GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

COURSE CURRICULUM
COURSE TITLE: SUGAR & FOOD TECHNOLOGY
(COURSE CODE: 3360505)

Diploma Programme in which this course is offered	Semester in which offered
Chemical Engineering	Sixth

1. RATIONALE

Food processing in India is growing as a large production industry covering a very wide range of ready/semi ready to eat foods. The modern food processing and preservation industry was born in 1800s. This course covers the fundamentals of manufacturing sugar and some key food items like dairy products, bakery products and beverages. This technology course enables the student to apply principles of engineering and science to operate food processing facilities for producing foods in large quantities and with narrow tolerances on parameters of standards to deliver the consumers high quality, safe and healthy foods. Diploma engineers may utilize their skills to interpret each steps of manufacturing process flow diagrams and to supervise operation of various equipment/processes involved.

2. COMPETENCY

The course content should be taught and implemented with the aim to develop required skills in the students so that they are able to acquire following competency:

- **Maintain the sugar and food technology processing hygienically**

3. COURSE OUTCOMES (COs)

The theory should be taught and practical should be carried out in such a manner that students are able to acquire required learning outcomes in cognitive, psychomotor and affective domain to demonstrate following course outcomes:

i. Characterise sugar and food
ii. Operate raw and refined sugar manufacturing plant
iii. Identify various equipment for sugar production
iv. Produce dairy products
v. Produce bakery products
vi. Produce beverages

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	PA	ESE	PA	150
3	0	2	5	70	30	20	30	

Legends: L - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** - Practical; **C** - Credit; **ESE** - End Semester Examination; **PA** - Progressive Assessment

5. COURSE CONTENT DETAILS

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit – I Sugar and Food Industries	1a. Describe the Physical and chemical properties of Sucrose/sugar 1b. Describe the properties and uses of the byproducts of sugar	1.1 Physical and chemical properties of Sucrose/sugar 1.2 Byproducts - molasses, bagasse and filter mud
	1c. Differentiate the different types of food industry 1d. Describe the different types of processing techniques 1e. Describe the storage of different types of food products	1.3 Types of Food Industry 1.4 Food processing techniques 1.5 Food processing equipment 1.6 Food storage
Unit – II Sugar Production Processes	2a. Describe the various stages of the sugar manufacturing process of raw sugar from sugar cane. 2b. Explain refining of sugar 2c. Explain manufacturing of sugar from beet	2.1 Raw sugar from sugarcane 2.2 Milling Operation, Clarification/ Purification, Carbonation process, Suphitation process, Filtration, Concentration/ Saturation, Crystallization, Centrifuging, Drying and Bagging 2.3 Refining of sugar 2.4 Beet sugar manufacturing
Unit – III Equipment For Sugar Production	3a. Distinguish the major equipment involved in sugar production	3.1 Major Equipment for Sugar Production: Crushers, Pressure mills, Shredders, Filter Press, Evaporators, Crystallizers, Centrifuge, Vacuum pump
Unit–IV Dairy Products	4a. Describe the composition of milk 4b. Explain the process of pasteurization 4c. Describe the process of producing milk powder	4.1 Milk and its composition 4.2 Methods of preparation of pasteurized milk 4.3 Preparation of milk powder
	4d. Differentiate cream and butter 4e. Describe the preparation and composition of cheese	4.4 Cream and butter 4.5 composition and preparation of cheese
Unit – V Bakery products and Beverages	5a. Describe the raw materials required for baking products 5b. Describe the function of the different equipment used in the baking industry,	5.1 Baking Industry, raw materials used in baking industries 5.2 Equipment used in baking industries
	5c. Describe manufacturing process of bread	5.3 Manufacturing of bread

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
	5d. Describe preparation of non-alcoholic carbonated beverages 5e. Describe preparation of Wine 5f. Describe preparation of Beer	5.4 Non–alcoholic Beverages, carbonated beverages 5.5 Beverage syrup manufacturing 5.6 Bottling of Carbonated Beverages 5.7 Manufacturing of wine and beer

6. SUGGESTED SPECIFICATION TABLE WITH HOURS and MARKS (Theory)

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Sugar and Food Industries	07	4	4	3	11
II	Sugar Production Processes	12	7	7	7	21
III	Equipment for Sugar Production	07	4	4	4	12
IV	Dairy Products	06	3	4	3	10
V	Bakery products and Beverages	10	4	6	6	16
Total		**42**	**22**	**25**	**23**	**70**

Legends: R = Remember**, U** = Understand**, A=** Apply and above Level (Bloom's revised 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.

