KUMARAGURU
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Register Number: ……

B.E DEGREE EXAMINATIONS: NOV/DEC 2014

(Regulation 2009)

Fifth Semester

ELECTRONICS AND INSTRUMENTATION ENGINEERING

EIE106**:** Process Control

Time: Three Hours **Maximum Marks: 100**

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. The quantity of control system which is directly measured and controlled

   a) Manipulated variable b) Input variable

   c) Controlled variable d) Process variable

2. Name a process giving inverse response

   a) Continues stirred tank reactor b) Drum Boiler system

   c) Binary distillation column d) Packed column

3. Which of the following system provides excellent transient and steady state response

   a) Proportional action b) Proportional + Integral action

   c) Proportional + Differential action d) Proportional + Integral + Differential action

4. The number of operational amplifiers require for designing of electronic PID controller is

   a) 1 b) 2

   c) 3 d) 6

5. A stepper motor has 6º per step and must rotate at 300 rpm. Calculate the required input pulse rate in pulses per second.

   a) 150 pulses/sec b) 100 pulses/sec

   c) 300 pulses/sec d) 600 pulses/sec

6. The control valve used for large change in flow rate with a small movement of valve stem is

   a) Quick opening valve b) Equal percentage valve

   c) Linear type valve d) Square root valve

7. The temperature range of temperature controller is 250°C to 550°C. The set point is kept at 400°C. Determine the percent span error when the temperature is 395°C.

   a) ±0% b) -3.33%

   c) +1.67% d) ±100%

8. The reaction curve method cannot used if

a) the system has a delay time
b) the system is minimum phase
c) the system is unstable
d) the system is marginally stable

9. The control is one in which desired parameter is controlled not by directly measuring but inferring from another liked parameter.

a) Split range control
b) Inferential control
c) Ratio control
d) Self tuning control

10. In a glass tube type water indicator for a boiler, one end of the tube is connected to water space and the other end is connected to

a) water space
b) chimney
c) steam space
d) super heater

PART B (10 x 2 = 20 Marks)

11. State "Degree of freedom of process".
12. A tank operating at 3 m head, 5 lpm outflow through a valve and has a cross section area of 2 m^2. Calculate the time constant.
13. Define direct and inverse actions of a controller.
14. How the offset is eliminated with the help of integral control mode?
15. Give two examples of pneumatic and electric actuators.
16. Define cavitation.
17. List the performance measures used for the selection and tuning of controller.
18. The Ziegler-Nichols tuning procedure is often called as continuous cyclic tuning method. Justify.
19. Point out the reason that the feedforward control is preferred along with feedback control.
20. Name the four equipments employed in a distillation unit.

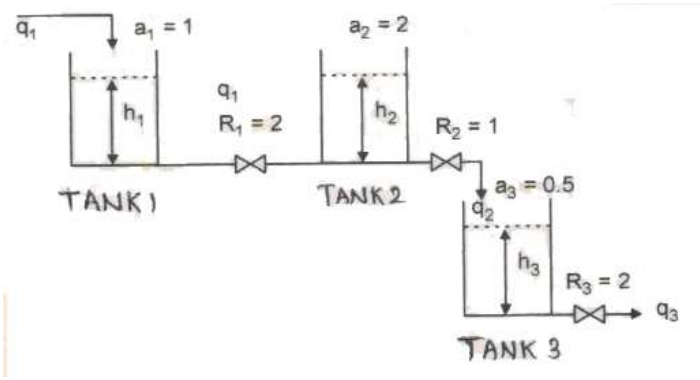
PART C (5 x 14 = 70 Marks)

21. a) (i) Develop a transfer function of mercury thermometer. (7)

(ii) Explain regulator operation for a process. (7)

(OR)

b) Determine the transfer function $H_2(s)/Q_1(s)$ and $H_3(s)/Q_1(s)$ for a three tank system shown in figure, where H_2, H_3 and Q_1 are the deviation variables. For a unit step change in Q_1, compute the initial and final heights in tank-3.



22. a) (i) A process has two time constants of 10 sec and 25 sec and a steady state gain of 1.3. Compute the gain of the proportional controller required to give a damping ratio of 0.5 in the closed loop response. (7)

(ii) Explain the concept of single point floating control mode. (7)

(OR)

b) Design an electronic three mode controller and derive its transfer function.

23. a) (i) What is need of control value in process control? How do you select the control valve? Explain. (7)

(ii) Illustrate the principle, construction and working of I/P converter with neat sketch. (7)

(OR)

b) With neat illustration, explain the construction and working of Double seated pneumatic control valve.

24. a) (i) Explain the controller tuning using one-quarter decay ratio. (7)

(ii) A process begins oscillation with a 30% proportional band in an 11.5 min period. Calculate 1) The nominal three-mode controller settings and 2) Settings to give quarter-amplitude response using Ziegler- Nichols tuning method. (7)

(OR)

b) (i) Express the various time integral performance criteria for closed loop response analysis. (5)

(ii) The transfer function of a system C(s)/R(s) = 1/ (5s+1) with 5 sec transportation lag. Compute the optimum controller setting using process reaction curve for P controller, PI controller and PID controller. (10)

25. a) Explain the following control structures with suitable examples.

i) Cascade control

ii) Adaptive control

(OR)

b) Design the control scheme for binary distillation process and explain the process in detail with neat diagram.

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