Total No. of Questions :8] *[Total No. of Printed Pages :4*

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EI/IC-605

B.E. VI Semester

Examination, June 2017

Control Systems

Time : Three Hours

Maximum Marks : 70

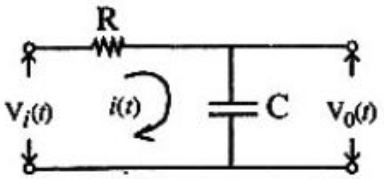
Note: i) Total number of questions Eight.

ii) Answer any five questions.

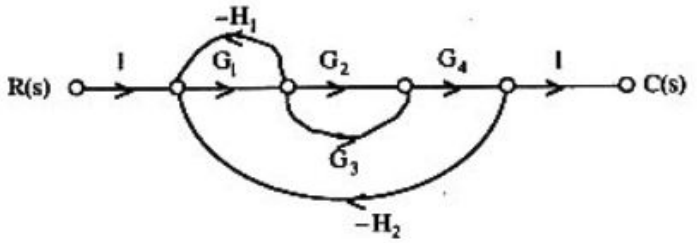
iii) All questions carry equal marks.

1. a) Describe the open-loop and closed-loop system. Also mention the advantages and disadvantages of open-loop and closed-loop control system. 7

   b) Find the transfer function for the following network. 7



2. a) Obtain the transfer function C(s)/R(s) using Mason's gain formula for the signal flow graph shown in fig. 7



   b) Discuss how a.c. servomotor is different from the conventional a.c. motor? Describe the operation and derive the transfer function of a.c. servomotor. Draw its characteristics. 7

3. a) A unity feedback system is having open loop transfer function.

$$G(s) = \frac{k}{s(s+10)}$$

   Determine gain K so that the system damping ratio is 0.5. With this value of K obtain the 9

   i) Setting time t_s

   ii) Peak overshoot Mp

   iii) Overshoot time t_p for a unit step input.

   b) Describe the effect of addition of poles and zeros to the closed loop transfer function. 5

4. a) Define steady state error. Also derive the expression for steady state error for a closed loop unity feedback system. 5

   b) For a system with negative feedback discuss the effect of feedback on the following: 9

      i) disturbance

      ii) System parameter variation

      iii) System time constant

      Obtain mathematical expression in each case.

5. Sketch the Bode plot for the system whose open loop transfer function is given as : 14

$$G(s)H(s) = \frac{20}{s(s+1)(s+4)}$$

Find:

i) Phase margin

ii) Gain margin and then comment on stability.

6. a) What are necessary conditions for stability of a control system? 7

   b) What are the difficulties arising in the Routh-Hurwitz stability criterion? How these difficulties are overcome? 7

7. a) Construct the state model for the following transfer function: 7

$$G(s) = \frac{s+3}{s^2+3s+2}$$

   b) Define control ability of a system. Determine the state controllability of the system described by: 7

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -1 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u$$

8. Write a short notes on the following (any two): 7 each

   a) Digital control

   b) MATLAB

   c) State equation

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