USN | | | | | | | | | | |

10ME82

Eighth 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. What are requirements of an ideal control system? Explain them. **(04 Marks)**

b. Explain with suitable examples regulator system and follow-up system. **(06 Marks)**

c. Discuss, giving equations, the effect of following controller on the system:
   i) Proportional plus derivative controller
   ii) Proportional plus integral controller **(10 Marks)**

2 a. Obtain the transfer function of an armature controlled d.c. motor. **(10 Marks)**

b. Obtain step response of a first order thermal system. **(05 Marks)**

c. Writing Equivalent Analogous System for Force-voltage and Force-Current Analogy. **(05 Marks)**

3 a. Use block diagram reduction to obtain the overall transfer function of the system shown in Fig.Q3(a).

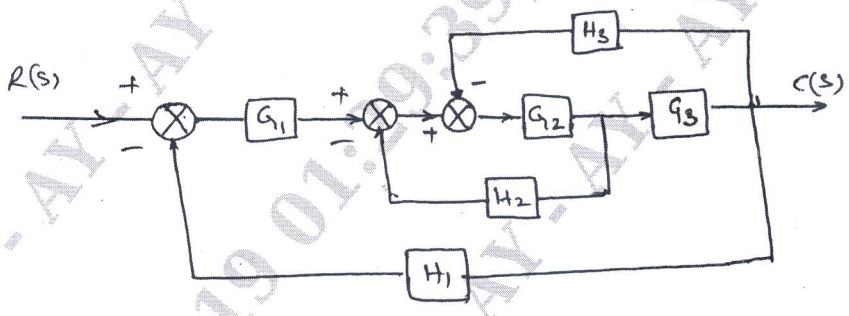

Fig.Q3(a) **(10 Marks)**

b. Obtain the closed loop transfer function $\frac{C(s)}{R(s)}$ for the signal flow graph of a system shown in Fig.Q3(b) by use of Mason's gain formula.

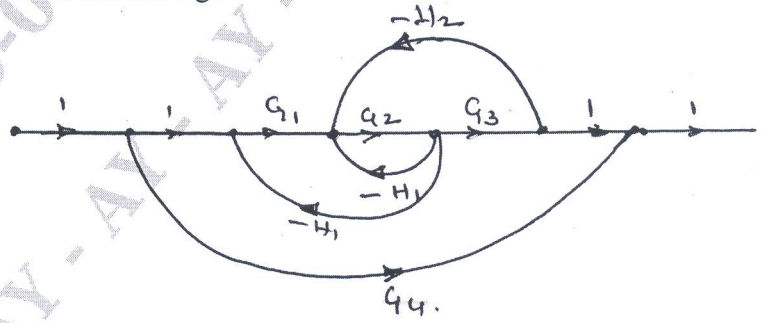

Fig.Q3(b) **(10 Marks)**

4 a. By applying Routh criterion, discuss the stability of the closed loop system whose characteristic equation is $s^6 + 3s^5 + 4s^4 + 6s^3 + 5s^2 + 3s + 2 = 0$. **(06 Marks)**

b. Determine the rise time, peak time, peak overshoot, and setting time for the given transfer function $G(s) = \frac{16}{s(s+2)}$ subjected to unit step function. **(08 Marks)**

c. Derive the response of a first order system, subjected to unit step function input. Explain the importance of time constant on speed of response. **(06 Marks)**

PART – B

5 a. Sketch the polar plot for $GH(s) = \frac{12}{s(s+2)(s+4)}$. **(06 Marks)**

b. Sketch the Nyquist plot for $GH(s) = \frac{10}{s(s+6)(s+8)}$. **(14 Marks)**

6 Sketch the Bode plot of a unity feedback system whose open loop transfer function is given by $G(s) = \frac{20}{s(1+0.1s)(1+0.05s)(1+0.5s)}$ and ascertain its stability. Write gain margin and phase margin. **(20 Marks)**

7 Sketch the root locus plot of a unity feedback with an open loop transfer function $G(s) = \frac{K}{s(s+3)(s+5)}$, find the value of K for stable. **(20 Marks)**

8 a. Write brief note on :
i) Lag compensator
ii) Lead compensator **(10 Marks)**

b. Define state variable and state transition matrix. List the properties of the state transition matrix. **(10 Marks)**

* * * * *