DAIRY AND FOOD ENGINEERING (IPCC)			
Course Code	**21AG62**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	(3:0:2:0)	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory + 10 Lab slots	Total Marks	100
Credits	04	Exam Hours	03

Course Objectives:

- Knowledge on milk and food processing unit operations offer strength to students
- To handle pasteurization, sterilization, packaging, etc. of dairy products
- Control spoilage of food through process operations such as evaporation, freezing, membrane processing etc.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Adopt different types of teaching methods to develop the outcomes through PowerPoint presentations and Video demonstrations or Simulations.
2. Chalk and Talk method for Problem Solving.
3. Arrange visits to show the live working models other than laboratory topics.
4. Adopt collaborative (Group Learning) Learning in the class.
5. Adopt Problem Based Learning (PBL), which fosters students Analytical skills and develops thinking skills such as evaluating, generalizing, and analyzing information.
6. Conduct Laboratory Demonstrations and Practical Experiments to enhance experiential skills.

Module-1 **8 Hours**

Deterioration in food product and their controls- causes of food spoilage and classification of food with respect to spoilage and consumption. Principles of food preservation, effect pH and water content on growth of microorganisms. Physical, chemical and biological methods of food preservation.

Dairy development in India and dairy technology- Indian dairy industry products Concentrated whole milk products, – Composition of milk, physico-chemical properties of milk, water content, acidity, pH, developed acidity, natural acidity, total acidity, density, specific gravity, freezing point of milk colour of milk, flavor.

Unit operations of various dairy and food processing systems- introduction, sampling, pasteurization, sterilization, packaging, cleaning grading, evaporation, drying, filtration and freezing.

Teaching-Learning Process	1. PowerPoint Presentation 2. Chalk and Talk are used for Problem Solving (In-general) 3. Video demonstration or Simulations 4. Laboratory Demonstrations and Practical Experiments

Module-2 **8 Hours**

Principle and equipment related to receiving of milk, quality determination, cleaning and disinfection of milk cans and tankers. Process flow charts for product manufacture – Pasteurized milk, Pearson square method and mass balance method for making balances method for milk standardization.

Pasteurization- Purpose, Methods of heating, design and mode of operation heating equipment (tubular heat exchanger, plate heat exchanger), **Sterilization** – UHT method (Direct and indirect heating), sterilization in the package (temperature and pressure patterns), equipment for sterilizing goods in the package (Batch autoclaves).

Thermal processing - Thermal death time curve, reaction kinetics of the heat treatment of milk.

Teaching-Learning Process	1. PowerPoint Presentation 2. Chalk and Talk are used for Problem Solving (In-general) 3. Video demonstration or Simulations 4. Laboratory Demonstrations and Practical Experiments

Module-3 **8 Hours**

Homogenization – Emulsifying, types of emulsions, emulsifiers, application, mode of operation, effect on the product. Centrifugation and cream separation- working of disc centrifuge, working of cyclone separator.

Preparation methods and equipment- Manufacture of cheese, paneer, butter and ice cream.

Dairy plant design and layout – factors in planning, importance of site selection. Location of building, size and type of dairy building, advantages of good plant layout, functional design, plant utilities requirement – electricity, water and power requirement.

Teaching-	1. PowerPoint Presentation

Learning Process	2. Chalk and Talk are used for Problem Solving (In-general) 3. Video demonstration or Simulations 4. Laboratory Demonstrations and Practical Experiments

Module-4	**8 Hours**
Canning and aseptic processing. Evaporation – Applications, functions, factors affecting rate of evaporation, basic evaporator construction, factors affecting liquid boiling point, thermodynamics of evaporation (phase change, boiling point elevation, Duhring plot. **Types of evaporation equipment**- Natural circulation evaporators – Batch type, horizontal short tube, vertical short tube, natural circulation with external calendria, long tube, forced circulation. **Drying** – Drying methods	
Teaching-Learning Process	1. PowerPoint Presentation 2. Chalk and Talk are used for Problem Solving (In-general) 3. Video demonstration or Simulations 4. Laboratory Demonstrations and Practical Experiments

