Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
A Constituent Institution of Manipal University

FIFTH SEMESTER B.TECH. (INSTRUMENTATION AND CONTROL ENGG.)

END SEMESTER MAKE UP EXAMINATIONS, DEC - 2017

SUBJECT: PROCESS INSTRUMENTATION AND CONTROL [ICE 3106]

Duration: 3 Hour Max. Marks:50

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitably assumed.

1A	A single tank system with an area of 3 ft^2 and steady state height of 4 ft, when the inlet flow is 16 cf/m has a valve connected at the outlet. Compare the transfer functions of the tank height to the inflow when the valve is linear (follows an equation of $q=ch_s$) and the valve is nonlinear (follows an equation of $q=ch_s^{1/2}$)	5
1B	Considering small deviations from steady-state operation, write the differential equations and draw a block diagram of the air heating system shown in Figure Q1B. Assume that the heat loss to the surroundings and the heat capacitance of the metal parts of the heater are negligible.	3
1C	Figure Q1C shows an air heating system used to regulate the temperature in a house. The heat is supplied from the combustion of fuel oil. Identify the manipulated variables and develop a feedback control configuration to achieve your control objective.	2
2A	Using a block diagram of the closed loop system, prove that an integral control action removes the offset of a first order process for a servo problem. Consider the transfer functions of the sensor and the final control element to be unity.	4
2B	Compare the controller principle of Two position, Multiposition and floating control modes.	4
2C	Distinguish between reverse action controllers and direct action controllers with a suitable example.	2
3A	A proportional-derivative controller has a 0.4 to 2.0V input measurement range, a 0 to 5V output, K_P=5%/%, and K_D=0.08%per (%/min). The period of the fastest expected signal change is 1.5 s. Implement this controller with an op amp circuit.	5
3B	What is the effect of feedback bellows in a pneumatic controller? How can a proportional pneumatic controller converted to an ON-OFF controller?	3
3C	Discuss the importance of quarter decay ratio in performance evaluation of controller.	2
4A	Explain the process reaction curve method for controller tuning and write the parameters for different controller modes.	5
4B	Using a suitable example describe the working of Ratio controller.	3
4C	What is the effect of increasing the derivative action of a PD controller in the speed of response of the output?	2
5A	Using suitable block diagrams describe the design procedure of a Feed Forward controller.	5

5B What are the process requirements and considerations for implementing a cascade controller in a control loop? 3

5C Discuss about the advantage of inferential control over normal feedback control. 2

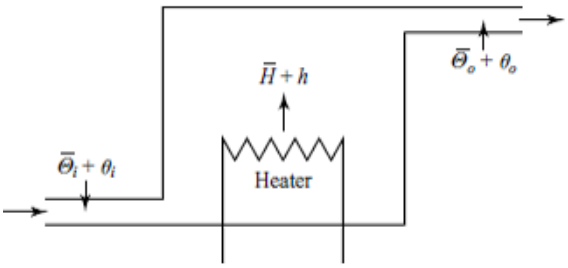

Figure: 1

Fig.Q1B

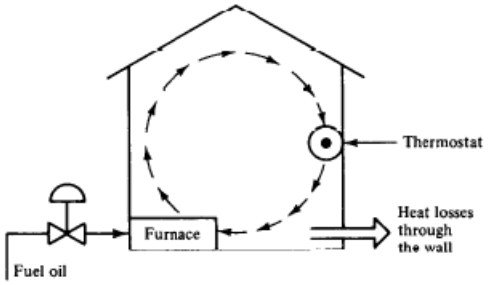

Fig.Q1C

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