KERALA AGRICULTURAL UNIVERSITY
B.Tech.(Food Technology) 2021 Admission
VI Semester Final Examination – June 2024

Beas.3212 **Instrumentation and Process Control in Food Industry (2+1)** **Marks: 50**
Time: 2 hours

I **Fill in the blanks** **(10x1=10)**

1. The most commonly used type of thermocouple is the _____ thermocouple, which is made from chromel and alumel wires.
2. Pyrometers are used to measure _____.
3. Viscosity is a measure of a fluid's _____ to flow.
4. In the Nyquist plot, the angle between the negative real axis and the point where the plot intersects the real axis is equal to the _____ of the corresponding pole of the transfer function.
5. The _____ of a digital controller refers to the time interval between successive samples of the input and output signals.

State True or False

6. A differential pressure flow meter measures the flow rate of a fluid by creating a pressure drop across a constriction in the flow path.
7. A pH meter can provide accurate pH measurements even in very high or very low pH solutions.
8. A PID controller is a type of feedback control system that includes proportional, integral, and derivative control.
9. A system is stable if its frequency response has no phase shifts greater than 180 degrees.
10. The Bode plot of a stable system always has a phase margin greater than or equal to zero degrees.

II **Write short notes on ANY FIVE of the following** **(5x2=10)**

1. Explain capacitance-based level sensor
2. Explain the working principle of electromagnetic flowmeter
3. What are some common applications of humidity measurement in industry?
4. Differentiate pneumatic control system and electrical control system
5. What is gain margin and phase margin in a Bode plot?
6. What is a self-generating transducer? How does a piezoelectric sensor work as a self-generating transducer?
7. What are adaptive controllers? What is the difference between adaptive and non-adaptive controllers?

III **Answer ANY FIVE of the following** **(5x4=20)**

1. Differentiate mass flow meter, volumetric flow meter and inferential flow meter? List out few examples in each category
2. Define process control and explain its importance in industrial applications? Explain the steps involved in simple system analysis for process control?
3. Explain the Nyquist plot and its importance in control system analysis? Discuss the stability analysis of a control system using frequency response techniques?
4. Define frequency response analysis and explain its significance in control systems
5. Explain the role of actuating and controlling devices in transducer systems
6. How do flow ratio control systems work, and what types of flow control valves are commonly used in these systems? What are some of the advantages and disadvantages of using flow ratio control systems, and in what applications are they typically used?

7. What are the key differences between adaptive and intelligent controllers, and how do these differences impact their performance in different applications? What are the major challenges associated with implementing adaptive and intelligent controllers, and what strategies can be used to overcome these challenges?

IV **Write an essay on ANY ONE of the following** **(1x10=10)**

1. Explain the working of the following with neat diagram and necessary equations/derivations
   (1) Ultrasonic method for the measurement of liquid level
   (2) Venturi meter method for flow measurement
2. Explain the classification of transducers and give examples of self-generating transducers, variable parameter type, digital, actuating, and controlling devices.

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