

Sixth Semester Examination – 2008

PROCESS DYNAMICS AND CONTROL

Full Marks – 70

Time : 3 Hours

Answer Question No. 1 which is compulsory and any **five** from the rest.

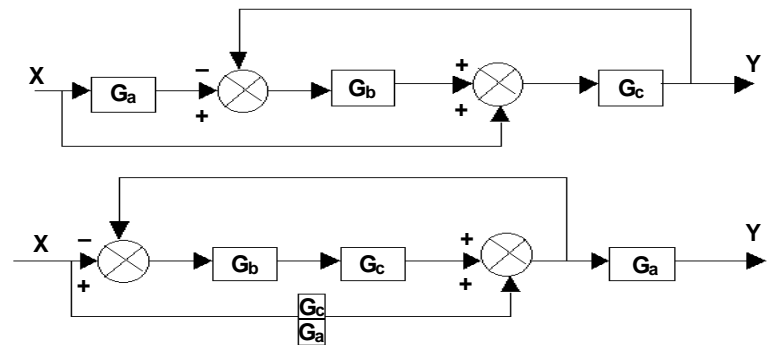
The figures in the right-hand margin indicate marks.



1. Answer the following questions : 2×10
 - (a) What are the objectives of a control system ?
 - (b) Define first order system and write down its characteristics.
 - (c) What do you mean by reset time ?

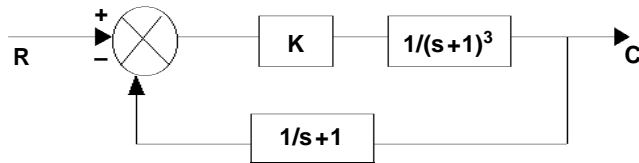
- (d) Which is faster, close loop response or open loop response of a first order system for both load and set point changes ?
- (e) What is the effect of derivative control on order of response ?
- (f) Explain stability of a system.
- (g) Distinguish between servo problem and regulator problem.
- (h) Define gain margin and phase margin.
- (i) What is the meaning of controller tuning ?
- (j) How does offset vary with time ?

2. Find the overall transfer function for the feedback control systems given below : 10



3. What is the characteristics equation for the following system ? Determine the value of K for which system is unstable by using Routh's test.

10



4. Sketch the root locus plot for

$$1 + \frac{K}{s+1} = 0. \quad 10$$

5. Define frequency response. Derive an expression for amplitude ratio and phase angle for the transfer function $Gaf = \frac{1}{s^2 - 1}$. What is Bode's stability criterion ?

2+5+3

6. A mercury thermometer having a time constant of 0.1 minute 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 sinusoidally about its

average temperature 100 °F with an amplitude of 20 °F. If frequency of oscillation is 10 π cycles per minute, then what will be the response of thermometer reading as a function of time ? 10

7. Describe the construction and characteristics of control valve in details with neat diagram. 10

8. Write short notes on any *four*: 2.5×4

- (a) Cascade control
- (b) Feedforward control
- (c) Dead time compensation
- (d) Ratio control
- (e) Internal model control.