Sem IV (C Scheme) R 2019 Dec '2022
Con CE(S)

14/12/2022

3 Hours   Max. Marks: 80

Instructions:
1. Question number 1 is compulsory.
2. Attempt any three questions from the remaining five questions.
3. Assume suitable data wherever necessary.
4. Figure to the right indicates full marks.

Q1. **Answer any four questions.**   [20]

a) Define time domain specifications of a second order system

b) Construct Signal Flow Graph for the following set of equation:
   Y2 = G1 Y1 – G2 Y4
   Y3 = G3 Y2 + G4 Y3
   Y4 = G5 Y1 + G6 Y3
   where Y4 is the output.

c) Define Gain Margin and Phase Margin.

d) Explain in brief any three criteria for selection of transducers.

e) Draw and explain in brief the block diagram of a Data Acquisition System.

Q2.

a) For the block diagram shown below calculate the transfer function   [10]
   C(s)/R(s) using block diagram reduction technique.
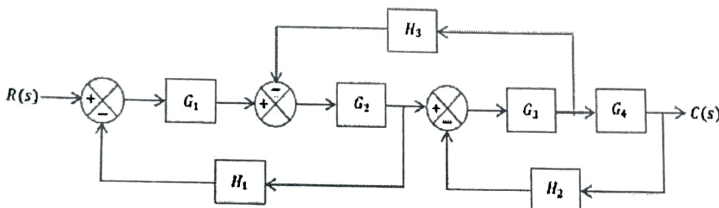
b) For the characteristic equation given below, calculate the range of k (if
   any) for a stable, unstable and marginally stable system. Also calculate   [10]
   the frequency of the system when system is marginally stable.
   Characteristic Equation: $s^4 + 5s^3 + 5 s^2 + 4s + k = 0$

Q3.

a) Draw the Root Locus for the system and comment on the stability.   [10]

$$G(s)H(s) = \frac{k}{s(s+3)(s+6)}$$

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b) Explain working principle, ranges and applications of (i) resistance temperature detectors (RTD) and (ii) thermocouple temperature transducers. **[10]**

Q4.

  a) For the system shown below, sketch the Bode Plot (Magnitude and Phase plot both) and hence find the gain margin and phase margin of the system and comment on the stability. **[10]**

$$G(s)H(s) = \frac{100}{s(s+2)\,(s+25)}$$

  b) For system having transfer function $\dfrac{25}{s^2+6s+25}$, calculate: **[10]**

   (i)   rise time
   (ii)   peak time
   (iii)   maximum peak overshoot
   (iv)   settling time

Q5.

  a) For the system shown below, sketch the Nyquist Plot and comment on the stability. **[10]**

$$G(s)H(s) = \frac{10}{(s+1)(s+2)\,(s+3)}$$

  b) Explain with proper diagrams the working of a SCADA system and its architecture. **[10]**

Q6. **Attempt any four questions.** **[20]**

  a) For a type 0 system, write the values for error constants and steady state error with unit step, unit ramp and unit parabolic input.

  b) Write short note on adaptive control systems.

  c) Write short note on fiber optic instrumentation.

  d) Write short note on strain gauge.

  e) Compare between radio and landline telemetry system.