



SE-7327

B. E. IV (Sem. VII) (Chemical) Examination
April / May – 2011
Process Control

Time : 3 Hours]

[Total Marks : 100

Instructions :

(1)

नीचे दशांशिक निशानीवाणी विगतो उत्तरवडी पर अवश्य लभवी.
Fillup strictly the details of signs on your answer book.

Name of the Examination :
B. E. 4 (Sem. 7) (Chemical)

Name of the Subject :
Process Control

Subject Code No. : 7 3 2 7 Section No. (1, 2,.....): Nil

Seat No. :

Student's Signature

(2) Assume suitable data if necessary.

(3) Draw a neat sketch wherever necessary.

(4) Figures to the right of each question indicate full marks.

1 (a) Answer the following : 10

- (1) Define non-interacting system.
- (2) Derive the Laplace transform of function $\cos kt u(t)$.
- (3) What is final value theorem ?
- (4) What is initial value theorem ?
- (5) Write the transfer function of following block diagram.



(b) Derive the transfer function equation of a monometer system. 8

2 Attempt any two of the following : 16

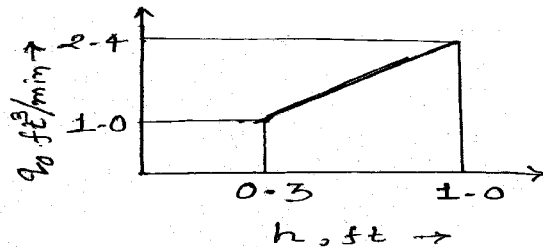
- (a) Derive the transfer equation for mixing process.
- (b) Derive the transfer function for two non interacting tank in series.

- (c) Derive transfer function for 1st order system using mercury in glass thermometer to a step forcing function and impulse forcing function.

3 Answer the following : (any two)

16

- (a) Write short notes on initial and final value theorem.
 (b) A thermometer having a time constant of 1 min is initially at 50°C. It is immersed in a bath maintained at 100°C at time $t = 0$. Determine the temperature reading at $t = 1.2$ min.
 (c) A tank having a cross-sectional / area of 2ft² is operating at steady state with an inlet flow rate of 2.0 cfm. The flow-head characteristics are shown in below figure.



- (i) Find the transfer function $H(s) / Q(s)$.
 (ii) If the flow to the tank increases from 2.0 to 2.2 cfm according to a step change, calculate the level h after two min the change occurred.

4 (a) Fill in the blanks :

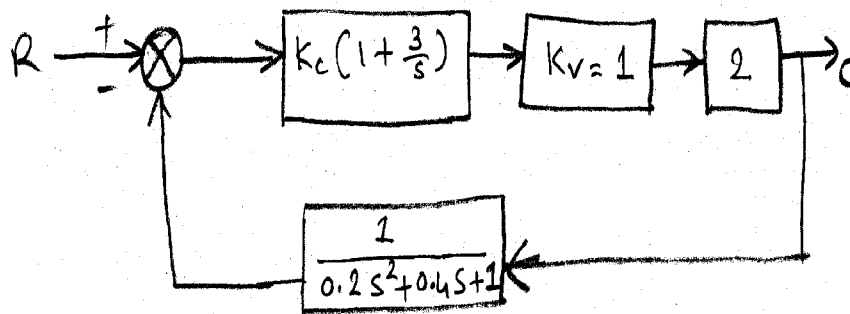
10

- (i) The bandwidth of an ON-OFF controller is approximately _____ .
 (ii) The transfer function P-I-D controller is _____ .
 (iii) The phase angle for the sinusoidal response of a first order system at corner frequency is _____ .
 (iv) _____ controller has maximum offset.
 (v) Stability of a control system containing a transportation lag can be best analysed by _____ response.
 (vi) A negative gain margin expressed in decibels means _____ system.
 (vii) The transfer function of second order system is _____ .
 (viii) Bode stability method uses _____ loop transfer function.
 (ix) Load variable in an endothermic CSTR is _____ .
 (x) The amplitude ratio (AR) of units corresponds to _____ decibels.

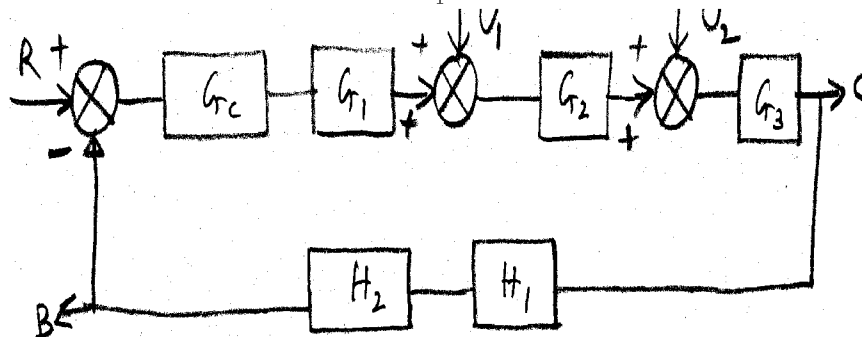
- (b) Differentiate between servo problem and regulator problem. 5
- (c) Discuss the transfer function for the proportional control. 5

5 Attempt any two : 2×7=14

- (a) By means of the Routh test, determine the stability of the system shown in figure when $k_c = 2$.



- (b) Determine the transfer functions C/R , C/U_1 and B/U_2 for the system shown in Fig. Also determine an expression for C in terms of R and U_1 .



- (c) Derive the transfer function for a process in a stirred tank heater.

6 Write short notes : (any four) 4×4=16

- (a) "Rise and response time" for step response of an underdamped second order system.
- (b) Graphical rules for Bode diagrams.
- (c) Theorems of the Routh test.
- (d) Cascade control
- (e) Gain margin and phase margin.