## SEMESTER S4

## FOOD PROCESS ENGINEERING LAB

| | | | |
|---|---|---|---|
| **Course Code** | **PCFTL408** | **CIE Marks** | 50 |
| **Teaching Hours/Week (L: T:P: R)** | 0:0:3:0 | **ESE Marks** | 50 |
| **Credits** | 2 | **Exam Hours** | 2 Hrs. 30 Min. |
| **Prerequisites (if any)** | None | **Course Type** | Lab |

**Course Objectives:**

**1.** To understand the principle behind the various food processing unit operations.

| Expt. No. | Experiments |
|---|---|
| 1 | Experimentation on the size reduction of food material using milling |
| 2 | Determination of Particle size distribution of food material using sieve analysis |
| 3 | Development of Food Product using single screw extrusion |
| 4 | Determination of the rate of heat transfer and heat transfer coefficient of heat exchanger |
| 5 | Determination of rate of filtration for constant pressure filtration |
| 6 | Perform the simple distillation for studying separation of mixture |
| 7 | Determination of Mixing index of various Food samples |
| 8 | Experimentation of Pasteurisation of milk/ fruit juices and microbial inactivation |
| 9 | Determination of the rate of drying for the given food grains in Rotary dryer |
| 10 | Experimentation of Osmotic dehydration of food materials |
| 11 | Determination of the percentage of actual recovery for single stage leaching |
| 12 | Determination of separation efficiency of an inclined belt separator |
| 13 | Experimentation on microwave heating of food materials |
| 14 | Experimentation on drying with a Fluidised bed dryer |
| 15 | Verification of the applicability of Freundlich equation for adsorption for the given system and determination of the values of adsorption constants ‘k’ and ‘n’ at room temperature |
| 16 | Development of a food product using Freeze drying |
| 17 | Determination of the separation efficiency of a spiral separator |
| 18 | Performance of a Spray dryer in food product development. |

KTU SPECIAL

## Course Assessment Method
## (CIE: 50 marks, ESE: 50 marks)

**Continuous Internal Evaluation Marks (CIE):**

| Attendance | Preparation/Pre-Lab Work experiments, Viva and Timely completion of Lab Reports / Record (Continuous Assessment) | Internal Examination | Total |
|---|---|---|---|
| 5 | 25 | 20 | 50 |

**End Semester Examination Marks (ESE):**

| Procedure/ Preparatory work/Design/ Algorithm | Conduct of experiment/ Execution of work/ troubleshooting/ Programming | Result with valid inference/ Quality of Output | Viva voce | Record | Total |
|---|---|---|---|---|---|
| 10 | 15 | 10 | 10 | 5 | 50 |

- ***Submission of Record: Students shall be allowed for the end semester examination only upon submitting the duly certified record.***
- ***Endorsement by External Examiner:*** *The external examiner shall endorse the record*

## Course Outcomes (COs)

KTU SPECIAL

At the end of the course students should be able to:

| | Course Outcome | Bloom's Knowledge Level (KL) |
|---|---|---|
| CO1 | Describe operational principles of milling equipment, dryers, extruders, heat exchangers, distillation, and separators in food engineering processes. | K2 |
| CO2 | Explain underlying concepts of particle size distribution analysis, heat transfer mechanisms, filtration principles, distillation processes, and adsorption dynamics in food engineering. | K2 |
| CO3 | Interpret experimental data from sieve analysis, heat transfer coefficients, filtration rates, adsorption constants, and separation efficiencies to assess process performance and equipment effectiveness in food engineering. | K2 |
| CO4 | Apply theoretical knowledge to operate and conduct experiments with milling equipment, dryers, extruders, distillation apparatus, and separators to achieve specific experimental goals in food engineering. | K3 |
| CO5 | Conduct experiments in food engineering to determine fluidization velocity, settling velocity, and recovery curves, integrating theoretical principles with practical applications relevant to food processing and manufacturing. | K3 |

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

**CO- PO Mapping (Mapping of Course Outcomes with Program Outcomes)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | | 3 | | | | 2 | 3 | 3 | | 3 |
| **CO2** | 3 | 3 | | 3 | | | | 2 | 3 | 3 | | 3 |
| **CO3** | 3 | 3 | | 3 | | | | 2 | 3 | 3 | | 3 |
| **CO4** | 3 | 3 | | 3 | | | | 2 | 3 | 3 | | 3 |
| **CO5** | 3 | 3 | | 3 | | | | 2 | 3 | 3 | | 3 |

