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10ME/PM82

# Eighth Semester B.E. Degree Examination, July/August 2021
## Control Engineering

Time: 3 hrs. Max. Marks:100

**Note:** ***Answer any FIVE full questions.***



1 a. Explain open loop and closed loop control system with an example for each type. **(08 Marks)**

b. What are the requirements of an ideal control system? **(06 Marks)**

c. Mention the characteristics of
   i) proportional controller
   ii) Integral controller
   iii) Derivative controller **(06 Marks)**

2 a. A thermometer is dipped in a vessel containing liquid at a constant temperature of $\theta_i$. The thermometer has a thermal capacitance for storing heat as C and thermal resistance to limit heat flow as R. If the temperature indicated by the thermometer is $\theta_0$. Derive the transfer function of the system. **(10 Marks)**

b. With the help of circuit diagram, obtain transfer function of armature controlled D-C motor. **(10 Marks)**

3 a. Reduce the block diagram as shown in Fig Q3(a) using reduction technique and obtain C(s)/R(s)

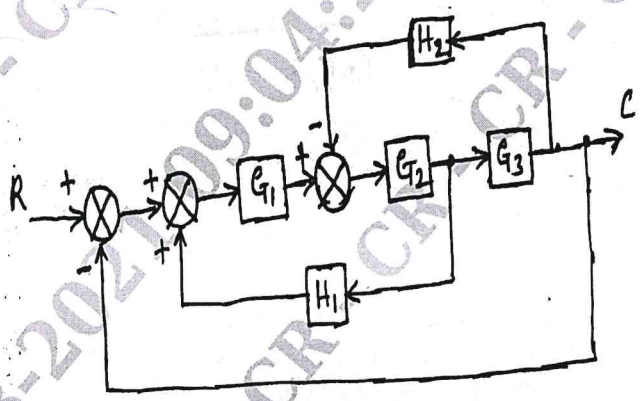


Fig Q3(a) **(10 Marks)**

b. Define following terms related to signal flow graph :
   i) Source node
   ii) Path
   iii) Forward path
   iv) Feedback loop
   v) self loop
   vi) Sink node. **(06 Marks)**

c. State and explain Mason's gain formula. **(04 Marks)**

4 a. Derive an expression for the unit step response of first order system. **(07 Marks)**

b. An unity feedback system has an open-loop transfer function $G(s) = \frac{K}{S(ST+1)}$

i) By what factor amplifier gain K should be multiplied so that damping ratio is increased from 0.2 to 0.8.

ii) By what factor the time constant T should be multiplied so that the damping ratio is reduced from 0.6 to 0.3. **(08 Marks)**

c. Investigate the stability of the system using R-H criterion having the following characteristics equation.

$s^4 + 2s^3 + 3s^2 + 8s + 2 = 0$. **(05 Marks)**

5 Sketch the Nyquist plat for system with

$G(s)\,H(s) = \frac{K}{s(s+2)(s+10)}$. Calculate the range of K for stability. **(20 Marks)**

6 Construct the Bode plat on a semi-log graph paper for a unity feedback system, whose open-loop transfer function is given by

$G(s)H(s) = \frac{10}{s(1+s)(1+0.02s)}$. Determine :

i) Gain and phase cross over frequencies

ii) Gain and phase margin

iii) Stability of the closed loop system. **(20 Marks)**

7 Sketch the root locus for the system having

$G(s)H(s) = \frac{K}{s(s^2+2s+2)}$. For what values of K the system is stable. Comment on stability. **(20 Marks)**

8 a. What is system compensation? Explain briefly the

i) Series compensation

ii) Feedback compensation **(08 Marks)**

b. Explain with a sketch :

i) Lag compensator

ii) Lead compensator. **(12 Marks)**

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