Registration No. : | | | | | | | | | | |

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B. Tech

PEEE 5407

Seventh Semester Examination – 2013

INDUSTRIAL AUTOMATION AND CONTROL

BRANCH : AEIE, MECH, IEE, EEE, ETC, EC, MME, MM

QUESTION CODE : C- 209

Full Marks – 70

Time : 3 Hours

*Answer Question No. **1** which is compulsory and any **five** from the rest.*

The figures in the right-hand margin indicate marks.

1. Answer the following questions : 2×10

(a) Differentiate between open-loop and closed-loop system, taking the example of a Oven.

(b) Identify the process element which with step input takes the system output to increase /decrease continuously.

(c) Compare the two position and multi-position control system.

(d) Which is a single mode controller that cannot be used alone and why ?

(e) What are advantages of using the substitution method over Routh criteria for finding stability ?

(f) Draw the basic flapper nozzle system. What is the need of fixed orifice on a flapper nozzle system ?

(g) How does Schmitt trigger help in reducing the effect of noise on switching ?

(h) List the advantages and disadvantages of feed-forward and feedback control configuration.

(i) What is the need of self-latching in a ladder diagram ?

(j) In what ways PLC are different from general purpose computers ?

P.T.O.

2. (a) Following parameters are given for a tank: area = 0.1 m^2, height at steady state is 1.0 m when discharge is 0.16×10^{-3} m^3/s and is given by $\sqrt{h}$. If inflow is suddenly increased to 0.2×10^{-3} m^3/s find the height of tank after 10 min at steady state. 5

(b) Derive the response of a non-Interacting two tank system with linear resistance element. Assume system parameters wherever required. 5

3. A water tank is gradually losing heat, and its temperature drops by 2°K per minute. When the heater is on, the system gains temperature at 4°K per minute. A two position controller has 0.5 mm control lag and a neutral zone of ±4% about a set point of 323 °K. Plot the temperature versus time graph and find the oscillation period. Assume at t = 0 temperature is at set point and the heater is off. 10

4. Error curve rises linearly to 1% in 0.5 min and remains fixed at 1%. K_p is 2, K_d is 1 min and K_i is 0.5 min^{-1}, P_o is 0%. Find the controller output at t = 0, 0.5 min and 1.0 min, when controller is operating at (a) PD (b) PI. 5+5

5. Using ZN method of tuning find tuned parameters of PID controllers for a process having its transfer function as $\frac{e^{-0.5s}}{(s+1)(2s+1)}$. All other elements in the control loop have unity transfer function. 10

6. (a) Show that the stability of feedback configuration is not disturbed by the addition of feed-forward controller. 5

b) Draw a cascade control scheme to jacketed reactor in which hot oil is supplied to the jacket. Reactor temperature is the primary variable and jacket temperature is secondary variable. 5

7. (a) Explain cavitation and flashing phenomena with the help of diagram. 5

(b) How does flow rate affect the differential pressure drop across the valves ? Compare sensitivities of the three valve characteristics. 5

8. Draw a PLC ladder diagram to realize the following : when the garage door is opened a light is switched on after the garage door is closed the light remains on for 60 sec. Use Tof to allow the driver to go inside the garage. Explain function each rung. 10