

**Eighth Semester B.E. Degree Examination, Dec.2018/Jan.2019**  
**Control Engineering**

Time: 3 hrs.

Max. Marks:100

**Note: Answer FIVE full questions, selecting at least TWO questions from each part.**

**PART – A**

- 1 a. Explain briefly the requirements of a control system. (04 Marks)
- b. Explain the types of feedback control systems with examples. (10 Marks)
- c. Identify and explain the salient features of a controller that corrects the error to zero. (06 Marks)
- 2 a. Derive the transfer function for the hydraulic system shown in Fig. Q2 (a). (10 Marks)

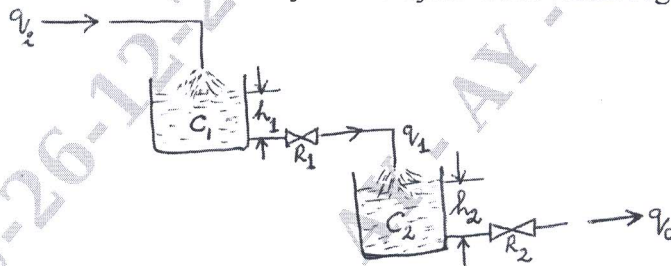


Fig. Q2 (a)

- b. Derive the transfer function for the circuit shown in Fig. Q2 (b). (10 Marks)

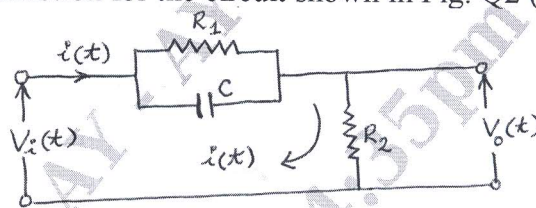


Fig. Q2 (b)

- 3 a. Determine  $\frac{C(s)}{R(s)}$  for the block diagram, shown in Fig. Q3 (a) by using block diagram reduction rules? (08 Marks)

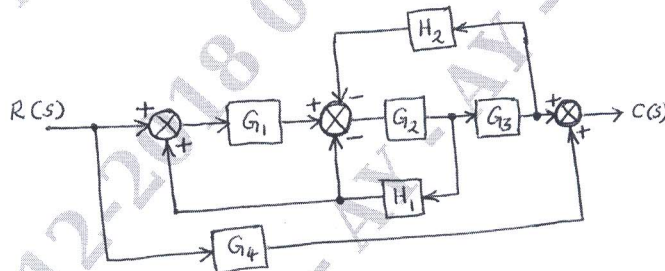


Fig. Q3 (a)

- b. Determine  $\frac{C(s)}{R(s)}$  for the signal flow graph shown in Fig. Q3 (b), using Mason's Gain formula. (12 Marks)

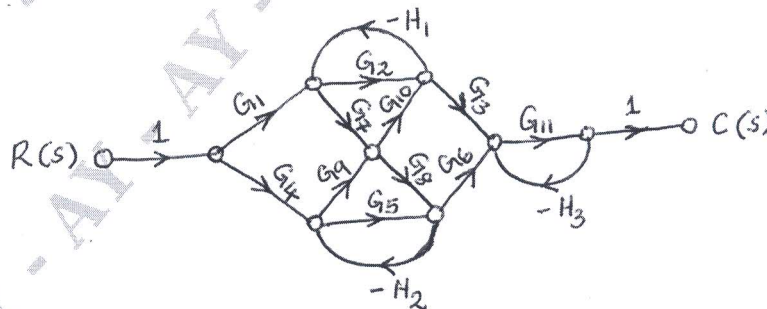


Fig. Q3 (b)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
 2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

- 4 a. Determine the expression for the response of the system shown in Fig. Q4 (a) to a ramp input  $\theta_i = Kt$ . Assume a critically damped system initially at rest. Sketch input versus time and output versus time curves. (10 Marks)

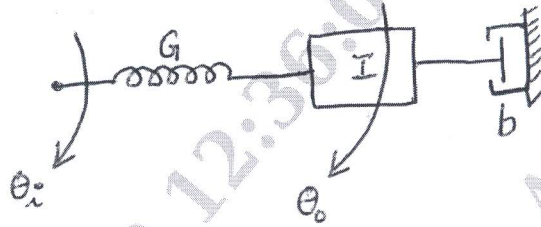


Fig. Q4 (a)

- b. Determine the number of roots in left half plane, right half plane and on the imaginary axis for the characteristic equation  $s^5 + 4s^4 + 8s^3 + 8s^2 + 7s + 4 = 0$  by Routh-Hurwitz criterion. (10 Marks)

**PART - B**

- 5 a. Explain Gain margin and phase margin using a polar plot. (05 Marks)  
b. Plot Nyquist diagram and ascertain the stability of the control system for the given open

loop transfer function  $G(s)H(s) = \frac{100}{s^3 + 8s^2 + 25s + 26}$ . (15 Marks)

- 6 Draw Bode asymptotic attenuation and phase angle diagrams for a system with the open loop transfer function,  $G(s)H(s) = \frac{25(s+2)}{s^2 + 10.5s + 5}$  and establish the nature of stability. (20 Marks)

- 7 For the control system shown in Fig. Q7, draw the Root Locus diagram and comment on the nature of stability of the system. (20 Marks)

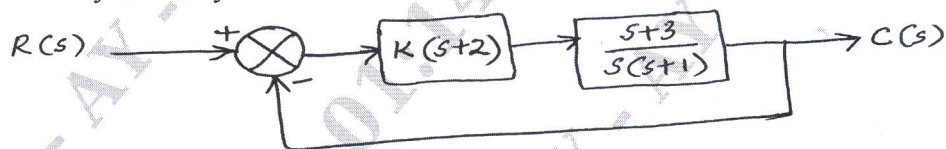


Fig. Q7

- 8 a. Explain the different types of feedback compensation with neat block diagrams. (06 Marks)  
b. Determine the controllability property of control system with state equation,

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \\ \dot{x}_3 \end{bmatrix} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -6 & -11 & -6 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} u(t)$$

- by (i) Kalman's test  
(ii) Gilbert's test.

(14 Marks)

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