

MANIPAL INSTITUTE OF TECHNOLOGY

A Constituent Institution of Manipal University

## SEVENTH SEMESTER B.TECH (INSTRUMENTATION & CONTROL ENGG.) **END SEMESTER EXAMINATIONS, NOV-2017**

## 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 pressure control 5 process. Also draw an alternate control loop for the same.
- **1B.** Explain the basic working of a CSTR with necessary sketch and also develop 5 the mathematical model of a CSTR.
- The temperature of water in a tank is controlled by a two-position controller. 4 2A. When the heater is off the temperature drops at 4<sup>o</sup> K per minute. When the heater is on the temperature rises at 6° K per minute. The set point is 323 K and the neutral zone is ±10% of the set point. There is a 0.2-min lag at both the on and off switch points. Find the period of oscillation and plot the water temperature versus time.
- **2B.** Write a note on floating control mode.

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- 2C. What is the necessity of using feedforward control system? Explain with 3 example.
- **3A.** Derive the transfer function for offset of a proportional control mode in servo 4 control mode for the closed loop system. Make necessary assumptions.
- Given the error of Fig Q3B, plot a graph of a proportional-derivative controller 6 3B. output as a function of time.
- **4A.** Explain Ziegler Nichols open and closed loop tuning method with necessary 3 equations.
- Write a note on the effect of controller output with increase in Kp, Ki and Kd 4B. 3 values with appropriate graphs.
- Derivative control action with a gain of  $K_D = 0.1\%$  /(%/min) is needed to control 4C. 4 flow through a pipe. The flow surges with a minimum period of 2 s. The input signal has a range of 0.4 to 2.0 V, and the output varies from 0.0 to 5.0 V. Develop the op amp derivative action circuit.
- 5A. What do you understand from time-integral performance criteria? Explain the 3 types and compare the performance of each type with a graph.
- **5B.** With necessary equations explain cascade control. Design a cascade control 4 system for a typical temperature process.
- **5C.** Explain the selective control strategy with an example.
- 6A. Draw the architecture of supervisory controller and explain the function of each 4 block.
- **6B.** Explain the working of a hydraulic actuator with directional control valve with 4 necessary sketch. 2
- 6C. What is position form of PID algorithm? Explain.



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