A **Reg. No. :** | | | | | | | | | | |

Question Paper Code: 56503

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2018

Sixth Semester

Electronics and Instrumentation Engineering

15UEI603-PROCESS CONTROL

(Regulation 2015)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. Dead zone is the CO1- R

   (a) Same as time constant

   (b) Same as transportation lag

   (c) Maximum change in the variable that does not change the reading of the instrument

   (d) None of the above

2. Thermocouple in a thermal well behaves as a true CO1- R

   (a) first order system (b) multiple first order system

   (c) second order system (overdamped) (d) second order system (underdamped)

3. The standard measured indication range of a transducer is 4-20mA. If we have a set point value of 11mA and a measurement of 11.5mA,calculate the error expressed as percent of span CO2- App

   (a) -3.125% (b) 3.125% (c) 31.25% (d) -31.25%

4. A proportional controller with a gain of K_C is used to control a first order process. The offset will increase, if CO2- U

   (a) K_c is reduced (b) K_c is increased

   (c) integral control action is introduced (d) derivative control action is introduced

5. The equation of ITAE is CO3- U

(a) $\int_0^\infty |e(t)|dt$ (b) $\int_0^\infty t\,|e(t)|dt$ (c) $\int_{-\infty}^\infty t\,|e(t)|dt$ (d) $\int_{-\infty}^\infty t\,dt$

6. Use of *I*-control along with *P*-control facilitates CO3- R

(a) elimination of offset (b) reduction of offset

(c) reduction of stability time (d) none of these

7. The main purpose of control valve positioner is to CO4- R

(a) Alter the fail safe status of the valve (b) Improve the precision of the valve

(c) Alter the characterization of the valve (d) Eliminate the cavitations of the valve

8. The relation slip between C_V and K_V is CO4- R

(a) $C_V = 1.17\ K_V$ (b) $C_V = 0.86\ K_V$ (c) $C_V = -1.17\ K_V$ (d) $C_V = 1.28\ K_V$

9. The control configuration with primary loop and secondary loop is known as _____ CO5- R

(a) Cascade control (b) Split range control

(c) Ratio control (d) Feed forward control

10. Feed forward controller accounts for the _____ changes CO5- R

(a) set point (b) load

(c) both (a) & (b) (d) neither (a) nor (b)

PART – B (5 x 2= 10Marks)

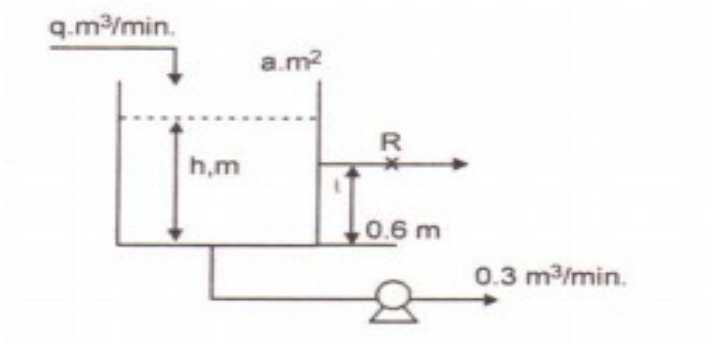
11. Why do we need mathematical modeling of process? CO1- U
12. Mention two drawbacks of derivative action. CO2- U
13. What are the parameters required to design a best controller? CO3- U
14. What is flashing in control valve? CO4- R
15. Define ratio control. CO5- R

PART – C (5 x 16= 80Marks)

16. (a) (i) Derive the transfer function H(s)/Q(s) for the liquid level system shown in Fig., When CO1- App (10)

(a) The tank operates about the steady state value of h_s =0.3m

(b) The tank operates about the steady state value of h_s =1

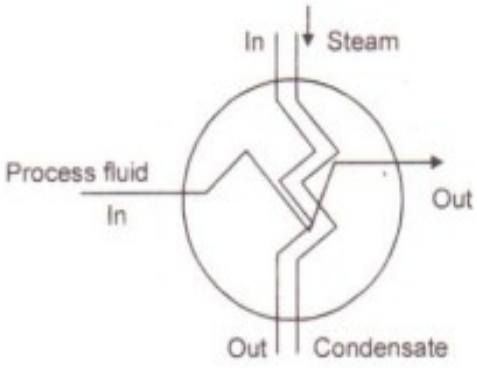


(ii) Obtain the model for first order liquid level system CO1- App (6)

Or

(b) (i) Explain in detail about servo and regulatory operation. Also obtain the transfer function for the same. CO1- U (12)

(ii)The figure shows a steam heater where process fluid is heated with the help of steam. Find out the number of degrees of freedom of this heating system. CO1- App (4)



17. (a) (i)Design an electronic PID controller using op-amp. CO2- App (8)

(ii)A Proportional –Derivative controller has a measured input range of 0.4-2V and an output range of 0-5V, and K_D = 0.08%per(% / min). The period of the fastest expected signal change is 1.5seconds. Implement this controller with an op amp circuit. CO2- App (8)

Or

(b) (i) A PI controller indicates an output of 12mA when the error is zero. The set point is suddenly increased to 14mA and the controller output is recorded and is given below. Find K_P and T_I . CO2- Ana (8)

Time t,sec	0	10	20	30
Output mA	14	16	18	20

(ii) Draw and explain pneumatic proportional controller. CO2- U (8)

18. (a) Explain the procedure for tuning PID controller using Z-N method and process reaction curve method. CO3- U (16)

Or

(b (i) Define decay ratio criterion and derive the controller tuning parameter using ¼ decay ratio criterion. CO3- Ana (8)

(ii) Explain the criterion which is used as guideline to select the controller for tuning. CO3- U (8)

19. (a) What is valve positioner? And explain in detail about Motion balance positioner and Force balance positioner. CO4- U (16)

Or

(b) Explain in detail about inherent and installed characteristics of control valve. CO4-U (16)

20. (a) Draw the configuration of cascade control and explain any one application with neat diagram. CO5- U (16)

Or

(b) Illustrate the operation of split range controller and inferential controller. CO5- U (16)