Module-5	**8 Hours**
Freezing – Introduction, freezing point curve for food, freezing time calculation by using Planks equation, types of freezing equipment, **Filtration** - ultra-filtration, processing variables, applications or ultra-filtration in milk processing, reverse osmosis, Membrane separation – Membrane separation methods. Composition and proximate analysis of food products- Carbohydrates, protein, lipids, methods of controlling water content, effect of water activity, methods of measuring a oxidation reduction potential effect on microorganisms, effect of nutrient content and effect of inhibitory substances Change undergone by food components during processing –Changes during heating, evaporation, drying, freezing, filtration and separation.	
Teaching-Learning Process	1. PowerPoint Presentation 2. Chalk and Talk are used for Problem Solving (In-general) 3. Video demonstration or Simulations 4. Laboratory Demonstrations and Practical Experiments

PRACTICAL COMPONENT OF IPCC

Course objectives:

- Knowledge on milk and food processing unit operations
- To handle pasteurization, sterilization, packaging, etc. of dairy products
- Control spoilage of food through process operations such as evaporation, freezing, membrane processing etc.

Sl.NO	Experiments
1	To study the Vat pasteurizer
2	To study the HTST pasteurizer
3	To study and evaluate the performance of the Homogenizers
4	To study the Sterilization
5	To study and evaluate the performance of the Butter churns
6	To study the Spray dryers
7	To study and evaluate the performance of the Freezers
8	To study the different food preservative used in food industry
9	To study the various Drying methods of food products
10	Demonstrate the working of the Evaporators
11	Demonstrate the working of the Cyclone separator
12	Demonstrate the working of the Heat exchangers

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

1. Enable the students to understand the methods of food preservation and the dairy development
2. Developed the understanding of physic – chemical properties of milk
3. Summarizing the methods of pasteurization and its importance
4. To acquaint the students with various dairy engineering operations such as homogenization, pasteurization, thermal processing, evaporation, freezing and drying of milk
5. Understanding the design and layout of a dairy plant
6. Control spoilage of food through process operations such as evaporation, freezing, membrane processing etc.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

CIE for the theory component of IPCC

Two Tests each of **20 Marks (duration 01 hour)**

- First test at the end of 5th week of the semester
- Second test at the end of the 10th week of the semester

Two assignments each of **10 Marks**

1. First assignment at the end of 4th week of the semester
2. Second assignment at the end of 9th week of the semester

Scaled-down marks of two tests and two assignments added will be CIE marks for the theory component of IPCC for **30 marks**.

CIE for the practical component of IPCC

- On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The**15 marks** are for conducting the experiment and preparation of the laboratory record, the other **05 marks shall be for the test** conducted at the end of the semester.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to 15 marks.
- The laboratory test **(duration 03 hours)** at the end of the 15th week of the semester /after completion of all the experiments (whichever is early) shall be conducted for 50 marks and scaled down to 05 marks.

Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **20 marks**.

SEE for IPCC

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (duration 03 hours)

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component).

- The minimum marks to be secured in CIE to appear for SEE shall be the 12 (40% of maximum marks-30) in the theory component and 08 (40% of maximum marks -20) in the practical component. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included. The maximum of 04/05 questions to be set from the practical component of IPCC, the total marks of all questions should not be more than the 20 marks.
- SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50.

Suggested Learning Resources:

Books

1. Fundamentals of Food Engineering-Rao, D.G. 2010. PHI learning Pvt. Ltd. New Delhi.
2. Introduction to Food Engineering - Singh, R.P. & Heldman, D.R. 2001. Academic Press.
3. Ahmed, T. 1997. Dairy Plant Engineering and Management. 4th Ed. Kitab Mahal
4. McCabe, W.L. and Smith, J. C. 1999. Unit Operations of Chemical Engineering. McGraw Hill.
5. Rao, D.G. Fundamentals of Food Engineering. PHI learning Pvt. Ltd. New Delhi. 171
6. Singh, R.P. & Heldman, D.R. 1993. Introduction to Food Engineering. Academic Press
7. Principles of foundry technology, 4th edition, P L Jain, Tata McGraw Hill, 2006.
8. Advanced Welding Processes technology and process control, John Norrish, Wood Head Publishing, 2006.

Web links and Video Lectures (e-Resources):

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Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Quizzes
- Assignments
- Seminars
- Mini Projects

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