B.E. / B.Tech. (Instrumentation Engineering) Model Curriculum Semester-IV

IN403M / IN403 - Automatic Control System

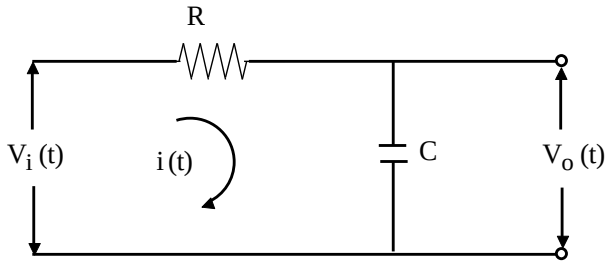
P. Pages : 3 **GUG/W/24/14016**

Time : Three Hours * 5 5 5 7 * Max. Marks : 80

Notes : 1. Same answer book must be used for each section.
2. All questions carry marks as indicated.
3. Assume suitable data wherever necessary.
4. Illustrate your answers wherever necessary with the help of neat sketches.

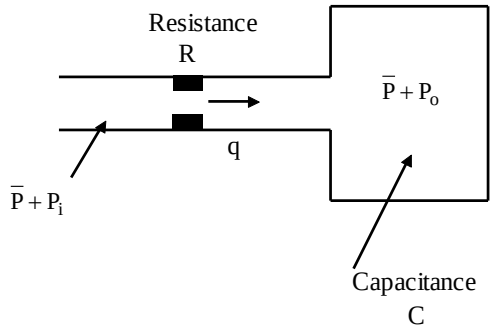
1. a) Discuss open loop and closed loop control system with example in detail. **8**

b) Find out transfer function $V_0(s)/V_i(s)$ of given network. **8**



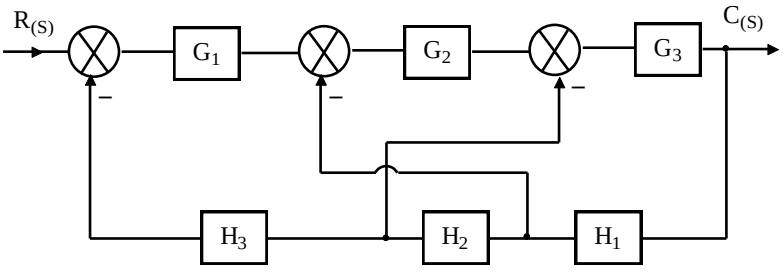
OR

2. a) Do the mathematical modeling of pneumatic system shown in figure and find its transfer function. **8**



b) Define different terms related to control system. **8**

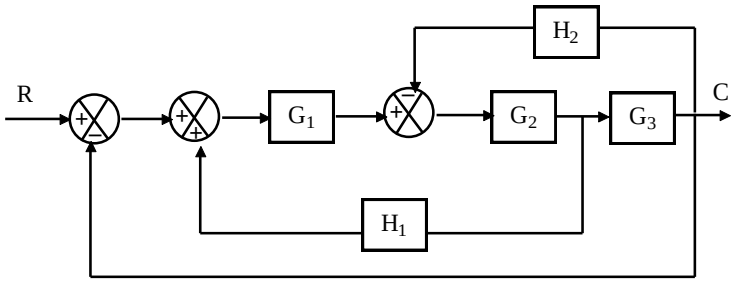
3. a) Find out transfer function of given block diagram using BDRT rules. **8**



b) Briefly explain the steps for constructing the signal flow graph. **8**

OR

4. a) Determine C/R by block, diagram reduction technique. **8**

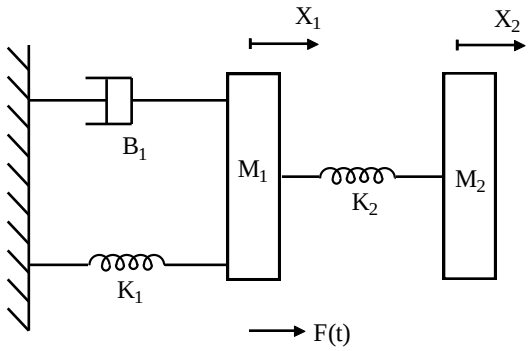


b) For the Mechanical system shown in figure: **8**

i) Draw the mechanical Network

ii) Write the differential equations of performance

iii) Draw the force voltage and force current analogous network.



5. a) Derive the expression for settling time t_s for second order under damped system for step input. **8**

b) Define the steady state error and error constants with respect to unit step, unit velocity and unit acceleration inputs. How can the steady state error be reduced? **8**

OR

6. a) A feedback control system has a forward path transfer function $G(s) = \frac{2}{(s+2)}$ and feedback path transfer function $H(s) = \frac{1}{(s+1)}$. **8**

Determine analytically and show graphically the complete transient response to a unit step input.

b) The overall transfer function of unity feedback control system is given by $C(s)/R(s) = 10/(s^2+6s+10)$. Find the K_p, K_v, K_a as well as steady state error if the input is $r(t) = 1+t+t^2$. **8**

7. a) For what positive value of K will be the characteristic equation given below have oscillatory roots, $s^4 + 4s^3 + 18s^2 + 36s + K = 0$. Also determine the range of K value for system to be stable. **8**

b) Sketch the root locus of the system having $G(s) = \frac{K}{s(s+2)(s+4)}$. Find out open loop gain K and dominant root of system for $\xi = 0.5$. **8**

OR

8. a) Explain all the rules for construction of root locus. **8**

b) Find stability of the system by Routh's criteria. The system characteristics equations $s^5 + s^4 + 2s^3 + 2s^2 + 3s + 5 = 0$. **8**

9. a) The open loop transfer function is given by $G(s)H(s) = K/s(s+1)(s+2)$. Sketch the Bode plot for K=20. **8**

b) Obtain a state space representation of the following system $C(s)/R(s) = (s+3)/(s^2+3s+2)$. **8**

OR

10. a) The open loop transfer function of unity feedback system is given by $G(s) = 2(s+2)/s(1-s^2)$. Sketch the Bode plot. **8**

b) For the system matrix given below compute e^{At}. **8**

$$A = \begin{bmatrix} -2 & 1 \\ 1 & -2 \end{bmatrix}$$

$$A = \begin{bmatrix} -1 & 0 \\ 0 & 3 \end{bmatrix}$$

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