

**B. TECH.**  
**(SEM VI) BACKPAPER THEORY EXAMINATION, 2017-2018**  
**PROCESS DYNAMICS & CONTROL**

*Time: 3 Hours*

*Total Marks: 100*

**Note:** Attempt all Sections. If require any missing data; then choose suitably.

**SECTION-A**

**1. Attempt all questions in brief. 2 x10 = 20**

- (a) Explain stability of a control system.
- (b) Define amplitude ratio.
- (c) Define ‘‘Rise time’’.
- (d) Differentiate between PI and PD controllers.
- (e) Define ‘characteristic equation’.
- (f) Define non-interacting system.
- (g) What do you mean by ‘over damped’?
- (h) Define interacting system.
- (i) Discuss the transportation lag.
- (j) Discuss the limitations of PI controller.

**SECTION-B**

**2. Attempt any three of the following: 10x3 = 30**

- (a) Discuss the term ‘feed-forward control’. With the help of a general block diagram, describe the feedback control of a process.
- (b) What are Initial Value and Final Value theorem and how are they useful in control system analysis? Find the inverse Laplace transform of following

$$f(s) = 7/(s^3 + 3s^2 + 7s + 5)$$

- (c) Validate that by the addition of integral mode in a proportional controller, the offset is completely removed.
- (d) Determine the decay ratio of the response, if a step change of magnitude 2 is introduced in to a system having transfer function:

$$Y(s)/X(s) = 5 / (s^2 + 0.4s + 0.5)$$

- (e) Differentiate between a negative feedback and positive feedback control system with suitable example.

### SECTION-C

3. Attempt any *one* part of the following: **10x1 =10**

- (a) Examine the response of ‘interacting and non-interacting systems in series’ with the help of suitable examples.
- (b) Explain the substitution rule for finding amplitude ratio and Phase difference for a system. Find these for a second order system and for PI and PID controller.

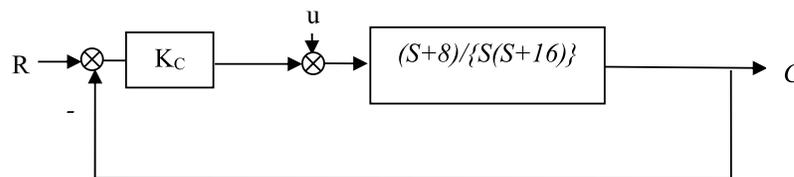
4. Attempt any *one* part of the following: **10x1 =10**

- (a) Discuss the various modes of control action and their response with their limitations and advantage.
- (b) Discuss the Routh’s test for testing the stability of a control system. What other information are obtained by Routh’s theorem about the control system?

5. Attempt any *one* part of the following: **10x1 =10**

- (a) A thermometer having first order dynamics with a time constant of 3 minutes is at 780C. It is placed in a water bath at 980C for 4 minutes and then again placed in a water bath at 800C. Obtain an expression for thermometer reading with respect to time and find temperature shown by the thermometer at (a) 3 minutes and (b) 5 minutes.

- (b) Find the closed loop transfer function  $c(s)/u(s)$  for the following control system. Also find offset for a unit step change in  $u$  if  $K_C = 8$ .



6. Attempt any *one* part of the following: **10x1 =10**

- (a) Justify this statement that “Thick walled thermometer behaves as a second order over damped system”.
- (b) Draw the root locus for a control system having following characteristic equation.

$$1 + \left[ \frac{k(16s+1)}{s(s+4)(s+8)} \right] = 0$$

7. Attempt any *one* part of the following: **10x1 =10**

- (a) Explain the significances of ‘open-loop and closed-loop’ in control system with the help of a simple block diagram.
- (b) Discuss the terms ‘overshoot’ and ‘decay ratio’ as applied to response of a second order system? Obtain the expressions for them in term of  $\tau$  and  $\xi$ .