



Roll no.

राष्ट्रीय प्रौद्योगिकी संस्थान, हमीरपुर

National Institute of Technology, Hamirpur
B. Tech. (Chemical Engineering) - 5th Semester
End Sem Exam (12th December, 2020)
CHD - 313 Process Dynamic Control

Duration: 120 min

Max. Marks: 50

Note

- *This question paper consists of three questions and one page.*
 - *Attempt all questions.*
 - *Wherever necessary, the diagram drawn should be neat and properly labelled.*
-

- Q1. a) Define transfer function. What is its significance in process control? (3 marks)
- b) A thermometer having a time constant of 0.1 min is at steady state temperature of 90°F. At time $t = 0$, the thermometer is placed in a temperature bath maintained at 100°F. Determine the time needed for the thermometer to read 98°F. (3 marks)
- c) What is a second order system? Explain with respect to U-tube manometer. (4 marks)

- Q2. a) What is a Control Valve? What do understand by shut-off service, divert service and throttling service? Explain with suitable schematic. (5 marks)

Or

- b) What is mathematical modelling? Derive the modelling equations of a CSTR. (5 marks)
- c) Differentiate between interacting and non-interacting systems. (5 marks)

- Q3. a) What is the difference between positive feedback and negative feedback? Describe the effects of feedback on gain, sensitivity and stability. (5 marks)
- b) A second order system has a unity feedback and an open loop transfer function as $G(s) = 500/s(s+15)$, Find the transient response specifications and if the function is subjected to a ramp input of 0.5 rad/second, what is the steady state error? (5 marks)

- Q4. Explain about PI, PD and PID controllers in detail. Derive the transfer functions. (10 marks)

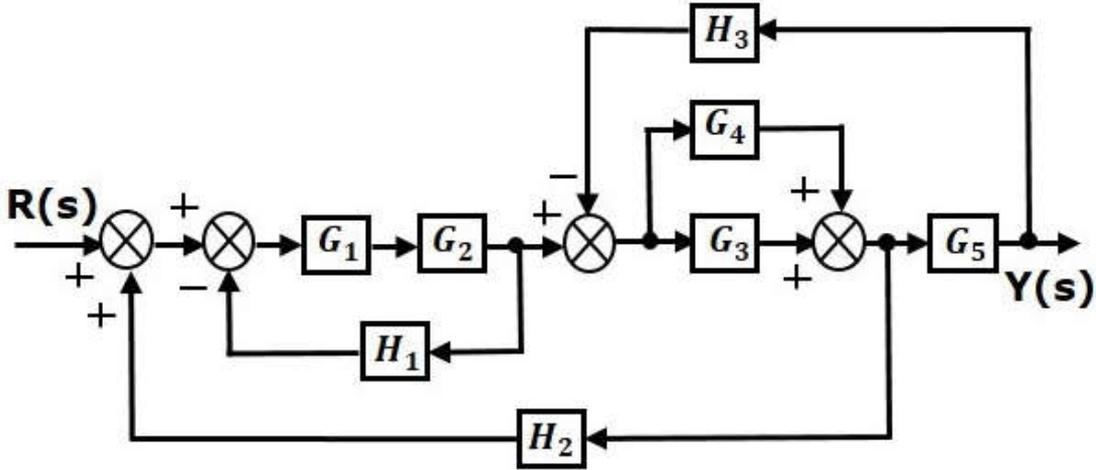
or

Q5. a) What do you understand by ‘Routh Array Stability Criterion’? Using ‘Routh Array Stability Criterion’, determine the stability of the system represented by the characteristic equation:

$$S^4 + 8s^3 + 18s^2 + 16s + 5 = 0$$

b) Explain about ‘Bode Plot’ in detail. What is the procedure to draw a ‘Bode Plot’? (5 marks)

Q6. Reduce the following block diagram in simplified form. (10 marks)



----- END OF THE QUESTION PAPER -----