [5]
Determine time domain specifications for a unit step input.
- 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 [7+3]
on system stability.
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 [5]
signal flow graph method.
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 [5]
the range of 'k' for the system to be stable.
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]

