Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

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

END SEMESTER DEGREE EXAMINATIONS, NOVEMBER - 2018

SUBJECT: PROCESS INSTRUMENTATION & CONTROL [ICE 3106]

TIME: 3 HOURS **MAX. MARKS: 50**

Instructions to candidates

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

1A Consider the liquid level system shown in Fig. Q1A, obtain the state space representation of the system considering h_1 and h_2 as outputs and q_{i1} and q_{i2} as outputs. 5M

1B Figure Q1B shows a manufacturing process diagram. In this process, the following independent control requirements must be satisfied: 3M

a. Control the level at Lsp. b. Control the temperature at Tsp. c. Control the output flow rate Qsp.

Draw the diagram showing the control loops by using the block diagram error-detector symbols and controller blocks. Include blocks for necessary signal converters.

1C With an example differentiate direct and reverse control action. 2M

2A Draw a closed loop system with the presence of disturbance. Derive the output equation for the system and explain the effect of P controller on the closed loop system. 5M

2B A 5-m-diameter cylindrical tank is emptied by a constant outflow of 1.0 m^3/minute. A two-position controller is used to open and close a fill valve with an open flow of 2.0 m^3/minute. For level control, the neutral zone is 1 m and the set point is 12 m. 3M

a. Calculate the cycling period.
b. Plot the level versus time.
c. Draw the schematic of control loop

2C Explain the function of integral term in PI controller with an example response. 2M

3A For the control system shown in Fig. Q3A, Plot the reaction curve and determine the controller settings for a PI controller using the Z-N open loop tuning method. 5M

3B What is Quarter decay ratio and discuss its importance in controller performance evaluation. 3M

3C Response of a closed loop process to unit step change in set point with two different controller parameters are as shown in the Fig. Q3C. The ISE values for A and B responses at 10 seconds are 1.54 and 1.49 respectively. Comment on the performance of the controller in both cases. 2M

4A Describe the procedure to obtain the controller parameters using Ultimate cycle method and write the parameters for a PID mode. 4M

4B Design a dynamic feedforward controller for the STR as shown in Fig. Q4B, where Fi is assumed to be a constant. The equations governing the system are: 4M

$$A\frac{dh}{dt} = F_i - F \quad \text{and} \quad Ah\frac{dT}{dt} = F_i(T_i - T) + \frac{Q}{\rho C_p}$$

4C Draw the block diagram of a Model Reference adaptive controller 2M

5A What are the causes of Delay in Process systems? Design a dead time compensator for eliminating the dead time in a closed loop system. 4M

5B Describe how a cascade control can be implemented in a furnace as shown in the Fig. Q5B were temperature and flow rate of fuel are the variables. 4M

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

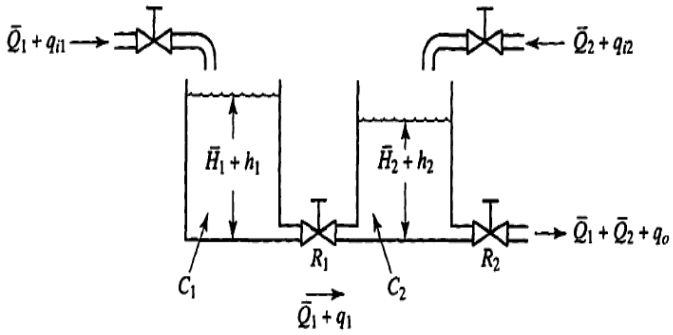

Fig. Q1A

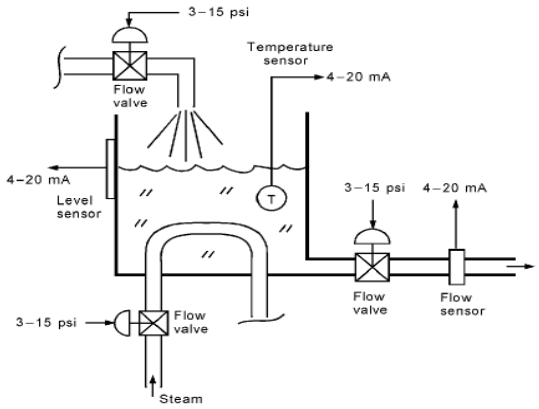

Fig. Q1B

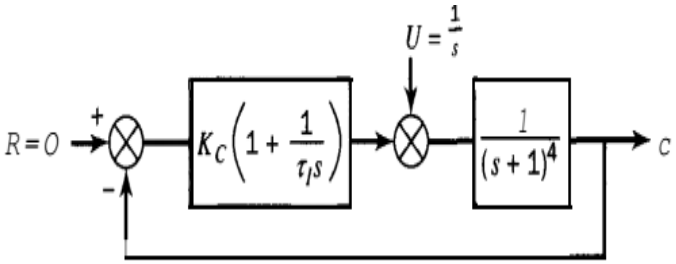

Fig. Q3A

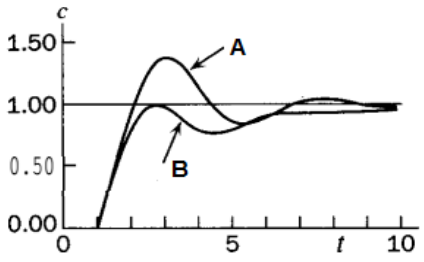

Fig. Q3C

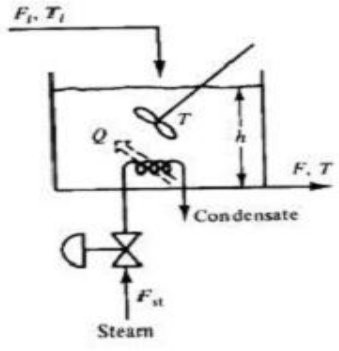

Fig. Q4B

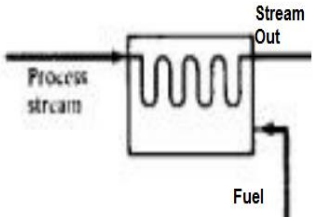

Fig. Q5B

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