

May 2023

**B.Tech. EIC 6<sup>th</sup> Semester (Re-Appear)**  
**Industrial Process Control (EI-601)**

Max. Marks:75

Time: 3 Hours

- Instructions:**
1. It is compulsory to answer all the questions (1.5 marks each) of Part -A in short.
  2. Answer any four questions from Part -B in detail.
  3. Different sub-parts of a question are to be attempted adjacent to each other.
  4. Assume relevant data if not mentioned.

**PART-A**

- Q.1.a What is SISO system and what is MIMO system? Give examples from the chemical engineering field for both. (1.5)
- Q.1.b Give the step response of a second order system. (1.5)
- Q.1.c List any four objectives of process control. (1.5)
- Q.1.d Mention two drawbacks of Integrative control action. (1.5)
- Q.1.e What are the steps involved to design a best controller? (1.5)
- Q.1.f How many control objectives you can specify at most? (1.5)
- Q.1.g Consider the system at steady state. How many degrees of freedom it poses? (1.5)
- Q.1.h Why first order lag system is called as self regulatory system. (1.5)
- Q.1.i Give the definition of Measurement. (1.5)
- Q.1.j Define deviation variable. (1.5)

**PART-B**

- Q.2 Give three different control configurations for liquid level control. Compare the simple feedback and feed forward control configuration. Which one would you trust to perform better in achieving your control objectives and why? (15)
- Q.3 What are the principal questions that arise during the design of a feedback controller? Discuss them on the basis of a physical example. What are the advantages and disadvantages of the three Time integral criteria? How would you select the most appropriate for particular applications? (15)
- Q.4.a Give the mathematical modelling of CSTR. Draw the relevant figure. (7.5)
- Q.4.b Show that as the number of non-interacting first-order systems in series increases, the response of the system becomes more sluggish. (7.5)

- Q.5.a Define the closed-loop responses for set point and load changes. Give transfer function of each. (7.5)
- Q.5.b Consider a process with one controlled output and two active manipulated variables. Under what conditions could you use both manipulated variables to control the signal output. (7.5)
- Q.6.a Describe Smith Predictor. What is the need of Smith predictor? (7.5)
- Q.6.b Discuss the new design problems raised by the use of a digital computer for process control (7.5)
- Q.7.a Define relative gain array for a process with two input and two outputs. What are the properties of a relative gain array? (7.5)
- Q.7.b Explain the feed-forward control nature of de-coupler. When do you have perfect de-coupling? (7.5)