GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3151408

Thermal and Non Thermal Processing of Food

5th SEMESTER

Type of course: Professional Elective Course

Prerequisite: Nil.

Rationale: Foods can be preserved by addition or removal of heat. Traditionally, foods have been processed thermally in a variety of ways such as steam retorting, pasteurization, baking, and frying. However, traditional thermal processing methods, which are aimed mainly at eliminating the harmful bacteria by heat, have some disadvantages that include loss of color, flavor, freshness, and some nutritional aspects. New ways of processing food in non-thermal ways offer a way to eliminate some of these disadvantages and ensure food safety.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ES (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Topics	Teaching Hrs.	Module Weightage
1.	Blanching: Steam blanchers, Hot-water blanchers. Pasteurization: Pasteurization of Foods- Theory and equipments, Energy Aspects of Pasteurization. Bulk Canning/In-container sterilisation: Theory andEquipment, Energy Aspects of Canning. Aseptic Processing: Theory and Equipment.	8	21
2.	Thermal Process Calculation: Survivor curve, Concept of Thermal Death Time, Thermal resistance curve and z value, Commercial sterlity, Probability of spoilage, Lethal rate and lethality, Method for process time calculation. Concept of rate constant, Q value and shelf life.	9	22
3.	Hurdle Technology: Concept and applications.Extrusion: Theory, Equipment and application. Frying: Theory and Equipment.	6	15
4.	Dielectric Heating: Theory, equipment and application. Ohmic Heating: Theory, equipment and application. Infrared Heating: Theory, equipment and application.Irradiation: Theory and application	8	21
5.	Pulsed electric field processing: Theory and Equipment. High pressure processing: Theory and Equipment. Processing using pulsed light: Theory and Equipment. Processing using ultrasound:Theory and application.	8	21

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Suggested Specification table with Marks (Theory):

Distribution of Theory Marks				
R Level	U Level	A Level	N Level	E Level
28%	25%	18%	13%	16%

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate 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. Introduction to Food Engineering, 4th Edition, R.P. Singh and D.R. Heldman, Academic Press, NY, 2009.
2. Food Processing Technology: Principles and Practice, P.J. Fellows, CRC Press, Boca Raton, FL, 2000.
3. Handbook of Food Preservation , M. Shafiur Rehman, CRC Press, Boca Raton, 2007
4. Fundamentals of Food Process Engineering, R.T. Toledo ,3rd edition, 2007, Springer.
5. Food Engineering Operations, Brennan JG, Butters JR, Cowell ND & Lilly AEI. 1990, Elsevier.
6. Food Extrusion, Vol. I and II. J.M. Harper, CRC Press Boca Raton FL, 1980.
7. New Methods of Food Preservation (Non Thermal Processing of Foods) G. W. Gould.
8. Emerging Technologies for Food Processing, Da-Wen Sun (Ed.) Elsevier Academic Press, U.K., 2005.
9. Non-Thermal Preservation of Foods, G.V. Barbosa-Canovas, U.R. Pothakumary, E. Palou, B.G. Swanson, Marcel Dekker, New York, 1998.

Course Outcomes:

At the end of this syllabus students will be able to :

CO	CO Statement	% Marks Weightage
1	Understand the blanching, pasteurization and canning concepts.	21
2	Calculate the thermal process time for food products.	17
3	Estimate the rate of deteriration and shelf life of food products.	05
4	Understand hurdle technology, extrusion and frying concepts.	15
5	Understand the mechanism of irradiation, ohmic, infrared and dielectric heating.	21
6	Understand the concepts of novel food processing technologies.	21

List of Practicals:

1. Study of effect of blanching on food.
2. Study of effect of frying treatments on quality parameters of food.
3. Study of extruder components.
4. Effect of extruder variables on food.
5. Estimation of spoilage probability.
6. Estimation of D and Z value of microorganism/enzymes in food.
7. Calculation of thermal process time using graphical method.
8. Calculation of thermal process time using improved graphical method.

9. Estmation of rate constant of food deteriration.
10. Calculation of shelf life and accelerated shelf life of food.

Major Equipments

1. Blancher
2. Deep fryer
3. Extruder
4. Retort

List of open source software/learning websites

1. https://nptel.ac.in/courses/126/103/126103017/
2. https://www.youtube.com/watch?v=ZwBoZVrZxbk&list=PL2E9_TlQKsGRQy05HBihSowy1WP9HBtdy
3. https://www.digimat.in/nptel/courses/video/126105011/L12.html
4. https://nptel.ac.in/courses/126105015/