GUJARAT TECHNOLOGICAL UNIVERSITY

BACHELOR OF ENGINEERING

Subject Code : 3165105

Subject Name : Microbial Food Safety and Risk Analysis

WEF Academic Year :	2022-23
Semester :	6
Category of the Course :	Professional Core-III

Prerequisite: Nil

Rationale: This is an overview of the application of risk assessment for evaluating and managing food borne microbiological health risks. Risk assessment comprises four steps: hazard identification, hazard characterization, exposure assessment, and risk characterization. The process provides a framework for systemic and objective evaluation of all available information pertaining to the food borne hazard. The outcome of microbial risk assessment is an estimation of the magnitude of human health risk in terms of likelihood of exposure to a pathogenic microorganism in a food and the likelihood and impact of any adverse health effects after exposure.

Course Scheme:

Teaching Scheme			Total Credits	Assessment Pattern and Marks				Total Marks
				Theory		Practical		
L	T	PR	C	ESE (E)	PA(M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Course Content:

Sr. No.	Course Content	No. of Hours	% of Weightage
1	An Overview of Food Safety: Safe Food definition, Food Hazards, Chemical Hazards, Food Allergens, Drugs, Hormones, and Antibiotics in Animals, Naturally Occurring Toxins, Pesticides, Microbiological Hazards, Bacteria, Viruses, Protozoa and Parasites, Bovine Spongiform Encephalopathy (BSE), Physical Hazards, Factors That Contribute to Foodborne Illness, Demographics, Consumer Lifestyles and Demand, Food Production and Economics, New and Evolving Pathogens, History of Food Safety, The Role of Food Preservation in Food Safety.	12	25
2	Issues in Food Safety, Genetically Engineered Foods: Regulation, The Case against and in favor of Food Biotechnology, Bovine Somatotropin, Food Irradiation, pesticide residues in food.	5	10
3		10	20

	Drinking water quality: History, Water Supply, Hazards to the Water Supply, Regulation, Restaurant Food Safety: Regulating the Industry, associated hazards, education and corrective action. National and International Food safety Regulations		
4	Introduction to Risk Analysis: Background, changing food safety environment, evolving food safety systems, an abundant array of hazards, Increasing demands on national food safety authorities. Risk Analysis: Components of risk analysis, carrying out risk analysis, Risk analysis at the international and national levels, Essential characteristics of risk analysis, Benefits for national governments of using food safety risk analysis.	8	15
5	Food Process Engineering Units and dimensions, concept of entropy, Energy, Anergy, exgergy, Degrdation of exergy, Material and energy balances. Novel evaporation/ dehydration techniques, New direction in evaporation and drying concentration, cyclic pressure freeze drying, spray drying.	5	10
6	Microwave drying and vacuum drying, osmotic dehydration efficient drying systems, infrared heating, freezing of foods, freeze concentration and drying, freezing point curves, methods of freeze concentration, design problems	5	10
7	Extrusion cooking - recent developments, methods, equipment, design criteria of extruders. Engineering aspects of single and twin screw extrusion cooking; Non-thermal processing: Microwave, irradiation, ohmic heating, pulsed electric field reservation, hydrostatic pressure technique	5	10

Reference Book:

1. Food Safety and Quality Systems in Developing Countries, Volume II: Case Studies of Effective Implementation || André Gordon || Academic Press, 2020
2. Food Process Engineering and Technology || Zeki Berk || Academic Press, 2018 (3rd Edition)
3. Food Safety: Theory and Practice || Paul L. Knechtges || Jones & Bartlett Learning, 2011
4. Microbiological Risk Assessment in Food Processing || Editors: M. Brown and M. Stringer || Woodhead Publishing, 2002
5. Food Safety Management: A Practical Guide for the Food Industry || Editor: Yasmine Motarjemi || Academic Press, 2014

Suggested Course Practical List:

1. Develop a HACCP plan for a specific food product, identifying critical control points.
2. Conduct microbiological tests to detect pathogens such as Salmonella and E. coli in food samples.
3. Perform ELISA tests to detect common food allergens in various food products.
4. Calculate the energy balance for a specific food processing operation, such as pasteurization.
5. Evaluate the efficiency and effectiveness of microwave drying on different food products.
6. Assess the impact of infrared heating on the quality and safety of food items.
7. Perform a risk assessment for genetically engineered ingredients in a food product.
8. Explore the impact of various food preservation techniques, like canning and freezing, on food safety.
9. Conduct an analysis of pesticide residues in fruits and vegetables using HPLC.
10. Test the quality of drinking water used in food processing for contaminants like heavy metals.
11. Perform a mock audit of a food processing facility to assess compliance with food safety regulations.
12. Evaluate the effectiveness of sanitation procedures in a food production environment.

List of Laboratory/Learning ResourcesRequired:

Equipment:

- ELISA Kit
- Microwave dryer
- Cyclone separator
- Texture analyzer
- High-Performance Liquid Chromatography (HPLC) systems
- Gas Chromatography (GC) systems
- UV-Vis spectrophotometers
- Infrared (IR) spectrometers
- Conductivity meters
- Turbidity meters
- Water testing kits for heavy metals and contaminants
- Pasteurizers
- Homogenizers
- Dehydrators

List of Open Source Software/learning website:

Open Source Software:

1. RStudio: https://rstudio.com/
2. Orange: https://orange.biolab.si/
3. KNIME: https://www.knime.com/
4. OpenFOAM: https://www.openfoam.com/
5. Jupyter Notebook: https://jupyter.org/

Learning Websites:

1. Coursera: https://www.coursera.org/
2. edX: https://www.edx.org/
3. Khan Academy: https://www.khanacademy.org/
4. MIT OpenCourseWare: https://ocw.mit.edu/index.htm
5. OpenCourseWare Consortium: https://www.ocwconsortium.org/

* * * * * * *