CURRICULUM FOR

BACHELOR-LEVEL STUDY IN FOOD TECHNOLOGY

degree

# B.Tech. (Food Technology)

**Semester System**

**Date: 2081/05/06**

(approval date of Subject Committee)

Institute of Science & Technology

Tribhuvan University, Nepal

August, 2024

## INTRODUCTION

The first food technology course at the certificate level was introduced in Nepal in 1973 (2030 B.S.). The aim of this course was to produce mid-level food technology professionals. This program was discontinued in 1979 (2036 B.S.), and in the same year, a new 4-year bachelor's degree course, commonly referred to as **B.Tech. (Food)**, was launched under the **Institute of Science and Technology (IoST)** at **Tribhuvan University (TU)**. The B.Tech. (Food) course has been revised twice; the first revision took place in 1994 (2050 B.S.), and the second in 2005 (2061 B.S.).

The revision of the current food technology curriculum is long overdue; it has been nearly two decades since the last update in 2005. As our understanding of various subjects and learning methodologies advances with time, regularly updating and revising the curriculum is essential. The need to revise the current curriculum is urgent, to ensure students are equipped with the skills, knowledge, and values necessary to succeed in a dynamic, interconnected world.

In this revised curriculum, the annual system has been changed to a semester system to align the curriculum with international practice. It is hoped that both students and faculty members will greatly benefit from the more focused, interactive, and student- centered learning observed in a semester system.

## NAME OF THE PROGRAM

The name of this program will be **Bachelor in Food Technology**, which may be termed **B. Tech. (Food)** in short.

## OBJECTIVES OF THE PROGRAM

The objectives of B. Tech. (Food) curriculum, established since its inception, have been maintained in this revised curriculum as well, which are as follows:

1. To provide knowledge in food science and the principles underlying food processing.
2. To give wider knowledge to students in advanced food engineering.
3. To acquaint students with industrial management practices.
4. To train the students in product-specific specialization areas.

## ELIGIBILITY CRITERIA FOR ENTRANCE EXAM

Eligibility for applying to the B.Tech. (Food) entrance exam is determined by the criteria established by the **Institute of Science and Technology (IoST), Tribhuvan University (TU)**. These criteria are subject to periodic revisions by the **Entrance Committee**.

## CRITERIA FOR ADMISSION

Applicants for the B.Tech. (Food) program must pass the entrance examination conducted by the **IoST Dean's Office, Tribhuvan University (TU)**. Admission will be granted based on merit, determined by the entrance examination scores and additional criteria established by the admission committee.

## COURSE STRUCTURE

- The B. Tech. (Food) course structure will be as follows:
- The B.Tech. (Food) course spans **8 semesters**, equivalent to **4 academic years**.
- Each academic year comprises **2 semesters**.
- A semester lasts **16 weeks**, with a minimum of **90 working days**.
- The entire course encompasses **140** credit hours: **93** credit hours for theory and **47** credit hours for practical session.
- Each credit hour, whether practical or theoretical, is equivalent to **25 marks**.
- The total weightage (full marks) of the course is **3500**.

*Explanation of relevant terminologies used*

**Credit Hours**: A credit hour is a unit that gives weight to the value, level, or time requirements of an academic course. It typically represents one hour of scheduled instruction given to students.

**Marks per Credit Hour**: The number of marks assigned to each credit hour reflects the weightage of that hour in the overall assessment of the student's performance.

**Total Weightage**: The full marks or total weightage indicate the cumulative points that a student can earn from the entire course.

Institute of Science & Technology
Dean's Office
Kirtipur 2045

This encompasses all the assessments, including exams, performance in the practical, and assignments.

