USN

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)**

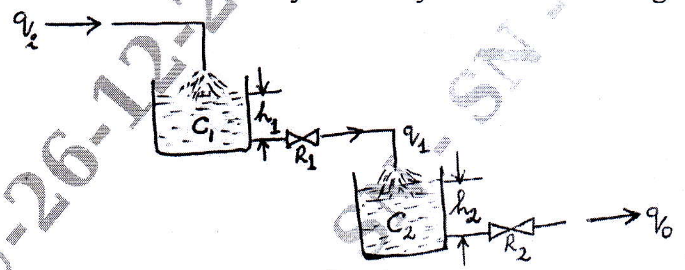

Fig. Q2 (a)

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

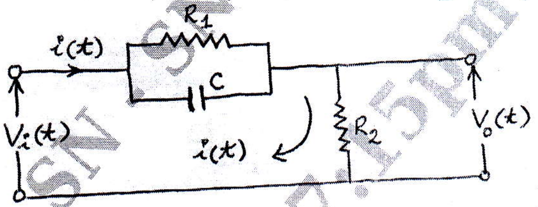

Fig. Q2 (b)

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)**

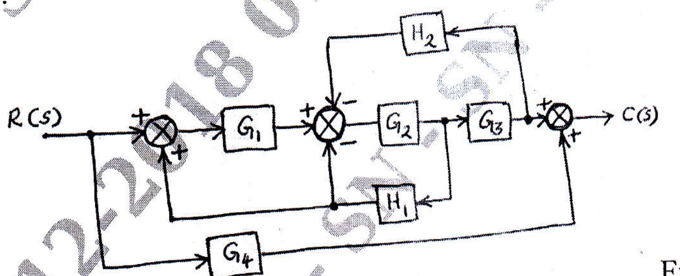

Fig. Q3 (a)

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

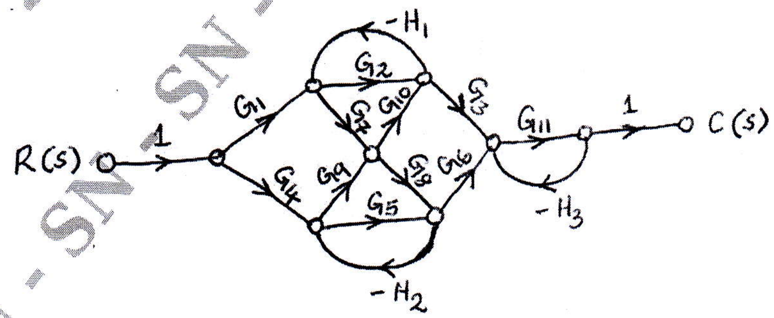

Fig. Q3 (b)

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)**

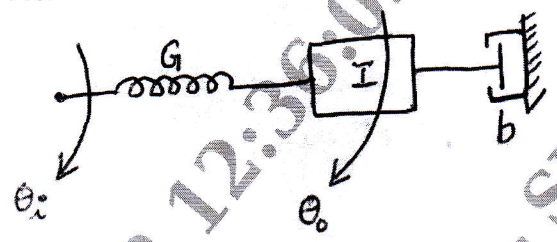

Fig. Q4 (a)

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 $G(s)H(s) = \dfrac{100}{s^3 + 8s^2 + 25s + 26}$. **(15 Marks)**

6 Draw Bode asymptotic attenuation and phase angle diagrams for a system with the open loop transfer function, $G(s)H(s) = \dfrac{25(s+2)}{s^2 + 10.5s + 5}$ 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)**

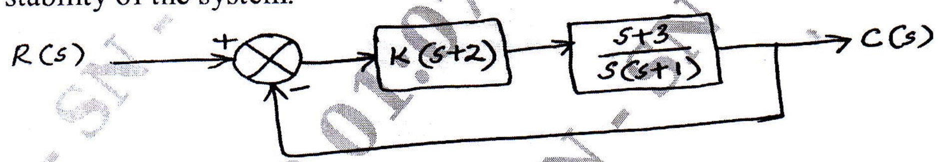

Fig. Q7

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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