B.ELECTRICAL ENGG. (EVENING) 5TH YEAR 1ST SEMESTER SUPPLE EXAM, 2017
(Supplementary)

SUBJECT: - PROCESS INSTRUMENTATION AND CONTROL

Full Marks 100
Time: Three hours
(50 marks for each part)

Use a separate Answer-Script for each part

No. of Questions	PART I	Marks
	Answer any three. *Two marks reserved for neatness and well organized answers.*	
1.(a)	Derive the mathematical model of non interacting two tank system with linear resistance element.	8
(b)	Outflow (q_0) from a tank is equal to $2h^{3/2}$. Inflow is 'm'. Steady state level in tank is 4m, the area of the tank is $2m^2$. Find [H(s)/M(s)] and characterizing parameters of the transfer function.	8
2(a)	Describe the Process Reaction Curve (PRC) method for tuning of PID controller.	8
(b)	Using direct substitution method, find stability range of k_p for the system having transfer function as $\frac{4}{10s^3+17s^2+9s+1}$.	8
3(a).	Find the closed loop solution of the following difference equation X(k+2)+5X(k+1)+2X(k)=0; X(0)=0; X(1)=1;	10
(b)	Derive the transfer function of ZOH.	6
4.	Write short notes on following (i)Feed Forward Control (ii)Ratio Control (iii)Cascade Control	16
5.(a)	State the advantages of digital controller.	4
(b)	What is the difference between servo and regulatory system.	4
(c)	Derive the mathematical model of CSTH.	8

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PART II

Answer any **THREE** questions. Two marks are reserved for well organized answers.

1. a) Explain the advantages of parallel realization of PID control rule using electronic circuits than cascade realization.   4+12
    b) Prove that in a digital PD controller's output with anti-derivative kick, $m_n = k_p e_n - \dfrac{K_p T_d}{\tau} c_n + \dfrac{K_p T_d}{\tau} c_{n-1} + b_n$, where m_n is the controller output sequence, b_n is the bias, c_n is the process output and e_n is the error sequence.

2. With a neat schematic diagram obtain the transfer function of a simple electronic analog PID controller using one OP-AMP.   16

3. a) Discuss about the spring and diaphragm pneumatic actuator in reverse and direct acting modes.   9+7
    b) What are the basic designs available in rotary valves? List their advantages over conventional globe valves.

4. a) Draw the schematic diagram of a pneumatic PI controller and derive its transfer function.   10+6
    b) State advantage of pneumatic controllers over their electronic counterpart.

5. Write Short notes on any two: 8+8
    a) Self Regulating Process;
    b) Equal Percentage Control Valves;
    c) Auto/Manual modes with bumpless transfer.