Subject code

The subject code is structured as follows (also see the following example):

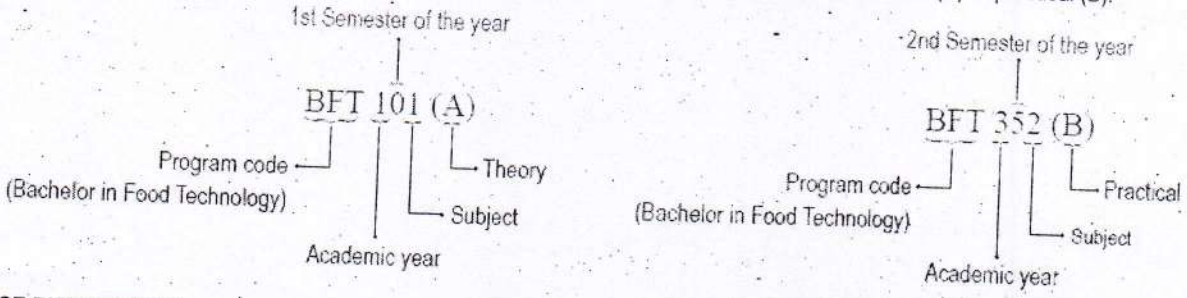
**Program Code:** Each subject code starts with a program code that is specific to the course of study. In this case, BFT denotes Bachelor in Food Technology.

**Academic Year Indication:** The program code is followed by the academic year within the program, which is indicated by the numbers 1 to 4, corresponding to the first-, second-, third-, and fourth year, respectively.

**Semester Indication:** The first semester of any academic year is represented by the number '0', and the second semester by the number '5'.

**Unique Number:** Following the "Semester Indication", there is a unique number that helps to identify the subject.

**Nature of the Subject:** The code ends with a letter that signifies whether the subject is theoretical (A) or practical (B).




## COURSE DISTRIBUTION

The entire course is divided into two categories:

1. **Allied courses**, which constitute **34%** of the curriculum.
2. **Core courses**, which make up the remaining **66%.**

The subject codes and the distribution of courses by their nature are detailed in **Table 1**.

**Table 1** Course distribution by nature

| Course type | Subject code | Subject | Credit | Nature | Sub-total | % Distribution |
|---|---|---|---|---|---|---|
| Allied courses | BFT 101 | Applied Physics | 3+1 | A+B | 35 + 13 = 48 | 34 |
| | BFT 102 | Engineering Mathematics | 3+0 | A | | |
| | BFT 103 | Industrial Chemistry | 3+1 | A+B | | |
| | BFT 104 | Applied Statistics | 3+1 | A+B | | |
| | BFT 105 | General Biochemistry | 3+1 | A+B | | |
| | BFT 106 | General Microbiology | 2+1 | A+B | | |
| | BFT 151 | Instrumental Techniques of Analysis | 3+1 | A+B | | |
| | BFT 152 | Basic Principles of Engineering | 3+1 | A+B | | |
| | BFT 156 | Fundamentals of Electrical Engineering | 2+1 | A+B | | |
| | BFT 201 | Computer Application in Food Technology | 2+1 | A+B | | |
| | BFT 251 | Workshop Technology | 2+2 | A+B | | |
| | BFT 402 | Operations Research | 2+1 | A+B | | |
| | BFT 451 | Research Methodology and Statistical Methods | 2+1 | A+B | | |
| | BFT 452 | Food Plant Management and Entrepreneurship Development | 2+0 | A | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Core course | BFT 153 | Food Chemistry-I | 2+1 | A+B | | |
| | BFT 154 | Food Microbiology | 2+1 | A+B | | |
| | BFT 155 | Human Nutrition | 2+1 | A+B | | |
| | BFT 202 | Food Chemistry-II | 2+1 | A+B | | |
| | BFT 203 | Sugar Technology | 2+1 | A+B | | |
| | BFT 204 | Food Engineering-I | 2+1 | A+B | | |
| | BFT 205 | Principles of Food Processing | 3+1 | A+B | | |
| | BFT 206 | Principles of Food Preservation | 3+1 | A+B | | |
| | BFT 252 | Cereals, Legumes and Oilseeds Technology | 2+1 | A+B | | |
| | BFT 253 | Industrial Microbiology-I | 2+1 | A+B | | |
| | BFT 254 | Food Engineering-II | 2+1 | A+B | | |
| | BFT 255 | Food Quality Control and Standards | 2+0 | A | | |
| | BFT 256 | Food Analysis | 3+1 | A+B | | |
| | BFT 301 | Industrial Microbiology-II | 2+1 | A+B | | |
| | BFT 302 | Biochemical Engineering-I | 2+1 | A+B | | |
| | BFT 303 | Fats and Oils Technology | 2+1 | A+B | 58 + 34 = 92 | 66 |
| | BFT 304 | Sensory Assessment | 2+1 | A+B | | |
| | BFT 305 | Dairy Technology-I | 2+1 | A+B | | |
| | BFT 306 | Meat Technology-I | 2+1 | A+B | | |
| | BFT 351 | Fruits and Vegetables, Tea, Coffee and Spices | 3+1 | A+B | | |
| | BFT 352 | Biochemical Engineering-II | 2+1 | A+B | | |
| | BFT 353 | Food Safety and Security | 2+0 | | | |
| | BFT 354 | Confectionery and Snack Foods | 2+1 | A+B | | |
| | BFT 355 | Dairy Technology-II | 2+1 | A+B | | |
| | BFT 356 | Meat Technology-II | 2+1 | A+B | | |
| | BFT 401 | Food Packaging | 2+1 | A+B | | |
| | BFT 403 | Food Storage | 2+1 | A+B | | |
| | BFT 404 | Industrial Tour | 0+1 | B | | |
| | BFT 405 | In-plant Training | 0+2 | B | | |
| | BFT 453 | Dissertation | 0+4 | B | | |
| | BFT 454 | Class Seminar | 0+2 | B | | |

