



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3160408
Semester – VI
Food and Agriculture biotechnology

Type of course: Professional Elective Course

Prerequisite: Advanced Molecular biology, Microbiology, Biochemistry, Basics of IPR, Thermodynamics, Chemical Engineering Fundamentals

Rationale: The subject aims to acquaint the students with the application of biotechnology to the pharmaceutical industry. The subject introduces the students with a requirement of skills that they may use to get employed in the biopharmaceutical industry.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
4	0	2	5	70	30	30	20	150

Course Contents:

Sr. No.	Topics	Teaching Hours	Module Weight age
AGRICULTURAL BIOTECHNOLOGY			
1	UNIT I: Multiple faces of Agribiotech: (a) Genetic engineering of crop plants: Agrobacterium-mediated gene transfer and Direct gene transfer methods (b) Engineering of crop plants for industrial traits: Tomato fruit ripening, production of high-value peptides & proteins, starch synthesis & site manipulation, fatty acid biosynthesis & site manipulation (c) Biopharming and production of foreign compounds in transgenic Plants: bioactive peptides, human proteins, enzymes, vaccines and antibodies.	9	15%
2	Unit II: Biofertilizers, Biopesticides & Organic farming a) Biofertilizers: Introduction, types, advantages and future perspective. b) Biopesticides: Introduction, types, advantages and future perspective. c) Organic farming: Overview, management of traditional and non-traditional additive agricultural waste management, crop proand organic farming, future trends	10	16.6%



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3.	<p>UNIT III: Introduction to Food Science and Technology (a) Fundamentals and Aims of food science and technology. Interdisciplinary approach, Nutritive value of foods, Food as a source of energy.</p> <p>(b) Food Microbiology: Microbial growth pattern, Microbial examination of food, Types of micro-organism normally associated with food -mold, yeast, and bacteria. Biochemical changes caused by microorganisms, deterioration of various types of food products. Intrinsic and Extrinsic .Parameters of Foods that affect microbial growth</p> <p>(c) Food poisoning and microbial toxins, standards for different foods. Food borne intoxicants and mycotoxins.</p> <p>(d) Food Preservation: Food Preservation with Low Temperatures, Food Preservation with High Temperatures, Preservation of Foods by Drying.</p> <p>(e) Food irradiation: Characteristics of Radiations of Interest in Food Preservation. Principles Underlying the Destruction of Microorganisms by Irradiation. Radappertization, Radicidation, and Radurization of food.</p>	18	30%
FOOD BIOTECHNOLOGY			
4.	<p>Unit IV: Biotechnology in relation to food industry, (a) Enzymes in foods and food industry, Nature and type of starters, SCP, medical foods, probiotics and health benefits of fermented milk and foods products. (b) Mushroom production ,Mycoprotein production, probiotics, Brewing-malting, mashing, hops, primary & secondary fermentation (a) Food Analysis: Brief overview: Sampling techniques and microbiological examination of surfaces, air sampling, Bioassay , Molecular methods for detection of food borne pathogens (b) Food Additive: Food flavours, food additives and toxicants. Artificial sweeteners and their role in controlling diseases and deficiencies</p>	13	21.6%
5.	<p>Unit V: Food Processing, Regulation and Technology based trends: (a) Basic principles, unit operations, and equipment involved in the commercially important food processing methods and unit operations. (b) Food Quality Assurance Food regulations, grades and standards, Concept of Codex Alimentarius/HACCP/USFDA/ISO 9000 series etc. Food laws and standards . (c) Current trends including use Internet of things, Big data and Space research for enabling agriculture and food technology. Possible future trends about the food industry, with increasing consumer awareness, environmental sustainability and fossil fuel crunch.</p>	10	16.6%

Suggested Specification table with marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
12	12	22	16	08	0

Legends: R=Remembrance; U= Understanding; A= Application; N = Analyze;E = Evaluate; C = Create and above Levels (Revised Bloom's Taxonomy)



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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: (Agricultural Biotechnology)

1. Biotechnology by B.D. Singh, Kalyani pub.
2. Elements of Biotechnology by P.K. Gupta, Rastogi Publications.
3. Modern Concepts of Biotechnology by H.D. Kumar, Vikas Pub. House.
4. Plant Genetic Engineering by Dodds J.H., Cambridge University Press.
5. Plant Biotechnology, H.S. Chawla. Second Edition.
6. Principles of Gene Manipulation, S.B.Primrose, Sixth Edition, Blackwell science

Reference Books: (Food Biotechnology)

1. Jay J.M. 1986. Modern Food Microbiology. 3rd Edn. VNR, New York.
2. Food Microbiology fourth edition William C.Frazier, Tata Mc Graw Hill
3. Food Microbiology 2nd Edition, Michael P.Doyle, ASM press
4. Fennema, O.R. Ed. 1976. Principles of Food Science: Part-I Food Chem Marcel Dekker, New York.
5. Meyer, L.H. 1973. Food Chemistry. East-West Press Pvt. Ltd., New Delhi.
6. Tzounis, A., Katsoulas, N., Bartzanas, T., & Kittas, C. (2017). Internet of Things in agriculture, recent advances and future challenges. Biosystems Engineering, 164, 31-48.
7. Traitler, H., Dubois, M., Heikes, K., Petiard, V., & Zilberman, D. (2017). *Megatrends in Food and Agriculture: Technology, Water Use and Nutrition*. John Wiley & Sons.

Course Outcome:

After learning the course, the students should be able to:

Sr. No.	CO Statement	Marks % Weightage
CO-1	evaluate the benefits of organic farming over traditional farming	10
CO-2	Apply the knowledge of genetic engineering and comprehend various methods used for improving agriculture produce quality and quantity	30
CO-3	Comprehend correlation between food microbiology, food biochemistry and food spoilage.	30
CO-4	Infer and apply the principles of preservation of food, food processing, various unit operations.	20
CO-5	Evaluate various food technology trends of the present and the future and work towards solving problems related to the same.	10

List of Practicals:

1. Microbial examinations of food and food products
2. Standard plate count of bacteria in food stuff.
3. Estimation of *coliform* bacteria in food.
3. Estimation of starch from potato/wheat flour/ from given sample.
4. Estimation of lactose in milk by Lane & Eynon's method
5. Extraction & estimation of amino acid from pea (free amino acids by ninhydrine test)
6. Estimation of ascorbic acid from given food sample by titrimetric method.
7. To perform Qualitative analysis of milk by MBRT test.



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8. To Detect presence of adulterants in milk.
9. To Detect presence of preservatives in milk.
10. Isolation and Characterization of food fermenting organism from idli batter.
11. To study the adulteration in tea using DNA barcode PCR (can be given in virtual mode or as a study)

List of Open Source Software/learning website:

Students can refer to video lectures relevant to subject, available on the websites, including NPTEL.

Students can refer to the CDs which are available with some reference books.