

(3 Hours)

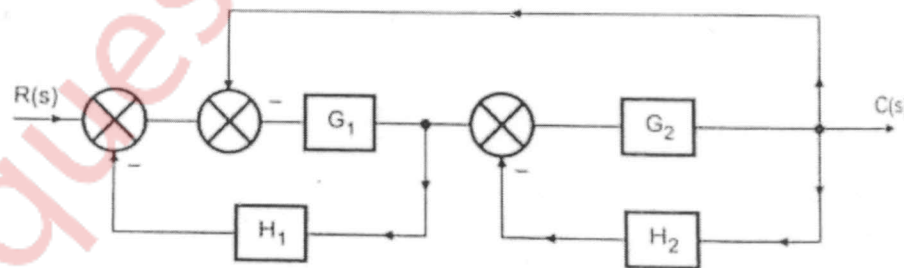


[Total marks: 80]

Instructions:

1. **Question 1 compulsory.**
2. Attempt any **three** questions from the remaining **five** questions.
3. Assume suitable data, **if necessary.**
4. **Figures/sketches** carry weightage.

- Q1) a) Take a suitable example of a Pressure gauge and draw its generalized measuring flow chart explaining every element with function. 10
- b) What are Encoders? With a neat sketch explain the working of an Incremental and Absolute optical encoder. Give examples of their use. 10
- Q2) a) Define Resolution, Precision and Accuracy of a measuring instrument. 7
A moving coil voltmeter has a uniform scale with 100 divisions, the full scale reading is 200v and $1/10^{\text{th}}$ of a scale division can be estimated with a fair degree of certainty. Determine the resolution of the instrument in volt.
- b) What is a Stroboscope? A stroboscope projects 6000 flashes per minute on a disc with 10 patterns mounted on the shaft of a machine. Find the speed of machine if the disc appears stationary and has a single point image. What will be the two possible shaft speeds if 10 points appear to be revolving once in 15 second? Draw your solution. 7
- c) Illustrate the working principle of "L.V.D.T." for displacement measurement. 6
- Q3) a) What are Bi-metallic Thermometers? State the principle of operation and explain with neat diagram the deflection measured in industrial type bi-metallic thermometers. 8
- b) A system is given by differential equation , $\frac{d^2y}{dt^2} + 4\frac{dy}{dt} + 8y = 8x$, 12
where $y = \text{output}$ and $x = \text{input}$. Determine all time domain specifications for unit step input and plot the response curve.
- Q4) a) Obtain the Transfer function for the Block diagram using Standard Block reduction rules. 10



- b) Enumerate the types of pressure measurement devices w.r.t. to pressure levels to be measured. State the working principle of any one transducer for each pressure level. 10

TURN OVER

- Q5) a) A second order system has unit feedback and open loop T.F. $G(s) = 500 / s(s+15)$. 10
- Draw the block diagram for closed loop system and write the characteristic equation.
 - Calculate the Damping ratio and natural frequency, peak time, peak overshoot and setting time for the system output when excited by step input.
 - Sketch the transient response for unit setup input
 - If the input is ramp of 0.5rad/sec, calculate steady state error.
- b) Sketch the Root Locus for the given system having $G(s). H(s) = K(s + 0.5) / s(s^2 + 2s + 2)$. 10
Comment on its stability.
- Q6) a) What do you understand by a State-space modeling of a system? What is its significance for theory and practical applications? Comment. 5
- b) Write a short note on PID controller. 5
- c) A feedback system has $G(s) H(s) = 100 (s+4) / s (s + 0.5) (s +10)$. Draw Bode plot and comment on its stability. 10