

Program Name : Diploma in Chemical Engineering
Program Code : CH
Semester : Sixth
Course Title : Food and Beverages Technology (Elective-III)
Course Code : 22613

1. RATIONALE

This course deals with the equipment which are generally employed for sorting, grading and processing of the food raw materials. It includes cleaning, grinding, pulping, drying, filling, sealing of raw material and processed foods. Even it also deals with material handling, distillation, crystallization and storage of food. This course is designed so that the technologists is able to use the separation processes of foods, fruit and vegetable processing, oil seeds processing, beverage processing and food additives.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Use different equipment in food and beverage industries.

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following *industry oriented* COs associated with the above mentioned competency:

- Use the cleaning, sorting and grading process.
- Use the equipment for Fruit and Vegetable Processing.
- Use the equipment for different types of Oil Seeds Processing.
- Apply the process parameters for Brewing different types of Beverages.
- Apply the blending process technology for food additives.

4. TEACHING AND EXAMINATION SCHEME

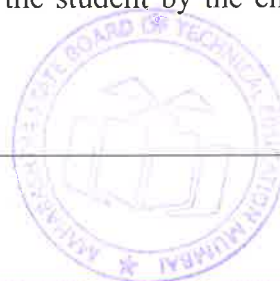
Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
				Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	
3	-	2	5	3	70	28	30*	00	100	40	25@	10	25	10	50	20

(*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain UOs required for the attainment of the COs.

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, ESE - End Semester Examination; PA - Progressive Assessment.

