

Printed Pages : 3



ECH602

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

PAPER ID : 151602

Roll No.

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B. Tech.

(SEM. VI) THEORY EXAMINATION, 2014-15
PROCESS DYNAMICS & CONTROL

Time : 3 Hours]

[Total Marks : 100

Note : Attempt **all** questions. Assume suitable data, if required.
All questions carry equal marks.

1 Attempt any four parts of the following : 5×4=20

- (a) What are the design elements of control system ?
Explain with examples.
- (b) Differentiate between positive feedback and negative feedback control taking suitable examples ?
- (c) A thermometer having time constant of 1 min is initially at 50 °C. It is immersed in a bath maintained at 100 °C at $t = 0$. Determine the temperature reading at $t = 1.2$ min.
- (d) Discuss the principle characteristics of the first-order system and describe the physical meaning of the time constant for the first order system.
- (e) What is the importance of initial and final value theorem in the study of process dynamic control ?
- (f) Find the inverse Laplace of $Y(s) = 1/S^2(S+1)$.

2 Attempt any two parts of the following : 10×2=20

- (a) Derive transfer function of single tank liquid level system. Draw a suitable sketch.
- (b) Consider a second order system with following transfer function

$$Y(s) / X(s) = 16 / (1.5S^2 + 2.4S + 6)$$

Introduce a step change of magnitude 6 into the system and find

- (i) Percent overshoot
- (ii) Decay ratio
- (iii) Ultimate value of y (t)
- (iv) Rise time
- (c) Discuss the characteristics of under damped response and plot the graph of overshoot and decay versus damping factor.

3 Attempt any two parts of following : 10×2=20

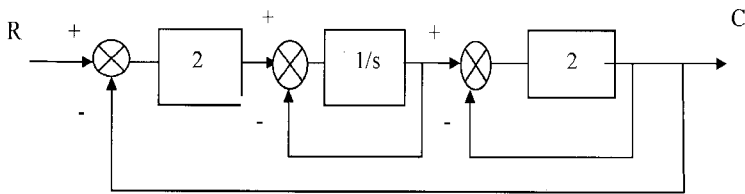
- (a) Differentiate between servo control problem and regulator control problem with the help of suitable examples ?
- (b) What are the modes of control action ? Discuss the advantages and limitations.
- (c) Explain the response of a closed loop control system for various types of control actions.

4 Attempt any two parts of the following : 10×2=20

- (a) Explain the Routh test for stability of a control system ? Check the stability of system described by following equation.

$$S^4 + 3S^3 + 5S^2 + 4S + 2 = 0$$

- (b) Evaluate the amplitude ratio and phase difference for the following by substitution rule :
- First order and Second order system
 - PI and PD controller
- (c) Find the transfer function $C(s)/R(s)$ of the system shown in figure.



5 Attempt any two parts of the following : 10×2=20

- Draw a neat sketch and explain
 - Feed-back control action
 - Feed-forward control action.
- Explain the Ziegler-Nichols settings result from closed loop considerations, where as the cohen-coon settings are determine the open loop response of the control system.
- Explain the analysis of cascade control. Name the main advantage and disadvantage of cascade control.