

B. E. E. (PART TIME) 5<sup>TH</sup> YR 1<sup>ST</sup> SEMESTER EXAMINATION, 2018

## SUBJECT: - PROCESS INSTRUMENTATION AND CONTROL

Time: Three hours

Full Marks: 100 (50 marks for each part)

Use a separate Answer-Script for each part

## PART I

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

1. a) Describe the importance of the measuring element in a process control loop. 5  
 b) What is transmitter gain? 2  
 c) Draw a process instrumentation diagram for a liquid level control system with a local pneumatic level controller. Hence describe its functioning. 5  
 d) How can the proportional and integral term be combined for the realization of an analog PID controller? 4
2. a) Explain how Clegg integrator can eliminate integral wind up effect in P-I controller. 5  
 b) Distinguish between cascade and parallel realization of P-I-D controller. 5  
 c) Differentiate between *Automatic* and *Manual* modes of operation in a process control loop. 6
3. a) Prove that in a digital PD-controller  $m_n = K_p \left( 1 + \frac{T_d}{\tau} \right) e_n - \left( \frac{K_p T_d}{\tau} \right) e_{n-1} + b_n$  12  
 where all symbols have usual meanings. Show the input-output relation in block diagram form. How can you keep provision for anti-derivative kick?  
 b) What are the advantages and disadvantages of electronic process controllers? 4
4. a) Draw the schematic diagram of a pneumatic PI controller and derive its transfer function. 10  
 b) State advantage of pneumatic controllers over their electronic counterpart. 6
5. Write short notes on any two. 2 X 8  
 a) Spring diaphragm type actuator with positioner.  
 b) Equal Percentage Control Valves  
 c) Auto/Man modes of operation with bumpless transfer.  
 d) Self-regulating and non-self-regulating process.

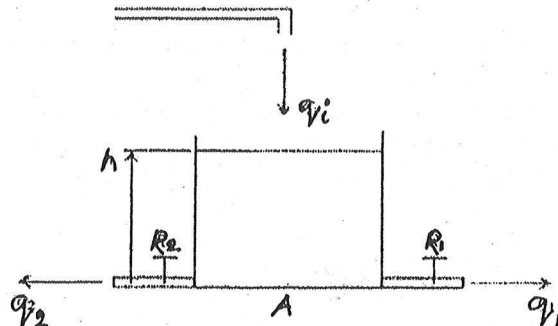
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**B. E. ELECTRICAL ENGG. (PART TIME) 5<sup>TH</sup> YEAR 1<sup>ST</sup> SEMESTER EXAM 2018 (OLD)****SUBJECT: - PROCESS INSTRUMENTATION AND CONTROL**

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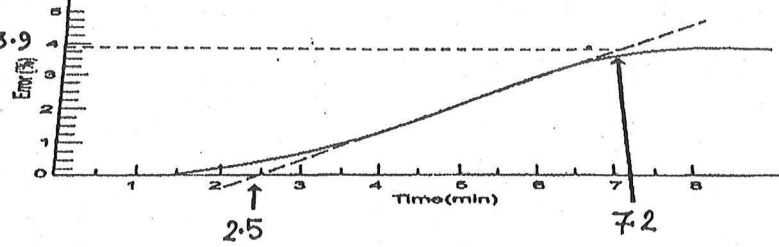
No. of Questions	PART II	Marks
<i>Answer any three.</i>		
<i>Two marks reserved for neatness and well organized answers.</i>		
1.(a)	Derive the mathematical model interacting two tank system with linear resistance element.	6
(b)	Derive the transfer function $H(s)/Q(s)$ for the liquid level system shown in fig. [H and $Q_i$ are the deviation variables in 'h' and ' $q_i$ ' respectively. Assume $A=0.75m^2$ , $R_1=1$ , $R_2=2$ . 	10
2.(a)	Discuss the advantage of applying cascade control in jacketed CSTR.	6
(b)	Consider a closed loop system in which the process comprises of two first order systems connected in series with time constants 1min and 1/2 min, respectively. Measuring element is also a first order system with time constant of 1/2 min. Controller is of proportional mode with gain $K_p$ . (i) Draw the process control loop. (ii) Using direct substitution method, comment on the stability with the limiting range of $K_p$ .	10
3.(a)	Write the difference between servo and regulatory system.	6
(b)	Why feedforward control is preferred along with feedback control? Explain feedforward control strategy for a typical process.	10

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No. of Questions	PART II	Marks
4.(a)	<p>A transient disturbance test is run on a process loop. The results of a 9% controlling variable give a 'Process Reaction Graph' as shown in fig. below. Find settings for three mode (PID) action by Cohen &amp; Coon Method.</p> 	10
(b)	Discuss degree of freedom analysis in mathematical modeling.	6
5.	<p>Write short notes on following.</p> <p>(a) Ratio control.</p> <p>(b) Z-N Method for controller tuning.</p>	16