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the



course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

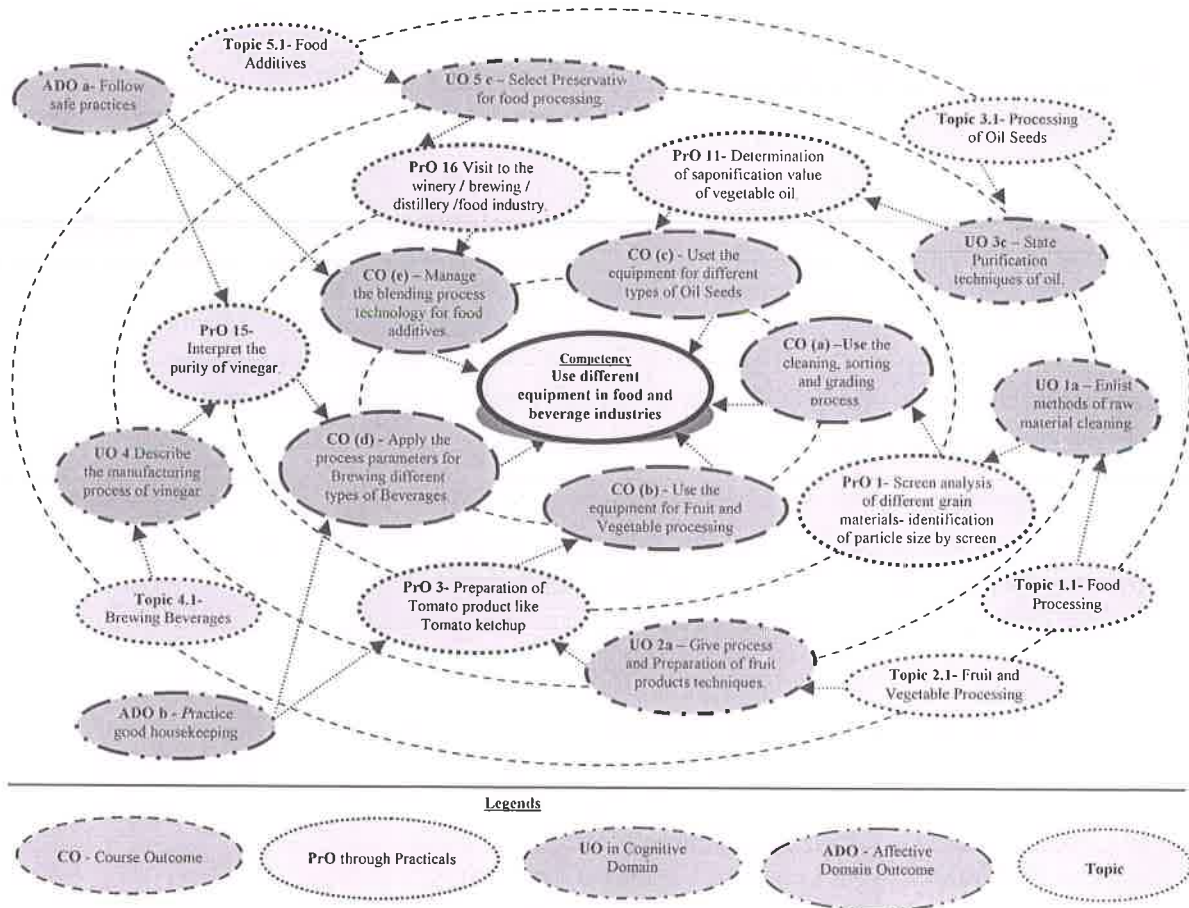


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Screen analyse of different grain materials- identification of particle size by screen analysis.	I	02*
2	Grade fruits, vegetable, grain according to size, colour etc.	I	02*
3	Estimate moisture content in different food materials.	I	02*
4	Prepare Tomato product like tomato ketchup.	II	02*
5	Prepare jam and jellies.	II	02*
6	Process certain vegetables by drying.	II	02*
7	Prepare Fermented Traditional food product any two Milk products and Food products	II	02
8	Measure specific gravity and viscosity of fruit juice sample.	II	02*
9	Use mechanical expeller to extract of active ingredient from oil seeds, coffee, lemon.	III	02
10	Determine iodine value of vegetable oil.	III	02*
11	Determine saponification value of vegetable oil.	III	02*

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
12	Determine acid value of vegetable oil.	III	02*
13	Prepare white grape wine.	IV	02
14	Use PH meter Determine PH for wine.	IV	02*
15	Analyse the purity of vinegar.	IV	02
16	Report the hygiene and safe practices adopted after viewing the video of the winery.	V	02
17	Report the hygiene and safe practices adopted after viewing the video of the brewery.	V	02
18	Report the hygiene and safe practices adopted after viewing the video of any other mechanised food industry.	V	02*
Total			36

Note

- i. A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicious mix of minimum 12 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.
- ii. The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
1	Preparation of experimental set up	20
2	Setting and operation	20
3	Safety measures	10
4	Observations and recording	10
5	Interpretation of result and conclusion	20
6	Answer to sample questions	10
7	Submission of report in time	10
Total		100

The above PrOs also comprise of the following social skills/ attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/ field based experiences:

- a) Follow safety practices.
- b) Practice good housekeeping.
- c) Practice energy conservation.
- d) Work as a leader/a team member.
- e) Follow ethical Practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organisation Level' in 2nd year



- 'Characterisation Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	PrO. No.
1	Sieve Shaker or vibrating screen.	1,2
2	Dryer.	3,6
3	Mixer or Hammer mill.	4,5,6,7
4	Mixer and Heating Bath.	4,5,6,7
5	Dryer and Oven.	3,6
6	Mixer	4,5,7
7	Specific gravity bottle and viscometer.	8
8	Extractor.	9
9	Titration set up	10,11,12,15
10	Fermentor and Filtration.	13
11	PH meter.	14
12	Video projection system	16 to 19

8. UNDERPINNING THEORY COMPONENTS

The following topics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit-I Food Processing	1a. Select suitable method for cleaning of specified food material with justification 1b. State the specifications of the specified raw food material cleaning equipment 1c. State the specifications of the given type raw food material Sorting or grading equipment. 1d. State parameters of cleaning, sorting and grading of the given raw food material.	1.1 Food Processing: a) Introduction to various raw materials used in food Production. b) Cleaning procedures for raw material and their importance. c) Equipment used for cleaning of raw materials (Vibrating screen, Dryer, Cyclone separator)- their specifications 1.2 Sorting and Grading :Types of sorters and graders- Color sorter, size sorter, shape sorter, weight sorter
Unit-II Fruits and Vegetable Processing	2a. Describe with sketches the process and preparation technique of the given fruit product. 2b. Explain with sketches the manufacturing of the given type of fruit beverages, 2c. Describe with sketches the manufacturing of the given type of vegetable product.	2.1 Fruit Processing a) Processing of fruit (selection, juice extraction, deaeration, straining, filtration and clarification) b) Preservation of fruit juices (pasteurization, use of chemical preservatives, preservation by sugars, freezing, drying, aseptic processing, and carbonation). 1.2 Jam, Jellies and fruit Preserves :

