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10AE71

Seventh Semester B.E. Degree Examination, June/July 2019
Control Engineering

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Explain the following briefly
(i) plant (ii) process (iii) system (iv) disturbances (v) feedback control. **(10 Marks)**

b. Discuss the requirement of an ideal control system. **(10 Marks)**

2 a. Find the transfer function $X_2(s)/F(s)$ for the system shown in Fig Q2(a).

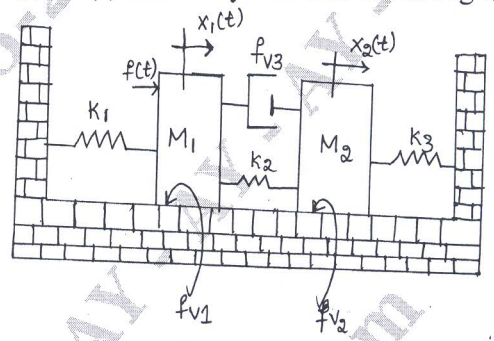

Fig Q2(a)

(10 Marks)

b. Derive the transfer function of an armature controlled d.c motor. **(10 Marks)**

3 a. Determine the transfer function of a system whose block diagram is given in Fig Q3(a). Using the block diagram reduction technique.

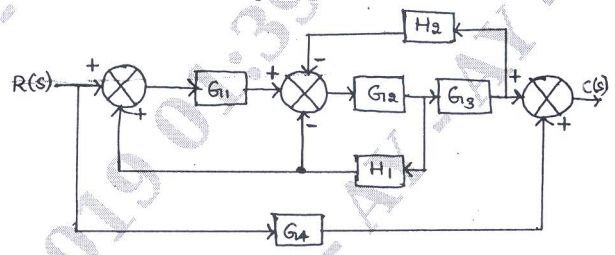

Fig Q3(a)

(10 Marks)

b. Draw the corresponding signal flow graph for the block diagram shown in Fig. Q3(b). Also find $\frac{C(S)}{R(S)}$. **(10 Marks)**

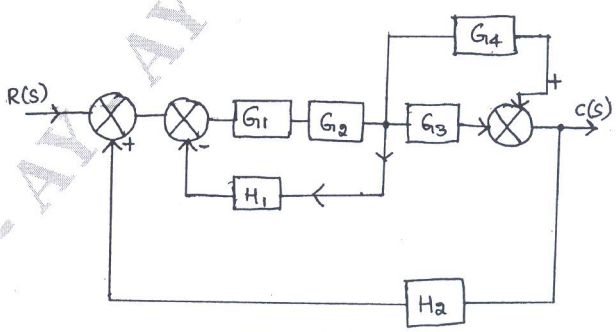

Fig Q3(b)

4 a. Discuss the various standard inputs used in the control system analysis. **(06 Marks)**

b. Derive the expression for unit step response of underdamped second order system. **(08 Marks)**

c. A unity feedback system is characterized by an open-loop transfer function $G(s) = \frac{K}{s(s+10)}$. Determine the gain k, so that, the system will have a damping ratio of 0.5. For this value of k, determine the setting time, peak overshot and time to peak overshot for unit step input. **(06 Marks)**

PART – B

5 a. Sketch the Nyquist plot for system with $G(s)H(s) = \frac{(1+0.5s)}{s^2(1+0.1s)(1+0.2s)}$ .comment on the stability. **(14 Marks)**

b. Explain the use of M and N circles. **(06 Marks)**

6 Construct Bode diagram for a feedback control system having its open loop transfer function. $G(s)H(s) = \frac{100(10s+1)}{s(s+0.4)(s+1)(s+10)}$. Also determine gain margin and phase margin if the system stable. **(20 Marks)**

7 Sketch the root locus of the control system shown in the Fig Q7.

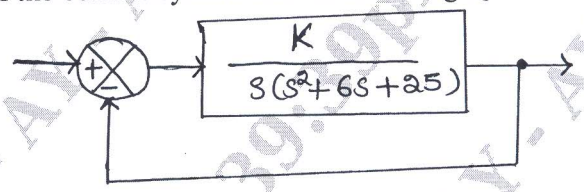

Fig Q7 **(20 Marks)**

8 a. Explain the following :

i) Series compensation

ii) Parallel compensation

iii) Series – parallel compensation. **(12 Marks)**

b. Obtain an expression for the frequency at which the phase lag is at its maximum for lag compensator. Also obtain their corner frequencies. **(08 Marks)**

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