SEMESTER S8

AUTOMATION IN FOOD INDUSTRY

Course Code	**PEFTT864**	**CIE Marks**	40
Teaching Hours/Week (L: T:P: R)	3:0:0:0	**ESE Marks**	60
Credits	3	**Exam Hours**	2 Hrs. 30 Min.
Prerequisites (if any)	None	**Course Type**	Theory

Course Objectives:

1. Understand the role and importance of automation in the food industry
2. Identify different areas where automation can be applied in food processing and production

SYLLABUS

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Module No.	Syllabus Description	Contact Hours
1	Module 1:Introduction to Automation in the Food Industry Overview of Automation – Definition and scope of automation – History and evolution of automation in the food industry – Types of Automation Systems – Hard and soft automation – Fixed and flexible automation – Benefits and Challenges – Advantages of automation in food production – Common challenges and limitations – Applications of Automation – Case studies and examples of automated systems in food processing – Ethical and Social Considerations – Impact of automation on workforce and society	9
2	Module 2: Automation Technologies and Tools Sensors and Actuators – Types of sensors used in food industry automation – Actuators and their role in automation – Control Systems – Introduction to PLC (Programmable Logic Controllers) – SCADA (Supervisory Control and Data Acquisition) systems – Robotics in Food Processing – Types of robots used in the food industry – Applications of robotics in food packaging and handling – Computer Vision Systems – Basics of computer vision – Applications in quality control and inspection – Emerging Technologies – AI	9

	and machine learning in food automation – Internet of Things (IoT) in food processing	
3	Module 3: Design and Implementation of Automated Systems System Design Principles – Key considerations in designing automated systems – Integration of various components – Automation Project Management – Planning and execution of automation projects – Cost-benefit analysis – Case Studies – Analysis of successful automation projects in the food industry – Safety and Compliance – Safety standards and regulations – Ensuring compliance with food safety standards – Maintenance and Troubleshooting – Strategies for maintaining automated systems – Common troubleshooting techniques	**9**
4	Module 4: Future Trends and Innovations in Food Industry Automation Sustainable Automation – Green automation technologies – Energy-efficient systems – Advanced Robotics – Collaborative robots (cobots) – Autonomous systems – Smart Manufacturing – Industry 4.0 and its impact on the food industry – Smart factories and digital twins – Predictive Maintenance – Use of predictive analytics in maintenance – Benefits and implementation strategies – Research and Development – Current trends in R&D – Potential future innovations in food automation	**9**

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Course Assessment Method
(CIE: 40 marks , ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	**15**	**10**	**10**	**40**

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
1. 2 Questions from each module. **2.** Total of 8 Questions, each carrying 3 marks **(8x3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

	Course Outcome	Bloom's Knowledge Level (KL)
CO1	Explain the fundamentals of optimization, including various types and formulations of optimization problems.	**K2**
CO2	Apply classical optimization techniques to both single and multi-variable problems, utilizing methods such as the simplex method and Lagrange multipliers.	**K3**
CO3	Develop numerical methods and algorithms for solving complex optimization problems, including gradient descent and interior point methods.	**K3**
CO4	Utilize advanced optimization techniques like dynamic programming, genetic algorithms, simulated annealing, and particle swarm optimization for real-world applications.	**K3**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

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CO-PO Mapping Table:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3											1
CO2	3		3									1
CO3	3	2										1
CO4	3	2	1									1

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Food Process Automation: Principles and Applications	B. W. Gould and G. R. Stewart	Springer	1st Edition, 1991
2	Automation in the Food Industry: Current and Future Technologies	Nicholas M. Holden and Ricardo Simpson	Woodhead Publishing	1st Edition, 2012
3	Food Process Engineering and Technology	Zeki Berk	Academic Press	2nd Edition, 2013
4	Fundamentals of Food Process Engineering	Romeo T. Toledo	Springer	3rd Edition, 2007

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Handbook of Food Process Design	Ahmed, Mohammad ShafiurRahman	Wiley-Blackwell	1st Edition, 2012
2	Food Engineering Handbook: Food Process Engineering	TheodorosVarzakas, ConstantinaTzia	CRC Press	1st Edition, 2014
3	Introduction to Food Engineering	R. Paul Singh, Dennis R. Heldman	Academic Press	5th Edition, 2013
4	Food Process Engineering Operations	George D. Saravacos, Zacharias B. Maroulis	CRC Press	1st Edition, 2011

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Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	https://onlinecourses.nptel.ac.in/noc24_me139/preview
2	https://onlinecourses.nptel.ac.in/noc24_ag15/preview
3	https://onlinecourses.nptel.ac.in/noc24_ag16/preview
4	https://onlinecourses.nptel.ac.in/noc24_me139/preview