Duration: 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. Attempt any four questions.   **[20]**

    a) 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.

    b) Distinguish between open loop and closed loop control systems.

    c) Explain in short, any three criteria for selection of transducers.

    d) Explain how stability of a system can be predicted by using Gain Margin and Phase Margin.

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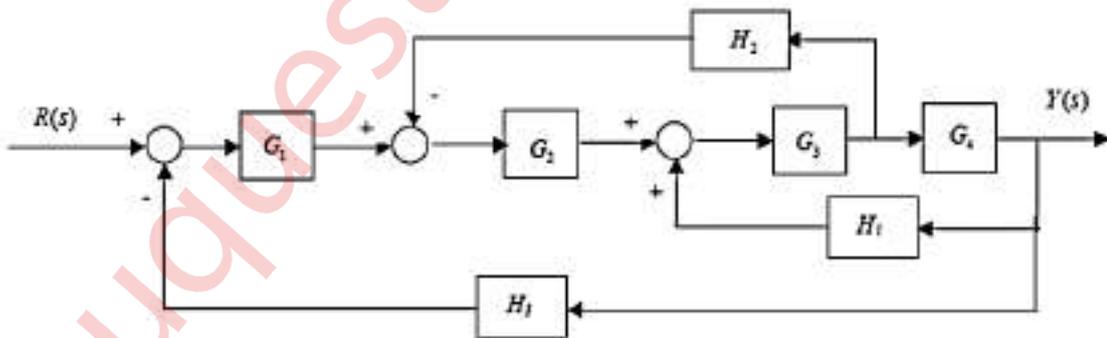
    b) For the characteristic equation given below, calculate the range of k (if any) for a stable, unstable and marginally stable system. Also calculate the frequency of the system when system is marginally stable.   **[10]**
        Characteristic Equation: $s^4 + 5s^3 + 5 s^2 + 4s + k = 0$

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Q3.

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

$$G(s)H(s) = \frac{k(s+3)}{s(s+1)(s+2)(s+4)}$$

b) What is LVDT? With neat diagram explain the principle of working and construction of LVDT. Also explain its application in displacement measurement. **[10]**

Q4.

a) 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

b) List the types of temperature transducers and hence explain the principle of working, construction and application of RTD in detail with proper diagram **[10]**

Q5.

a) Draw the Bode plot and hence find the gain margin and phase margin of the system and comment on the stability. **[10]**

$$G(s)H(s) = \frac{10}{s(s+4)\,(s+10)}$$

b) Draw and explain different type of telemetry system with block diagram. **[10]**

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

   a) Write short note on strain gauge.
   b) For a type 0 system, write the values for error constants and steady state error with unit step, unit ramp and unit parabolic input
   c) Write short note on fiber optic instrumentation.
   d) Write short note on MODBUS protocol.
   e) Write a short note on SCADA.
   f) Write short note on adaptive control systems.

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