Reg. No. :

Question Paper Code: 41554

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2016

Fifth Semester

Electronics and Instrumentation Engineering

14UEI504 - PROCESS CONTROL INSTRUMENTATION

(Regulation 2014)

Duration: Three hours   Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. The variable used to maintain the controlled variable at its set point is called

     (a) controlled variable   (b) manipulated variable
     (c) set point variable   (d) process variable

2. Dead time is also called

     (a) pure delay   (b) transport lag
     (c) distance-velocity lag   (d) all of the above

3. A controller is used to

     (a) reduce the error by generating a correction signal to the final control element
     (b) eliminate the disturbance by generating a correction signal to the final control
          element
     (c) both (a) and (b)
     (d) none of these

4. In Proportional control

     (a) the output of controller is directly proportional to the error
     (b) the output of controller is inversely proportional to the error
     (c) both (a) and (b)
   (d) none of these

5. IAE means

    (a) inverse arithmetic error   (b) integral absolute error

    (c) internal absolute error   (d) none of these

6. Which one is the tuning method for design of PID controller?

    (a) damped oscillation method   (b) Ziegler Nichols method

    (c) ultimate cycle method   (d) all of the above

7. The relationship between stem position x and fraction of maximum flow $f(x)$ for a quick opening control valve

    (a) $f(x) = x^2$ (b) $f(x) = x^3$ (c) $f(x) = \sqrt{x}$ (d) All of these

8. Which one of following is the current to pressure converter?

    (a) control valve   (b) flapper-nozzle system

    (c) actuator   (d) all of the above

9. The objective of which of the following is to maintain the ratio of two process variables as a specified value.

    (a) feed forward control   (b) cascade control

    (c) ratio control   (d) inferential control

10. In which control loop, output of the controller is divided and sent to two or more control valves

    (a) inferential control   (b) feed forward control

    (c) ratio control   (d) split range control

PART - B (5 x 2 = 10 Marks)

11. Distinguish between continuous process and batch process.

12. Why derivative mode of control is not recommended for a process?

13. Why is it necessary to choose controller settings that satisfy both gain margin and phase margin?

14. Why installed characteristics of a control valve are different from inherent characteristics?

15. When inferential control is used?

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16. (a) (i) Develop the first order transfer function for a liquid level process shown below. Where, q, q_0 are inlet and outlet volumetric flow rates respectively. R – Resistance of the valve and pipe, h – head. (8)
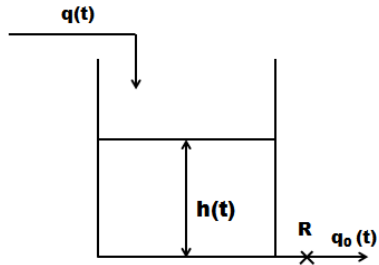
(ii) Develop a mathematical model for a mercury thermometer. Make necessary assumptions. (8)

Or

(b) (i) Illustrate servo and regulatory operation with an example for each. (8)

(ii) Consider the system shown in figure. Develop a mathematical model for the system. Assume that the effluent stream from a tank is proportional to the hydrostatic liquid pressure that causes the flow of liquid. Cross-sectional area of tank 1 is $A1$ (ft^2) and of tank 2 is $A2$ (ft^2). The flow rates q, q_1, q_2 are in ft^2/min. Take necessary assumptions. (8)
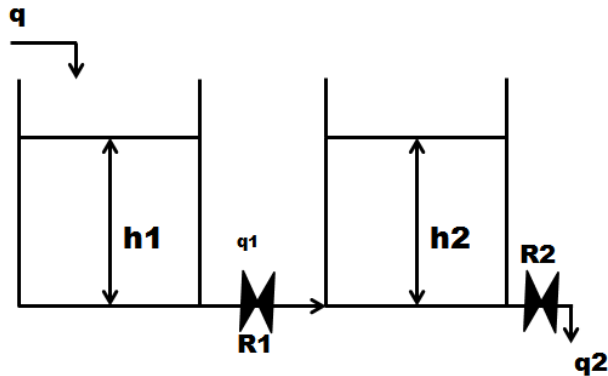
17. (a) Describe the characteristics of ON-OFF and single speed floating controllers. Also explain how they can be implemented using electronic elements. (16)

Or

(b) (i) With a neat block diagram, explain the functioning of a pneumatic PID controller. (8)

(ii) Illustrate the need and benefit of each component of composite PID controller. (8)

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18. (a) (i) What is the use of evaluation criteria? Explain IAE, ISE, ITAE and ¼ decay ratio criteria. (8)

(ii) Explain the process reaction curve method of controller tuning. (8)

Or

(b) Explain the procedure for tuning the controller settings by the following methods

   (i) Damped oscillation method (8)

   (ii) Zeigler Nichols method (8)

19. (a) (i) Explain the working of a simple current to pressure converter with neat diagram. (8)

(ii) Explain the working principle of pneumatic actuated control valve with positioner with the help of neat diagram. (8)

Or

(b) (i) Discuss the factors to be considered before the selection of control valve for a given application. (8)

(ii) Explain the occurrence of cavitations and flashing in control valve. (8)

20. (a) (i) What is split range control? Explain with a simple example. (8)

(ii) Explain the concept of feed forward control with neat diagram. (8)

Or

(b) Explain the cascade control scheme with example. (16)

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