GUJARAT TECHNOLOGICAL UNIVERSITY

FOOD PROCESSING & TECHNOLOGY (14)
FOOD PROCESS INSTRUMENTATION & CONTROL
SUBJECT CODE: 2151402
B.E. 5th SEMESTER

Type of course: Food Processing Technology

Prerequisite: Nil

Rationale: Basic concept of process controls, types of control & their application, concept of automatic control and its classification. This will give in hand knowledge about instrumentation and its control of typical food processing units like reactor, evaporator, dryer and many more. The purpose of process control is to reduce the variability in final products so that legislative requirements and consumers' expectations of product quality and safety are met. It also aims to reduce wastage and production costs by improving the efficiency of processing.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P	C	Theory Marks			Practical Marks			
				ESE (E)	PA (M)		ESE (V)		PA (I)	
					PA	ALA	ESE	OEP		
3	0	2	5	70	20	10	20	10	20	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	**Introduction:** Definitions - Instrument, Controller and recorder, Principle of measurement, Static and dynamic characteristics of instrument, Error analysis and its calibration.	6	13
2	**Transducers:** Types & classification and selection criteria, Basic principles, Construction and applications of transducer elements, Strain gauge with bridge circuits and calibration procedures.	6	12
3	**Temperature Measurement:** Mercury thermometers, Bimetal thermometers, Capillary type thermometers, Recording thermometers, Thermocouples, Resistance thermometers, thermister.	7	13
4	**Pressure Measurement:** Pressure gauge, Elastic deformation elements, Basic concept of pneumatic pressure transmitter, Pressure current and Pressure resistance transducers.	7	14
5	**Flow Measurement:** Positive displacement meter, Turbine type, Float type, Timed flow and magnetic meters.	4	9
6	**Miscellaneous Measurements:** Weight measurement - Mechanical scale, Electronic tank scale, Conveyor scale and measurement of specific gravity, Measurement of humidity, Measurement of viscosity, Measurement of density, Automatic valves.	8	16
7	**Process Control:** Simple system analysis, Dynamic behavior of simple process, Laplace transforms, Process control hardware.	6	15
8	**Frequency Response Analysis:** Frequency response characteristics, Bode diagram	4	8

	and Nyquist plots and stability analysis.		

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
20	**20**	**22**	**19**	**19**	**-**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. Manual for plant operators by Milk industry foundation, Washington, DC.
2. Process system analysis and control by Donald RC., Mc-Graw Hill.
3. Process Instrumentation by Patranobish., Tata Mc-Graw Hill.
4. Transducers and Instrumentation by Murty DVS., Prentice Hall of India.
5. Process Control Instrumentation Technology by Johnson C. Prentice Hall of India.

Course Outcome:

After learning the course the students should be able to:

1. This programme will enable the students to gain skills and knowledge in instrumentation and process control of the food process system.
2. Apply principles of process control to analyze the performance of industrial processes.
3. Apply concepts of measurement and sensor selection to specify, install, configure, calibrate, troubleshoot, and maintain various process instruments commonly used in industry.

List of Experiments:

1. Introduction to various electronic measurement equipments like CRO, DMM, Regulated Power Supply
2. To study the characteristics of IC temperature sensors
3. To study the characteristics of Resistance Temperature Detector using PT100
4. To study the characteristics of NTC thermistor
5. To study the characteristics of Strain gauge
6. To study the characteristics of Linear Variable Differential Transformer (LVDT)
7. To study the characteristics of K type thermocouple
8. To study the rotameter
9. To study the pressure gauge
10. Working principle of pH meter

Design based Problems (DP)/Open Ended Problems:

Generate a feedback loop in which a transmitter measures the temperature of a fluid

Major Equipments

1. Cathode Ray Oscillator (CRO)
2. Digital Multi Meter (DMM)
3. Regulated Power Supply
4. IC sensor kit

5. RTD Kit
6. Thermistor kit
7. Strain gauge kit
8. Load cell
9. Rotameter
10. Pressure gauge

List of Open Source Software/learning website:

a. http://www.cna.nl.ca/
b. http://socs.curtin.edu.my/
c. http://www.foodprocessing.com

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.