

(A constituent unit of MAHE, Manipal)

FIFTH SEMESTER B.TECH. (ELECTRONICS & INSTRUMENTATION ENGG.)

END SEMESTER DEGREE EXAMINATIONS, MARCH - 2021

PROCESS INSTRUMENTATION AND CONTROL [ICE 3154]

TIME: 3 HOURS

27-03-2021

MAX. MARKS: 50

Instructions to candidates : Answer ALL questions and missing data may be suitably assumed.

- 1A. Draw the closed loop block diagram of a typical feedback system and specify function of each component.
- 1B. With necessary diagrams explain direct acting and reverse acting controller.
- 1C. Derive the final mathematical model of a thermal process with three cases of heat added into the system.

(2+4+4)

(4+2+4)

- 2A. Prove that proportional controller will result in offset for servo and regulatory operation on a first order process.
- 2B. Design a two-position controller that provides an output of 5 V when a type-J TC junction reaches 250° C and drops to a low of 0 V when the temperature has fallen to 240° C. Assume a 0° reference.
- 2C. A liquid-level control system linearly converts a level of 0 to 5 m into a 1 to 5V control signal. A relay serves as the two-position controller to open or close an inlet valve. The relay closes at 2.8V and opens at 3.2V. Find (i) the relation between liquid level and voltage, (ii) the neutral zone or level gap in meters.
- 3A. Extend the concept of ON-OFF controller to implement a three position controller using OpAmp and explain the operation with necessary equations.
- 3B. A liquid-level system converts a 0–10 m level into a 4- to 20-mA current. Design a three-mode controller that outputs 0–5 V with a 20% PB, 0.06-min reset time, and 0.1-min derivative time. Fastest expected change time is 0.5 min.
- 3C. Briefly explain ultimate cycle method.
- 4A. Write a note on performance criteria for tuning of controllers.
- 4B. For the block diagram shown in Fig Q4B, develop feedback control loop and discuss its impact.
- 4C. Explain with an example split range control.

(2+4+4)

(5+3+2)

- 5A. Mention and explain the method used to control systems having higher dead time with necessary block diagram.
- 5B. Explain the concept of IMC with necessary block diagram.
- 5C. Draw the block diagram of a multi loop control system with two primary controllers and two crosscontrollers and discuss the response of the system.

(3+3+4)



Fig Q 4B
