FACULTY OF ENGINEERING & TECHNOLOGY

Effective from Academic Batch: 2022-23

Programme: **Bachelor of Technology (Food Processing Technology)**

Semester: **V**

Course Code: **202060522**

Course Title: **Sensors and Automation**

Course Group: **Open Elective I**

Course Objectives: This course provides the vital knowledge of the various aspects of small scale and large-scale automation and enables students to understand the basic concepts of sensors interfacing for automation. This course gives an insight of embedded computers, PLC, and DCS used in small and large-scale industry.

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
				Theory		J/V/P*		Total
Lecture	Tutorial	Practical		Internal	External	Internal	External	
2	0	2	3	50/18	50/17	25/9	25/9	150/53

* **J**: Jury; **V**: Viva; **P**: Practical

Detailed Syllabus:

Sr.	Contents	Hours
1	**Introduction to Automation:** Automation, Role of automation in small and large - scale industries, type of automation system, Benefits of automation. Automation pyramid, automation tools like embedded computers, PAC, PLC, SCADA, DCS, Hybrid DCS with reference to automation pyramid.	3
2	**Sensors:** Introduction, Classification of Sensors, Different fields of sensors based on the stimuli - various schematics for active and passive sensors, Implications of specifications uses of sensors - measurement of stimuli - block diagram of sensor system, Transfer Function, Calibration, Full-Scale Output, Range, Accuracy, Calibration Error, Hysteresis, Nonlinearity, Saturation, Resolution, Dynamic characteristics, Environmental factors, Uncertainty in measurement, Sensors for temperature, pressure, force, displacement, speed, flow, level, humidity and pH measurement. Actuators, process control valves, Industrial electronics devices.	10

3	**Industrial Standard Protocols:** Definition of protocol, Introduction to Open System Interconnection (OSI) model, Communication standard (RS232, RS485), USB and I 2C,Modbus (ASCII/RTU), Introduction to third party interface, concept of OPC (Object linking and embedding for Process Control), HART Protocol: Introduction, frame structure, programming, implementation examples, benefits, advantages and limitation. Foundation Fieldbus H1: Introduction, frame structure, programming, implementation examples, benefits, advantages and limitation. Comparison of HART, Foundation Fieldbus, Devicenet, Profibus, Controlnet, Industrial Ethernet.	**7**
4	**Small-Scale Automation:** Introduction to embedded computers, sensors interfacing with embedded computers i.e., tiny AVR, ATMEGA 328P, Raspberry Pi. large-Scale **Industrial Automation:** Programmable Controllers, Programmable logic controllers (PLCs), PLC Programming, Advantages and applications of PLCs, Overview of DCS, Features and advantages of DCS.	**8**
	Total	**28**

List of Practicals / Tutorials:

1	To study performance characteristics temperature sensor.
2	To study performance characteristics Pressure sensor.
3	To study performance characteristics Humidity and pH sensor
4	To study the working of photovoltaic sensors.
5	To study various industrial protocols
6	PLC Controller logic implementation for any one industrial application.
7	Programming with ATMEGA 328P.
8	Programming with Raspberry Pi.
9	Mini project.
10	Industrial visit report

Reference Books:

1	S. K. Singh, Industrial Instrumentation and Control, 3rd Edition, McGraw Hill Education.
2	A.K. Sawhney, Electrical and Electronic Measurements and Instrumentation, Dhanpat Rai.
3	David A. Bell, Electronic Instrumentation and Measurements, 3rd Edition, Oxford University Press.
4	A.D. Helfrick and W.D. Cooper, Modern Electronic Instrumentation and Measurement Techniques, 3rdEdition, Prentice Hall
5	Garry Dunning, Introduction to Programmable Logic Controllers, 3rd Edition, Cengage Learning India.

Supplementary learning Material:	
1	NPTL resource material

Pedagogy:

- Direct classroom teaching
- Audio Visual presentations/demonstrations
- Assignments/Quiz

- Continuous assessment
- Interactive methods
- Course Projects

Internal Evaluation:
The internal evaluation comprised of written exam (40% weightage) along with combination of various components such as Certification courses, Assignments, Mini Project, Simulation, Model making, Case study, Group activity, Seminar, Poster Presentation, Unit test, Quiz, Class Participation, Attendance, Achievements etc. where individual component weightage should not exceed 20%.

Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):

Distribution of Theory Marks in %						**R**: Remembering; **U**: Understanding; **A**: Applying; **N**: Analyzing; **E**: Evaluating; **C**: Creating
R	**U**	**A**	**N**	**E**	**C**	
10%	20%	20%	15%	15%	20%	

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.

Course Outcomes (CO):

Sr.	Course Outcome Statements	%weightage
CO-1	Understand automation, types, pyramid and industrial standard protocols.	**30**
CO-2	Understand, design and develop various sensors interfacing with embedded computers.	**20**
CO-3	Learn large scale industrial automation with interfacing and applications.	**30**
CO-4	Practical implementation and designing prototypes for small and largescale automation	**20**

Curriculum Revision:	
Version:	2
Drafted on (Month-Year):	June-2022
Last Reviewed on (Month-Year):	
Next Review on (Month-Year):	June-2025