



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Bachelor of Engineering

Level: Under Graduate

Branch: Food Engineering & Technology

Subject Code: BE05051041

Subject Name: Millets Processing and Value Addition

w. e. f. Academic Year:	2024-25
Semester:	05
Category of the Course:	Professional Elective Course - 1

Prerequisite:	
Rationale:	Millets, rebranded as "Nutri-cereals," are climate-resilient crops essential for nutritional security. This course provides comprehensive knowledge on the processing technologies required to transform raw grains into high-value products. It focuses on primary and secondary processing, innovative product development (RTE/RTC), and the critical technical challenges of storage stability and rancidity prevention. The course prepares students for the growing "Shree Anna" industry by integrating technical engineering skills with quality management and entrepreneurship.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
01	Describe the types, nutritional profiles, and health benefits of major and minor millets.	Remember / Understand
02	Apply primary processing techniques including cleaning, dehulling, and milling to millet grains.	Understand
03	Design and formulate Ready-to-Eat (RTE) and Ready-to-Cook (RTC) millet-based products	Apply
04	Evaluate factors affecting storage stability and design packaging solutions for millet products.	Analyze / Evaluate
05	Analyze the technical and financial requirements for setting up a millet processing business.	Analyze
06	Implement FSSAI standards and government subsidy schemes in the millet value chain.	Understand / Apply



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Teaching and Examination Scheme:

Teaching-Learning Scheme (in Hours per Semester)					Total Credits = TH/30	Assessment Pattern and Marks					Total Marks
L	T	P	PBL*	TH		Theory		Tutorial/Practical			
						ESE (E)	PA (M)	PA/ (I)	PBL (I)	ESE (V)	
45	0	30	15	90	03	70	30	20	30	50	200

Where L=Lecture, T=Tutorial, P=Practical, TW/SL=Term-Work/Self-Learning, TH=Total Hours, ESE=End- Semester Examination, PA = Progressive Assessment

***Problem Based Learning (PBL) aims to accommodate learning beyond syllabus as per clause 9.4 of NBA manual.**

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	Introduction to millets: types & Nutritional Benefits: What are millets, Types & Varieties, Positive & Neutral Millets, Why include millet in our diet, Identifying polished & unpolished millets , How to store millets , Health benefits of Indian millets, Environmental benefits of millets, Millets consumption - DO's & DON'Ts	8	18
2.	Primary Processing of Millets: Principles and machinery for cleaning, destoning, and grading. Dehulling / Decortication: traditional vs. modern methods. Milling: size reduction, flour production, sifting, and grading. Principles of mass balance in milling.	7	15
3.	Secondary Processing: RTE & RTC Products: Product development of millet-based value-added products. Ready-to-Cook (RTC): noodles, and pasta. Ready-to-Eat (RTE): extruded snacks, flakes, bakery products (biscuits, cakes), Industrial applications of twin-screw extrusion.	8	18
4.	Shelf Life, Storage Stability and Packaging of Millet Products:	10	22



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	Factors affecting shelf life, Physical, chemical and microbial changes during storage. Storage conditions for millet products, Moisture control and prevention of rancidity. Basic methods for shelf-life evaluation (Real-time and ASLT). Packaging requirements: Conventional methods (jute) vs. Modern methods (Vacuum, MAP). Biodegradable packaging materials (Biopack). Role of packaging in maintaining quality and safety.		
5.	Millets processing business setup : Plant layout optimization, Product development and marketing strategies, Machinery selection and technical specifications, Packaging, labeling, and branding, Important aspects for a Millet Entrepreneur, Competitive advantage and the right pricing	6	14
6.	Subsidy Schemes & Govt. Initiatives for Millets : Useful Subsidy schemes for millet business, Events that were launched, Initiatives taken by Government, Nutritional Security through Intensive, Millet Promotion POSHAN MISSION Abhiyan, Constitution of Task Forces (IYoM) 2023 .	6	13
	Total	45	100

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
35	35	10	10	10	00

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

The syllabus of Millets Processing and Value Addition directly contributes to:

SDG 2	Zero Hunger
SDG 3	Good Health and Well-Being
SDG 4	Quality Education
SDG 9	Industry, Innovation and Infrastructure
SDG 12	Responsible Consumption and Production
SDG 13	Climate Action



