GUJARAT TECHNOLOGY UNIVERSITY

Branch Name: Food Processing & Technology (14)
Subject Name: By- Product Utilization and Management
Subject Code: 2171406
BE Semester: 07

1. **Type of course :** Food Processing Technology
2. **Prerequisite** : Nil
3. **Rational**
   a. By-product utilization is the study of food industry waste utilization for preparing by products
   b. Management of waste material is treatment of waste to safely dispose the waste materials.
   c. It includes study of food waste generation, their characteristics and requirements of disposal.
   d. Productions of useful by-products like colour, alcohol, protein, fat, biogas etc.
   e. Case studies of byproducts utilization.
   f. Food waste treatment methods.
   g. Legal and statutory requirement of waste disposal and handling.

4. **Teaching Scheme & Examination Scheme.**

ESE = End Semester Examination

Subject Code	Subject Name	Teaching Scheme(Hours)			Credits	Theory Marks					Tutorial Work/Practical Marks						Total
		Theory	Tutorial	Practical		ESE (E)		PA (M)			Viva (V)			PA(I)			
							Passing Criteria	Other PA	ALA	Passing Criteria	Viva	OEP	Passing Criteria	Other PA	CS	Passing Criteria	
2171406	By products utilization and management (DE-I)	4	0	2	6	70	23/70	20	10	12/30	20	10	15/30	20	0	10/20	150

PA = Progressive Assessment
ALA = Active Learning Assisgnments
OEP = Open Ended Problems
CS = Case Studies

5. **Learning Objective.**

This subject is aimed to develop an understanding among the students on

a. Origin and type of waste and by products, waste identification, classification and composition.
b. Need for treatment and utilization. Impact of waste disposal on environment.
c. Food waste water treatments.
d. Utilization of waste in food industries.
e. Legal and statutory requirements for food waste handling, treatment and disposal.

6. **Open Ended Problems**

The topics taught in this subject would be useful to develop insight and application based knowledge among students

Functional design of Effluent Treatment plant for food industry. Quantity, quality of food waste available to be determined. Also determination of waste component analysis to decide treatment of process to meet legal requirement. Develop a flow diagram of ETP plant with various details of by products & critical points. Modifications of ETP to meet varying need.

7. Course Content

TOPIC	SUB TOPIC	LECTURES	Module Weightage (%)
Food industry By-products and Waste:	Introduction, status in India, definition, origin and type of waste and by products, their identification, classification, composition and characterization, need for treatment and utilization, impact on environment, food waste as source of biogenic raw material and energetic utilization	**10**	**20**
Introduction to Food Waste Treatment,	Basic unit operations, techniques & equipment for treatment, primary treatments like screening, sedimentation, skimming, floatation coagulation & flocculation, flow equalization, filtration, adsorption, chemical oxidation, membrane separation, ion exchange. Anaerobic & aerobic digestion of organic wastes, activated sludge process, biomass generation & its utilization.	**12**	**28**
Food Wastes and By-products Related to Specific Processing Industries	Like fruit and vegetables (apple, orange, mango, potato etc.), dairy industry, oil and oil seeds industry, sugar industry, grains and milling industry, fermentation (alcohol and beer), livestock and poultry, fish, meat.	**08**	**18**
Brief Case Studies	involving (i) utilization of whey from dairy industry, (ii) Utilization of specific plant by-products for recovery of proteins, pectins, dietary fibres, antioxidants, colorants etc. (iii) Utilization of biomass for production of animal feed, compost and bio-gas.	**08**	**17**
Introduction to Food Packaging Waste	Handling and treatment, Farm wastes. Incineration of solid food waste and its disposal.	**03**	**9**
Future Trends	Introduction to legal and statutory requirements for food waste handling, treatment and disposal.	**03**	**8**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks				
Remembrance R Level	**Understanding U Level**	**Application A Level**	**Analyze N Level**	**Evaluate E Level**
20	**20**	**20**	**22**	**18**

8. Reference Books:

1. Waste Management for the Food Industries, by Ioannis S. Arvanitoyannis, First edition 2008, Elsevier Inc, USA.
2. Food and Agricultural Wastewater Utilization and Treatment, Sean X. Liu, First edition 2007 Blackwell Publishing, Iowa 50014, USA.
3. Managing Food Industry Waste, ROBERT R. ZALL, First edition, 2004, Blackwell Publishing Professional, Iowa, USA.

4. The Treatment and Handling of Waste by Bradshaw AD Chapman & Hali.
5. Alternative Strategies for the Treatment of Food Processing Waste by Rockey J.
6. Food Processing Waste Management by Green J.H. AVI Publication
7. Post harvest Technology of Fruits and Vegetables by L.R. Verma. Indus Pub.

9. Course Out come

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

a. Identify various waste from food industries and understand their characteristics
b. Understand various methods of waste treatment and disposal
c. Understand various by products from food industry waste
d. Design and develop a functional ETP plant to suit requirement.
e. Understand legal aspects related to food waste disposal.

10. List of Practicals.

Sr. No.	Name of experiments
1.	Isolation of leaf protein from green I
2.	Isolation of leaf protein from green II
3.	Production of Banana fiber from banana pseudostem
4.	Production of ethyl alcohol from molasses I
5.	Production of ethyl alcohol from molasses II
6.	Isolation of starch from mango kernels.
7.	Extraction of pectin from fruit waste I
8.	Extraction of pectin from fruit waste II
9.	Extraction of oil from citrus peel I
10.	Extraction of oil from citrus peel II
11.	Production of cellulosic polymers from agricultural waste I
12.	Production of cellulosic polymers from agricultural waste II

11.Major Equipments

1. Soxhlet apparatus
2. Centrifuge
3. Distillation Unit
4. PH Meter
5. Grinder

12. List of open source software/learning websites

a. http://www.fpeac.org/fruit/WasteMinimizationUtilization-BerryProcessing.pdf
b. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3614052/
c.http://agropedialabs.iitk.ac.in/agrilore/sites/default/files/BYPRODUCTS%20UTILIZATION%20FROM%20BANANA%20(1)_1.ppt

d.http://foodseg.linux15.webhome.at/fileadmin/userdaten/pres_symp_I/symp1_pres_WG_4__Schreibgeschuetzt_.pdf