## COURSE DURATION

The course spans **8 semesters** over **4 academic years**, with each year divided into two semesters. Each semester consists of **16 weeks** and includes at least **90 working days**. The curriculum comprises **43 papers**: 4 are theory-only, 37 combine theory and practical, and 2 are practical-only. Additionally, there is a compulsory **7-day industrial tour** and a **45-day In-plant Training (internship)** in the **7th semester**. The **8th semester** is exclusively for dissertation work and related subjects.

## CREDIT SYSTEM

The course load is weighted by credit hour (or credit) as follows:

- [illegible] marks.

प्राविधिक परिषद्को कार्यालय कीर्तिपुर

Institute of Science & Technology
Dean's Office
Kirtipur 2045

- 1 credit hour of theory class equals 1 hour of lecture per week.
- 1 credit practical class equals 4 hours of practical session per week.

Subjects with practical sessions lasting less than 4 hours (especially in Sem I and Sem II) are required to conduct 1-hour tutorial class and 3-hour lab session for the group.

## EVALUATION

The evaluation process includes both internal assessments and final examinations. The final exams, known as semester examinations, will be conducted by the Institute of Science and Technology (IoST) at the end of each semester. A summary of the weightage distribution for these examinations can be found in Table 2.

Table 2 Marks distribution for the course

| Course category | Marks (weightage) distribution | | |
|---|---|---|---|
| | Internal assessment [1] (% weightage) | Final exam (% weightage) | Pass marks [2] |
| Theory | 40% | 60% | 40% in each category |
| Practical | 40% | 60% [3] | 50% in each category |

| Course category | Marks (weightage) distribution | | |
|---|---|---|---|
| | Evaluator | Weightage | Pass marks |
| Class seminar [1] | - Mentor faculty | 50% | 60% |
| | - Commentator faculty | 25% | |
| | - HOD | 25% | |
| In-plant Training [4] | - Immediate plant supervisor | 60% | 60% |
| | - Plant manager | 30% | |
| | - On-the-spot inspection | 10% | |
| Dissertation [5] | - Supervisor | 40% | 60% |
| | - External examiner | 30% | |
| | - Internal examiner | 20% | |
| | - HOD | 10% | |
| Industrial tour [1] | - Guide teacher(s) | 100% | 60% |

[1] The evaluations will be carried out by the college or campus.