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References/Suggested Learning Resources:

(a) Books:

1. Handbook of Millets - Processing, Quality, and Nutrition Status by C. Anandharamakrishnan, Ashish Rawson, C. K. Sunil (2024/25).
2. Millets: Properties, Processing, and Health Benefits by Anil Kumar Siroha, Sneha Punia (2021) .
3. Innovative Millet Processing: Harnessing Novel Technologies for Nutritional Excellence by Samuel Jaddu, Rama Chandra Pradhan (2025/26).
4. Millets - The Trending Ancient Grains by Dr. Kruti S. Dhirwani (2022) .
5. FSSAI Guidance Note: "Millets - the nutri-cereals" and Comprehensive Group Standard (2023) .
6. Food Processing Technology: Principles and Practice by PJ Fellows, Woodhead Publishing.

(b) Open-source software and website:

1. NPTEL
2. https://www.millets.res.in/millets_info.php
3. <http://www.sciencedirect.com/science/book/>
4. <http://www.ucc.ie/en/ace-dfsct/>

Suggested Course Practical List

1. Millet cooking recipes & techniques for snacks; Smoothies, Dosa, Dhokla, Upma, Instant Idli
2. Special kitchen tips on utensils, oils, salts, etc.
3. Cooking practicals of millet-based recipes on Cookies, Bread
4. Cooking practicals of millet-based recipes on Samosa, Thepla, Smoothie
5. Market analysis, demand for millet-based products
6. Millets in food industries, farmer producer company
7. Discussions with successful entrepreneurs on millet business

List of Laboratory/Learning Resources Required: Equipment

- Mixer grinder / blender
- Induction cooktop / gas stove
- Baking oven
- Dough kneader (or manual kneading setup)
- Weighing balance (digital)
- Basic stainless steel utensils (pans, bowls, trays)
- Flour mill / pulverizer (small scale)
- Sieves (standard mesh sizes)



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- pH meter (basic)
- Moisture analyzer (or hot air oven)
- Heat sealing machine
- Refrigerator / storage unit

***List of suggested activities for Problem Based Learning:**

Sr. No.	Activity Name	Suggested Topics / Focus Area	Hours	Evaluation Criteria
1	Industry/Research Laboratory Visit	Visit to Millet Processing Unit / ICAR-IIMR / Millet Startup	10 h (Visit +Report)	Report with observations, flowchart, supervision notes
2	Technical Video-Based Learning	Modern millet processing techniques (Dehulling, Extrusion, Fermentation, Drying)	10 h	Report, answer sheet, learning points
3	Assignment Writing (Theoretical)	Millet composition, functional properties, anti-nutritional factors	10 h	Presentation, content accuracy
4	Problem Solving/ Coding	Shelf-life calculation, moisture content analysis, packaging selection	10 h	Solution development, assessment output
5	Online Course (MOOCs)	NPTEL/SWAYAM courses on food processing, millet technology	10 h	Based on completion and reflective submission
6	Complex Problem Solving	Development of millet-based functional food (diabetic/gluten-free product)	10 h	Assessment of accuracy and creativity
7	Literature Review	Recent research on millet processing, health benefits, product innovation	8 h (+4 papers)	Critical review, report submission



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8	Research Paper Discussions	Emerging trends in millet-based foods and nutraceuticals	20 h (5 papers×4 h)	Discussion and reflective notes
9	Poster/Chart/Power Point Presentation	Millet value chain, processing flow, nutritional comparison	6 h	Clarity, creativity, external feedback
10	Model Development (Working/Non-working)	Millet processing flow model / storage & packaging model	8–12 h	Functionality and usability check
11	Industrial Exposure (2–3 Days)	Millet industries, packaging units, quality control labs	20 h	Critical review, participation certificate
12	Group Discussion (Tech Trends)	Sustainable processing, millet startups, plant-based foods	1h per GD	Technical input, communication skill rating
13	Case Study/Regulatory Aspect	FSSAI standards, labeling of millet products, contamination issues	10 h	Report with analysis and regulation linkage
14	Application/Software Development	Shelf-life prediction tool, cost analysis of millet product	10 h	Based on functionality and usability

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