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QUESTION BANK (DESCRIPTIVE)

Subject with Code : PROCESS DYNAMICS AND CONTROL(16EE7508)

Course & Branch: M.Tech – CS **Year & Sem:** I-M.Tech & II-Sem **Regulation:** R16

UNIT –I

1.(a) Give an illustrative examples on blending process. (L1) (5M)
(b) Explain continuous batch process. (L1) (5M)

2. Explain about different types of processes in detail (L2) (10M)

3. Explain various conservation laws useful for mathematical modeling. (L3) (10M)

4. Explain about continuous, semi batch and batch process in detail. (L1) (10M)

5. (a) Define ‘process’, ‘controlled variable’, ‘manipulated variable’, and ‘disturbance variable’ giving suitable examples. (L2) (5M)
(b) Compare and contrast various process control strategies with reference to any one physical example. (L2) (5M)

6. (a) What is process control? What are the various control processes? (L2) (5M)
(b) Write the different steps involved in developing dynamic models? (L5) (5M)

7. Classify the control strategies for process control and explain with an example. (L1) (10M)

8. A stirred tank blending process is operating with W1 = 600 kg/min, W2 = 2 kg/min and x1 = 0.05. The liquid volume and liquid density are constant, 2 m3 and 900 kg/m3 respectively.
(i) Calculate the initial steady state value of the exit composition, x(0).
(ii) Calculate the exit composition response to a step increase in inlet concentration x1 from 0.05 to 0.075.Use the initial steady state composition calculated in part (i).
(iii) Calculate the approximate exit composition response to a sudden change in W2 and from 2 kg/min to 1 kg/min. Again use the original steady state value of x(0). (L4) (10M)

9. (a) Discuss the various approaches for designing control system with the help of neat block diagrams. (L2) (5M)
(b) Explain the blending process in detail. (L2) (5M)

10. Mention various elements involved in the process control and explain their function with neat block diagram. (L2) (10M)

UNIT –II

1. Explain about various process controllers in detail (L2) (10M)

2. (a) Explain the standard block diagram and its alternative form of a feedback control system. (L2) (5M)

   (b) Derive the closed loop transfer function for set point changes. (L4) (5M)

3. Explain How non-linear system could be linearized. (L4) (10M)

4. (a) What is the differential equation model of the series PID controller? Qualitatively describe its response to a step change in e(t). (L3) (5M)

   (b) What are the features of smart sensors? (L2) (5M)

5. Derive the transfer function for a blending process. (L3) (10M)

6. Explain about closed loop response of simple loop control systems with an example.(L4) (10M)

7. Develop the transfer function for CSTR blending process. (L3) (10M)

8. Discuss feed back controllers with CSTR heater example. (L2) (10M)

9. Discuss a typical process transducer in detail. (L2) (10M)

10. (a) What are ‘proportional kick’ and ‘derivative kick? How can they be reduced? Explain. (L4)(5M)

    (b) How is digital version of analog PID controller developed? Obtain the position form of digital PID controller. What is its disadvantage? (L4)(5M)

UNIT –III

1. Discuss Routh stability criterion for time delay systems. (L4) (10M)

2. Give the expression for digital version of PID controllers. (L2) (10M)

3. Explain the following (L1) (10M)
   (i) P controller (ii) PI controller (iii) PID controller

4. Draw root locus diagram for control system that have open loop transfer function
   G(S) =4kc /(s+1)(s+2)(s+3) (L4) (10M)

5. (a) Discuss the important performance criteria for closed loop system. (L2) (5M)
   (b) Use the direct synthesis method to calculate the PID controller settings for the process:
   $$G(s) = \frac{2e^{-s}}{10s+1)\,(5s+1)}$$
   Desired closed loop time constant = 1s. Derive the formulae used (L5) (5M)

6. Consider a process G(s)= $\frac{0.2}{(-s+1)}$, That is open loop unstable. If G_V=1, G_M=1 , determine whether a proportional controller can stabilize the closed loop system. (L5) (10M)

7. (a) Derive closed loop transfer function for a blending system. (L4) (7M)
   (b) Derive closed loop transfer function for a blending system when set point changes.(L1) (3M)

8. (a) Explain the direct synthesis method used for designing PID controllers in detail. What is its limitation? (L4) (5M)
   (b) Compare the different controller design relations based on performance criteria. (L5) (5M)

9. Describe the mathematical approach of tuning PID controller parameters through Internal Model Control method. [L4] (10M)

10. For an open loop system G(s)=($Ke^{-\theta s}$)/((τs+1)) derive PID controller parameters through Internal Model Control method. [L3] (10M)

UNIT –IV

1. How Process reaction curve method differs from Ziegler-Nichols method and discuss its importance. (L5)(10M)

2. Compare and contrast Feed Forward control with Feed Back control. (L4)(10M)

3.Explain how the PID controller parameters are tuned by Ziegler-Nichols method.(L2)(10M)

4. Design Feed Forward controller in combination of Feed Back controller for any one application. (L4)(10M)

5. Explain how the PID controller parameters are tuned by Process Reaction Curve method. (L2)(10M)

6. Explain how feed forward controller implemented and discuss its advantages and discuss its advantages. (L3)(10M)

7. Explain how the PID controller parameters are tuned by 1/4th decay ratio method. (L2)(10M)

8. (a) What is a feed forward control? What are the disadvantages of feed forward control? Compare feed forward and feedback controls. (L5)(5M)
   (b)What are the configurations for feed forward – feedback control? (L2)(5M)

9. (a) Write a detailed note on “Troubleshooting control loops”. (L2)(5M)
   (b)Describe the ‘step test method’ for on-line tuning of controller parameters. What are its demerits? (L2) (5M)

10. (a) Explain any one method for ratio control. (L2) (5M)
    (b) Show that lead-lag units can provide reasonable approximations to ideal feed forward controllers. (L3) (5M)

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UNIT-V

1. Discuss multivariable control techniques. (L2) (10M)

2. Discuss how to reduce control loop interactions. (L2) (10M)

3. Explain control loop interaction (L2) (10M)

4. Discuss decoupling of control systems (L2) (10M)

5 (a) Explain any two physical examples of multivariable control problems. (L2) (4M)
   (b) A process has the transfer function matrix:

$$\begin{bmatrix} \frac{5e^{-5s}}{4s+1} & \frac{2e^{-4s}}{8s+1} \\ \frac{3e^{-3s}}{12s+1} & \frac{6e^{-3s}}{10s+1} \end{bmatrix}$$

Find the expressions for ideal decouplers and indicate how they can be simplifies based on practical considerations. (L4)(6M)

6. (a) Discuss the various physical examples of multivariable control problems. (L2)(4M)
   (b) A process has the transfer function matrix.

$$G_P = \begin{bmatrix} \frac{5e^{-5s}}{4s+1} & \frac{2e^{-4s}}{8s+1} \\ \frac{3e^{-3s}}{12s+1} & \frac{6e^{-3s}}{10s+1} \end{bmatrix}$$

Find expression for the ideal decouplers and indicate how they can be simplified based on practical considerations. (L4)(6M)

7. (a) Explain the strategies for reducing control loop interactions. (L2) (5M)
   (b) Discuss various multivariable control techniques in detail. (L2) (5M)

8. Discuss pairing of controlled and manipulated variables. (L2) (10M)

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