



Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)



SEVENTH SEMESTER B.TECH (INSTRUMENTATION AND CONTROL ENGINEERING)

END SEMESTER EXAMINATIONS, NOV/DEC 2015

SUBJECT: PROCESS INSTRUMENTATION AND CONTROL [ICE 401]

Time: 3 Hours

MAX. MARKS: 50

Instructions to Candidates:

- ✤ Answer ANY FIVE FULL questions.
- ✤ Missing data may be suitably assumed.
- 1A. Draw the schematic of a closed loop control system for a temperature control 4 process. Also draw an alternate form for the same.
- 1B. Draw the block diagram of a single loop feedback process control system and 3 explain the function of each block.
- **1C.** What is the necessity of using feedforward control system? Explain with **3** example.
- 2A. Explain the basic working of a CSTR with necessary sketch and also develop 5 the mathematical model of a CSTR.
- 2B. A liquid-level control system linearly converts a displacement of 1 to 5 m into a 4 to 20-mA control signal. A relay serves as the two-position controller to open or close an inlet valve. The relay closes at 14 mA and opens at 10 mA. Find (a) the relation between displacement level and current, (b) the neutral zone or displacement gap in meters.
- 2C. Derive the transfer function for offset of a proportional controller in servo 3 control mode for the closed loop temperature control system shown in figure Q.2(c).
- **3A.** Given the error of Figure Q.3(a), plot a graph of a proportional-integral **4** controller output as a function of time.
- **3B.** Write a note on the effect of controller output with increase in Kp, Ki and Kd **3** values with appropriate graphs.
- 3C. A temperature controller controls temperature from 100° to 200°C. A sensor provides an output of 2 to 8 V for this temperature range. The controller output drives a heater with an output of 0 to 5 volts. What circuit gain is needed if the controller is to be used with a proportional gain of 4%/%?
- 4A. Design a three mode electronic controller that outputs 0-7 V with 62% PB, 7
 0.08 min reset time and 0.09min derivative time. Fastest expected change time is 0.8 minute and input range is from 2.5 to 8 V.
- **4B.** Draw the sketch of a flapper nozzle based current to pressure converter and **3** explain its working.

- 5A. With necessary equations explain cascade control. Design a cascade control 4 system for a process shown in figure Q. 5(a).
- **5B.** What do you mean by split range control? Show a schematic arrangement of **3** this type of control.
- 5C. Design a split range control for a process where the pH value of process 3 liquid is brought closer to neutral by the addition of either acid or caustic reagent liquids and explain its working. (Use air to open and air to close valve for acid and base inlet streams based on requirement).
- **6A.** Draw the architecture of supervisory controller and explain the function of **4** each block.
- 6B. Inlet pressure of a particular fluid handled is 40 psi, outlet pressure is 20 psi and vapor pressure is 16 psi. Calculate the application ratio and predict the chances of cavitation and flashing.
- 6C. What is position and velocity form of PID algorithm? Explain.



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