7. SUGGESTED PRACTICAL / EXERCISES

The practical/exercises should be properly designed and implemented with an attempt to develop different types of skills **(outcomes in psychomotor and affective domain)** so that students are able to acquire the competencies/programme outcomes. Following is the list of practical exercises for guidance.

Note*: Here only outcomes mainly in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of certain outcomes in affective domain which would in turn lead to development of* ***Course Outcomes*** *related to affective domain. Thus over all development of* ***Programme Outcomes (****as given in a common list at the beginning of curriculum document for this programme) would be assured.*

Faculty should refer to that common list and should ensure that students also acquire outcomes in affective domain which are required for overall achievement of Programme Outcomes/Course Outcomes.

S. No.	Unit No.	Practical/Exercise	Approx. Hours Required
1	I	Determine moisture content in sugar	02
2	I	Determine ash content in sugar	02
3	I	Measure the pH of sugar solution	02
4	I	Determine POL by polarimeter	02

S. No.	Unit No.	Practical/Exercise	Approx. Hours Required
5	II	Determine solid content in juice by brix hydrometer	02
6	II	Analyse baggase	02
7	II	Prepare chart showing unit operations and major equipments used in sugar industries	02
8	II	Prepare the chart showing unit operations and major equipments used in various food industries	02
9	III	Determine specific gravity and fat content of milk sample	02
10	III	Prepare cheese from milk	04
11	III	Prepare butter milk and butter	02
12	IV	Prepare of loaf bread	04
			28

8. SUGGESTED STUDENT ACTIVITIES

Following is the list of proposed student activities. These could be individual and group based.

i. Explore internet, visit websites of reputed sugar/food production companies and prepare ppt presentations on different topics (in group of four-five) and present in class
ii. Study (in group of four-five) the design of some real sugar/food production plant and identify good features of design and also weaknesses in it, present in class to have a group discussion.
iii. Survey market for different types of processed food items available and identify their ingredients/nutrients, further explore their production processes.

9. SPECIAL INSTRCTIONAL STRATEGY (If Any)

i. Show animations/ videos and drawings/models of pulp and paper production processes
ii. Arrange visit to nearby sugar factory, dairy, bakery and a canning factory
iii. Arrange expert lectures.

10 SUGGESTED LEARNING RESOURCES

A) Books

S. No.	Title of Books	Author	Publication
1	Dryden's outlines of Chemical Technology	Rao, M.Gopal, Sitting, Marshall	Affilated East-West Press Pvt. Ltd. - New Delhi, 3rd Edition
2	A Textbook of Chemical technology Vol-1 and Vol-2	Pandey G.N. and Shukla	Vani Books Company Hyderabad 2nd edition
3	Shreves' Chemical Process Industries	Austin, George T.	McGraw-Hill Education India Pvt. Ltd - New Delhi, 5th
4	Handbook of Cane sugar technology	Mathur, R.B.L.	Oxford and IBH publishing , - New Delhi, 2nd edition
5	Hand book of cane sugar engineering	Hugot, E.	Elsevier science, 3rd edition,

C) Major Equipment/Materials with Broad Specifications

i. Double Wedge Polari Meter
ii. Brix Hydrometer
iii. Oven with digital weight Balance
iv. Muffle Furnace
v. Lactometer,

D) Software/Learning Websites

i. www.nzic.org.nz/ChemProcesses/food/6E.pdf
ii. www.emt-india.net/process/sugar/pdf/The%20Sugar%20Industry.pdf
iii. www.journeytoforever.org/farm_library/AD36.pdf
iv. www.smallb.in/sites/default/files/knowledge_base/carbonated_soft_drink.pdf
v. www.eolss.net/sample-chapters/c17/E6-58-05-02.pdf
vi. www.pcij.org/blog/wp-docs/WHO_types_of_alcohol.pdf
vii. www.mssewb.org/scheme/data/S24_Pgs/kasba_bakery.pdf

11. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

- **Prof. Kartik R. Desai**, Head, Chemical Engineering Department, N. G. Patel Polytechnic, Isroli - Ahwa.
- **Prof. Mukesh B. Dhangar**, Lecturer in Chemical Engineering Department, N. G. Patel Polytechnic, Isroli - Ahwa.
- **Prof. Manish R. Nasit**, Lecturer in Chemical Engineering Department, N. G. Patel Polytechnic, Isroli - Ahwa.

Coordinator and Faculty Members from NITTTR Bhopal

- **Dr. Bashirulla Shaik**, Assistant Professor, Department of Applied Sciences
- **Dr. Joshua Earnest**, Professor, Department of Electrical & Electronics Engineering.