*1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation*

| **Text Books** | | | | |
|---|---|---|---|---|
| **Sl. No** | **Title of the Book** | **Name of the Author/s** | **Name of the Publisher** | **Edition and Year** |
| 1 | Chemical Engineering | Richardson & Coulson | Elsevier | 5th edition |
| 2 | Unit operations in food engineering | Ibarz and Canovas | CRC Press | 2002 |
| 3 | Experiments in Unit Operations and Processing of Foods | Cecila Lenzi | Elsevier | 2008 |

| **Reference Books** | | | | |
|---|---|---|---|---|
| **Sl. No** | **Title of the Book** | **Name of the Author/s** | **Name of the Publisher** | **Edition and Year** |
| **1** | Cereal grains laboratory references & procedure manual | Sergio O Serna Saldivar | Taylor and Francis Group | 2012 |
| **2** | Food Processing Technology: Principles and Practice | PJ Fellows | CRC Press | 2nd Edition, 2000 |
| **3** | Unit Operations in Chemical Engineering. | Warren McCabe, Julian Smith, Peter Harriott | Mc Graw Hill Book Co. | 5thedition 1993 |

| **Video Links (NPTEL, SWAYAM…)** | |
|---|---|
| **Module No.** | **Link ID** |
| **1** | https://onlinecourses.nptel.ac.in/noc20_ag01/preview |
| **2** | https://onlinecourses.nptel.ac.in/noc20_ag01/preview |
| **3** | https://onlinecourses.nptel.ac.in/noc20_ag01/preview |
| **4** | https://onlinecourses.nptel.ac.in/noc20_ag01/preview |

KTU SPECIAL

## Continuous Assessment (25 Marks)

1. **Preparation and Pre-Lab Work (7 Marks)**

   - Pre-Lab Assignments: Assessment of pre-lab assignments or quizzes that test understanding of the upcoming experiment.
   - Understanding of Theory: Evaluation based on students' preparation and understanding of the theoretical background related to the experiments.

2. **Conduct of Experiments (7 Marks)**

   - Procedure and Execution: Adherence to correct procedures, accurate execution of experiments, and following safety protocols.
   - Skill Proficiency: Proficiency in handling equipment, accuracy in observations, and troubleshooting skills during the experiments.
   - Teamwork: Collaboration and participation in group experiments.

3. **Lab Reports and Record Keeping (6 Marks)**

KTU SPECIAL

   - Quality of Reports: Clarity, completeness and accuracy of lab reports. Proper documentation of experiments, data analysis and conclusions.
   - Timely Submission: Adhering to deadlines for submitting lab reports/rough record and maintaining a well-organized fair record.

4. **Viva Voce (5 Marks)**

   - Oral Examination: Ability to explain the experiment, results and underlying principles during a viva voce session.

***Final Marks Averaging: The final marks for preparation, conduct of experiments, viva, and record are the average of all the specified experiments in the syllabus.***

## Evaluation Pattern for End Semester Examination (50 Marks)

1. **Procedure/Preliminary Work/Design/Algorithm (10 Marks)**

   - Procedure Understanding and Description: Clarity in explaining the procedure and understanding each step involved.
   - Preliminary Work and Planning: Thoroughness in planning and organizing materials/equipment.

- Algorithm Development: Correctness and efficiency of the algorithm related to the experiment.
- Creativity and logic in algorithm or experimental design.

**2. Conduct of Experiment/Execution of Work/Programming (15 Marks)**

- Setup and Execution: Proper setup and accurate execution of the experiment or programming task.

**3. Result with Valid Inference/Quality of Output (10 Marks)**

- Accuracy of Results: Precision and correctness of the obtained results.
- Analysis and Interpretation: Validity of inferences drawn from the experiment or quality of program output.

**4. Viva Voce (10 Marks)**

- Ability to explain the experiment, procedure results and answer related questions
- Proficiency in answering questions related to theoretical and practical aspects of the subject.

KTU SPECIAL

**5. Record (5 Marks)**

- Completeness, clarity, and accuracy of the lab record submitted