GUJARAT TECHNOLOGICAL UNIVERSITY

BIOTECHNOLOGY (04)
AGRICULTURAL AND FOOD BIOTECHNOLOGY
SUBJECT CODE: 2160408
B.E. 6th Semester

Type of course: B.E. (Biotechnology)

Prerequisite: Basic concepts of Microbiology, Biotechnology and techniques relevant to field of Biotechnology.

Rationale: It is one of the advanced subjects of Biotechnology. Agriculture biotechnology covers the study of concepts, methods and tools employed to understand and manipulate the genetic makeup of organisms to increase the production of agricultural products. It involves the application of various advanced Biotechnological techniques in two vast sectors of the society, food and agriculture.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
				Theory Marks			Practical Marks			
L	T	P	C	ESE (E)	PA (M)		ESE (V)		PA (I)	
					PA	ALA	ESE	OEP		
3	0	3	6	70	20	10	20	10	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. (d) Conservation of plant genetic resources, plant patents and plant variety certificates (e)Importance of Marine Compounds for Industrial application, role of marine biotechnology	**10**	**16%**
2	**Unit II: Biofertilizers, Biopesticides & Organic farming** a) **Biofertilizers:** Introduction, types, advantages and future perspective.	**6**	**12%**

	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		
3.	**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. **(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 **(c) Food poisoning** and microbial toxins, standards for different foods. Food borne intoxicants and mycotoxins**.** **(d) Food Preservation:** Food Preservation with Low Temperatures, Food Preservation with High Temperatures, Preservation of Foods by Drying. **(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.	**14**	**28%**
	FOOD BIOTECHNOLOGY		
4.	**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 and related methods. (b) **Food Additive:** Food flavours, food additives and toxicants. Artificial sweeteners and their role in controlling diseases and deficiencies, Nutraceuticals.	**12**	**26%**

5.	**Unit V: Food Processing:** **(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 Almentarious/HACCP/USFDA/ISO 9000 series etc. Food laws and standards	**6**	**18%**

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**

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.

Course Outcome:

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

- Develop a fundamental understanding of basic concepts of Food Biotechnology and its uses in the society at a large extent.
- Evaluate applications of various concepts & techniques of Food Biotechnology to facilitate biotechnological advancement and innovations.

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.
4. Estimation of starch from potato/wheat flour/ from given sample.
5. Estimation of lactose in milk by Lane & Eynon's method
6. Extraction & estimation of amino acid from pea (free amino acids by ninhydrine test)
7. Estimation of ascorbic acid from given food sample by titrimetric method.
8. To perform Qualitative analysis of milk by MBRT test.
9. To Detect presence of adulterants in milk.
10. To Detect presence of preservatives in milk.
11. Isolation and Characterization of food fermenting organism from idli batter.

Open Ended Problem:

Students are free to select any area of science and technology based on Food Biotechnology and Agricultural Biotechnology applications to define Projects.

Some suggested projects are listed below:

- To find out the amount of sugar from any food sample
- To check the microbial content of any food sample
- Detection of adulterant from any food sample
- Microbial analysis of any soil
- To check the presence and proportion of any important nutrient in a soil

List of Open Source Software/learning website:

Students can refer to video lectures available on the websites including NPTEL. Students can refer to the CDs which are available with some reference books. Students can develop their own flowsheets for demonstration of various Food Biotechnology techniques.

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.