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	2d. Explain regulations in production and preservation of the given type of food material. 2e. Explain the hygienic and safe practices to be followed for the specified fruit and vegetable processing techniques	Selection, Preparation, Regulations in production and preservation. 1.3 Vegetable Processing a) Potato and Sweet potato Processing: Chips, French fries processing. b) Tomato Processing: Pulping and processing of tomato juice, ketchup.
Unit– III Processing of Oil Seeds	3a. Describe with sketches the processing technology of the given type of oil seeds. 3b. Describe with sketches the Solvent Extraction for the specified type of oil seed 3c. Describe with sketches the working of the given type of mechanical expeller. 3d. Describe with sketches the purification techniques of the given type of oil. 3e. Describe with sketches the Hydrogenation, plasticizing of the given type of oil. 3f. Explain the hygienic and safe practices to be followed for the specified oilseed manufacturing process technology	3.1 Production of oil: Processing technology of oil seeds- Oil seed pressing, Solvent extraction, Purification (degumming, refining, bleaching, deodorization) 3.2 Oil Processing: Hydrogenation, plasticizing, tempering, winterization.
Unit– IV Brewing Beverages	4a. Describe the given terms related to brewing. 4b. Describe with sketches any one the given process (malting, mashing or fermentation). 4c. Describe the properties of the given types of wine. 4d. Explain the hygienic and safe practices to be followed for the specified beverage manufacturing process technology. 4e. Describe the process technology of the given type of .	4.1 Vinegar process: Introduction - Types of vinegar a. Mechanism of acetic acid fermentation Process - slow and quick process. Brewing raw materials and its role. 4.2 Malting of barley, Mashing, brew kettle boiling, brewing, carbonation, packaging, pasteurization. 4.3 Process of wine: Process technology of white wine-grape preprocessing, grape juice treatment, fermentation, clarification and aging. 4.4 Process technology of Red, Rose, fortified and sparkling wine.
Unit –VI Food Additives	5a. Select the relevant food additives for the specified processed food 5b. Describe properties of the specified type of additives. 5c. Select relevant preservative for the specified food processing. 5d. Select the relevant type of ‘agent’	5.1 Food Additives: Introduction, Role and amount to be added of additives - Antioxidants, Coloring and Flavoring agents, Chelating agents, Curing agents, Stabilizers and Thickeners, Emulsifiers, Flour Improvers. 5.2 Humectants, Anti-caking agents, Leavening Agents, Nonnutritive

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	for the process the given type of food.	sweeteners, Preservatives such as sulphur dioxide and benzoic acid, Buffering agents.

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above of Bloom's 'Cognitive Domain Taxonomy'.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Food Processing	08	02	02	04	08
II	Fruit and Vegetable Processing	12	04	04	06	14
III	Processing of Oil Seeds	08	04	04	06	14
IV	Brewing Beverages	14	04	08	08	20
V	Food Additives	06	02	06	06	14
Total		48	16	24	30	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist students for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related *co-curricular* activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- Prepare journals based on practical performed in laboratory.
- Follow the safety precautions.
- Visit any food processing industry and prepare report on it.
- Prepare power point presentation on different food processing products.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- Massive open online courses (*MOOCs*) may be used to teach various topics/sub topics.
- 'L' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for *self-directed learning* and assess the development of the LOs/COs through classroom presentations (see implementation guideline for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for *co-curricular activities*.



- e) Guide student(s) in undertaking micro-projects

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be **individually** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should **not exceed three**.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

- Prepare report:** Prepare report on different equipment, machinery used in food processing industries.
- Prepare model:** Prepare demonstrative/working model of dryer/mixer/oven in laboratory.
- Prepare charts:** Prepare charts displaying various food products available in market.
- Prepare List:** Prepare list of various food processing industries in India.
- Prepare the report:** Collect information regarding various additives added in food products.
- Industrial Visit report:** Visit nearby food processing industry to observe various operation and prepare the report.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Food Processing Technology	Fellows, P. J.	Wood head Publishing Ltd., Cambridge
2	Food Processing and Preservation	Subbulakshmi, G.	New Age International Publisher, New Delhi.
3	Handbook of Food Engineering Practical	Valentas Rotstein Singh	CRC Press, New York
4	Principles of Fermentation Technology - 2 nd Edition	Stanbury, P. F. and Whitaker, A. and Hall, S. J.	Aditya books Pvt. Ltd., New Delhi
5	Food, Facts and Principles	Shakuntala, Maney	New age international (P) Ltd., New Delhi
6	Food Additives Data Book	Smith, Jim, Lily Hong-Shum.	John Wiley and Sons. Second Edition.2011. New Delhi.
7	Food and Beverage Management	Andrews, Sudhir	Mc Graw-Hill Companies.
8	Food and Beverage Service	Singaravelaran, R.	Oxford University Press, New Delhi.



14. SOFTWARE/LEARNING WEBSITES

- a) Food Production Methods -<https://nptel.ac.in/courses/103107088/33>
- b) Food Processing Equipment - <https://nptel.ac.in/courses/103103029/35>
- c) Fundamentals of food processing engineering-
<https://public.wsu.edu/~rasco/.../Intro%20to%20Food%20Processing82905.pdf>
- d) Introduction to food processing - <https://www.slideshare.net/shilleary/introduction-to-food-processing>
- e) Oil seed processing- <https://www.slideshare.net/.../oilseed-processing-for-smallscale-producers-9582940>
- f) Food Additives - <https://www.fda.gov/Food/.../Food Additives Ingredients/default.htm>

