

(Following Paper ID and Roll No. to be filled in your
Answer Books)

Paper ID : 151613

Roll No.

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B.TECH.

Theory Examination (Semester-VI) 2015-16

PROCESS DYNAMICS & CONTROL

Time : 3 Hours

Max. Marks : 100

Note : i. Attempt all questions

ii. Assume missing data suitably if any.

Section-A

Q1. Attempt all questions. All part carries equal marks.

(2×10=20)

- i. Describe various types of forcing functions for a control system.
- ii. Describe first order system with example.
- iii. Define following:
 - a. Proportional controller
 - b. Proportional Integral Controller
- iv. Describe various variables and physical elements used in process control system using heated tank system.
- v. Define Servo and Regulatory problem.

- vi. Define negative feedback system with example.
- vii. Define following:
 - a. Phase margin
 - b. Gain Margin
- viii. What do you understand by cascade control explain using an example?
- ix. Describe the following:
 - a. Feed forward control
 - b. Feed backward control
- x. Write down the various Ziegler Nicholas settings for controller tuning.

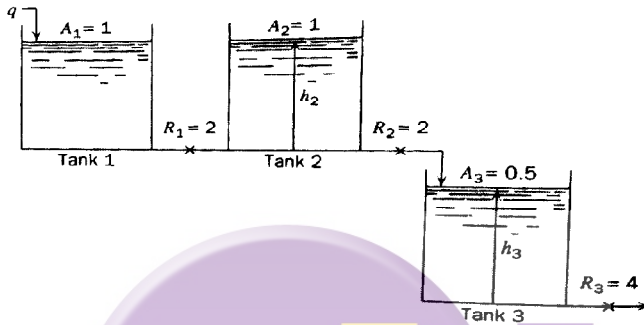
Section-B

Q2. Attempt any five question from this section. (5×10=50)

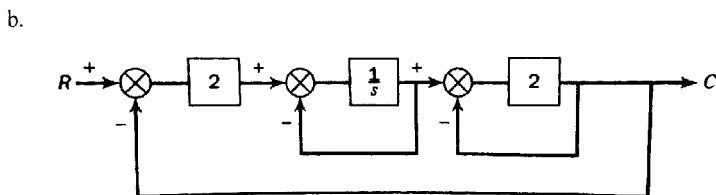
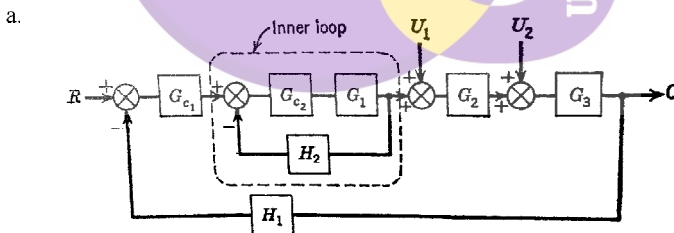
- (a) A mercury thermometer having a time constant of 0.1 min is placed in a temperature bath at 100°F and allowed to come to equilibrium with the bath. At time $t=0$, the temperature of the bath begins to vary sinusoidal about its average temperature of 100°F with an amplitude of 2°F. If the frequency of oscillation is $10/\pi$ cycle/min, plot the ultimate response of the thermometer reading as a function of time. What is the phase lag?
- (b) Derive the first order transfer function for a liquid level tank system with constant flow outlet.

(2)

- (c) Find the transfer functions H_2/Q and H_3/Q for the three tank system shown below. Tank 1 and Tank 2 are interacting. For a unit-step change in q , determine $H_3/(0)$ and $H_3/(\infty)$.



- (d) What is the mechanism of control valve? What is the transfer function for a control valve?
- (e) Determine the transfer function C/R for the following block diagram:



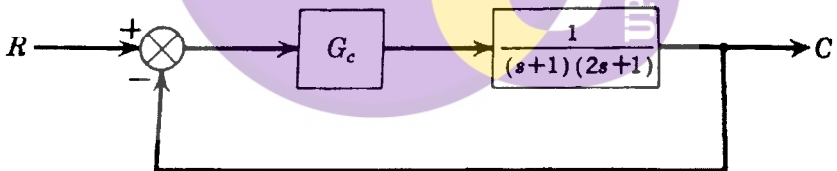
- (f) Derive the relationship for the proportional control for a change in SET POINT and LOAD respectively.
- (g) Given the characteristic equation $s^4 + 3s^3 + 5s^2 + 4s + 2 = 0$ determine the stability by Routh criterion.
- (h) Define following with suitable example:
 - a. BODE plot for first order system.
 - b. Transportation lag

Section-C

Attempt any two questions from this section. (2×15=30)

Q3. Draw the root locus diagram for the system shown below

where $G_c = Kc / (1 + 0.5s + \frac{1}{s})$



Q4. Plot the bode diagram for the system whose overall transfer

function is $\frac{1}{(s+1)(s+5)}$.

Q5. Write down the design equation $D(z)$ for conventional PID controller.