[2] Students are required to pass every category of the internal assessments (Table 3) to be eligible for the final examination. Failing the internal assessments means students are not permitted to apply for the final examination.

[3] The final practical examinations will take place under the supervision of an external examiner appointed by the Institute of Science and Technology (IoST).

[4] The evaluation for In-plant Training will be jointly conducted by the host organization or industry and the faculty member responsible for the on-site evaluation.

[5] Students must successfully complete the coursework up to the 6th semester to engage in dissertation work. However, they are only eligible to defend their dissertation after passing all semester examinations, excluding the dissertation itself. The dissertation defense will occur in the presence of an external examiner designated by IoST.

The distribution of marks for internal assessments can be found in Table 3 for theory courses and Table 4 for practical courses. The final score for each course is calculated by summing the marks obtained across all assessment categories.

Institute of Science & Technology
Dean's Office
Kirtipur 2045

Table 3 Marks distribution for the internal assessment (theory: Part A)

| Credit hour | Full marks | Marks distribution | | |
|---|---|---|---|---|
| | | Attendance | Assignments | Preboard exam |
| 3 | 30 | 2.5 | 7.5 | 20 |
| 2 | 20 | 2.5 | 5.5 | 12 |

*Explanation with example:*

- For a subject with **3 Credit Hours** of theory (**Part A**), the total marks for this part will be **75** (i.e., 3 Credit Hours × 25 marks = 75 marks). Of these, **40%** (which is **30 marks**) will be allocated for internal evaluation.
- The internal evaluation marks will be distributed across three components, viz., attendance, assignments, and preboard exam. In the above case for a subject with 3 Credit Hour theory, the distribution (based on **Table 3**) will be as follows:
  - **2.5 marks** for attendance,
  - **7.5 marks** for assignments, and
  - **20 marks** for the preboard exam.
- The preboard exam will take place after at least **75%** of the course material has been covered. The results of the internal evaluations must be submitted to the central office's examination section, along with the students' examination application forms.
- The minimum attendance requirement to sit for semester exams will be **75%** in every subject. The total number of **classes conducted before the preboard exam** will be taken as **100** in the calculation of the marks secured by the student. The marks secured in the attendance category will be calculated using the formula:

$$\text{Attendance Score} = \frac{\text{Actual Attendance Percentage}}{100} \times 2.5$$

**Note to the teachers:** Students cannot get less than **1.875** in the attendance category, as this score is possible only if the attendance is less than 75%, in which case the student will not be eligible to sit in the final exam.

- **Students must pass the internal evaluation to be eligible for board exams. The institute should arrange reexaminations until the student meets the qualification criteria for the board exams.**
- **The results of the internal evaluations will be submitted to the central office's examination section, along with the students' examination application forms.**
- For internal notification of the results of the internal evaluation, the institute will not disclose the marks obtained. Instead, it will only publish the list of passed students and promptly notify the failed students for reexamination.

**Table 4** Marks distribution for the internal assessment (practical: **Part B**)

| Credit | Full marks | Marks distribution | | |
|---|---|---|---|---|
| | | Attendance | Practical record | Performance |
| 2 | 20 | 7.5 | 5 | 7.5 |
| 1 | 10 | 3.5 | 3 | 3.5 |

*Explanation with example:*

- For a practical (**Part B**) with **2 Credits**, the total marks will be **50** (i.e., 2 Credits × 25 marks = 50 marks). Of these, **40%** (which is **20 marks**) will be allocated for internal evaluation.
- The internal evaluation marks will be distributed across three components:
  - **7.5 marks** for attendance,
  - **5 marks** for practical record, and
  - **7.5 marks** for the performance.
- The results of the internal practical evaluations will be forwarded to the central office's examination section **only after the completion of the final practical exam**, once they are compiled with the marks obtained in the said exam.

Institute of Science & Technology
Dean's Office
Kirtipur 2045

- The minimum attendance requirement to sit for practical exams will be 75% in every subject (having practical). The total number of practical classes conducted before the preboard exam will be taken as 100 in the calculation of the marks secured by the student. In the above example, for a 1 credit practical session, the marks a student can secure in the attendance category will be calculated using the formula:

$$\text{Attendance Score} = \frac{\text{Actual Attendance Percentage}}{100} \times 3.5$$

Note to the teachers: In this case, students cannot secure marks below 2.625 in the attendance category (1 credit practical).

- For the final practical examination, the distribution of marks for final practical exam and *viva-voce* (by the external examiner assigned by IoST) will be as in **Table 5**.

**Table 5** Marks distribution of the final practical exam

| Credit | Full marks | Marks distribution | |
|---|---|---|---|
| | | Practical exam (Internal examiner) | *Viva-voce* (External examiner) |
| 2 | 30 | 20 | 10 |
| 1 | 15 | 10 | 5 |

*Explanation with example*

- For a practical **(Part B)** with **2 Credits**, the total marks will be **50** (i.e., 2 Credits × 25 marks = 50 marks). Of these, **60%**
- (which is **30 marks**) will be allocated for final examination.
- The final practical exam marks will be distributed between the internal and the external examiner. In the above case, the distribution will be as follows:
  - **20 marks** by the internal examiner, and
  - **10 marks** by the external examiner.

## EXAMINATION DURATION

The written examination duration will be **2 hours** for both 3 Credit Hours and 2 Credit Hour courses, both in internal assessment and final examinations. For the final practical examination, a duration of **4 hours** will be allotted for 1 Credit course and **6 hours** for 2 Credits course.

## THE GRADING SYSTEM

Grading system will be as per the grading system of Tribhuvan University, as given in **Table 6**.

**Table 6** Grading System of TU for undergraduate level

| Grade | GPA | Grading Scale (in%) | Performance |
|---|---|---|---|
| A | 4 | 90 – 100 | Outstanding |
| A⁻ | 3.7 | 80 – less than 90 | Excellent |
| B⁺ | 3.3 | 70 – less than 80 | Very Good |
| B | 3 | 60 – less than 70 | Good |
| B⁻ | 2.7 | 50 – less than 60 | Satisfactory |
| C | 2.3 | 40 – less than 50 | Pass* |
| F | 0 | 0 – less than 40 | Fail |

Pass* refers to acceptable

## MEDIUM OF INSTRUCTION AND EXAMINATION

The medium of instruction and examination will be English.

## ATTENDANCE RE

Students are req d to regularly attend all theory and practical classes and should maintain a minimum of 75% attendance in each course separately to qualify ng in the final examination form.

Institute of Science & Technology
Dean's Office
Kirtipur 2045

## STUDENT-TEACHER RATIO

Depending on the room space and classroom amenities, the maximum student-teacher ratios will be as follows:

- 24:1 for theory classes
- 15:1 for practical classes (maximum)

## PROVISION FOR DEPARTMENTS AND COMMITTEES

The college/campus can form departments (instruction committees) comprising at least 5 faculty members per committee, head of the department (HOD) included. There will also be an ad-hoc dissertation committee consisting of the HOD, external examiner, dissertation supervisor and internal examiner for evaluating the students' dissertation/thesis (see Table 2).

## INSTRUCTIONAL MATERIALS

The instructional materials include, but not limited to, the following:

- **Printed and digital materials:** Hands out, textbooks, presentation slides, animations, etc.
- **Audio-visual materials:** Lecture slides (presentations) and relevant videos.
- **Online learning system:** Online meeting platforms like Zoom, Teams, Google Meet, etc.

For practical classes, faculties are required to provide the **necessary learning materials (printed matter, videos, etc.) to the students in advance** (preferably one week in advance) so that the practical session requires less time for the explanation.

## TEACHING-LEARNING METHODOLOGY

The teaching-learning methodology will involve an inductive, deductive, and learner-centered 'feed-forward' system, including lectures, tutorials, discussions, assignments, demonstrations, and hands-on practice as the method of knowledge delivery.

## QUESTION PATTERN FOR THE THEORY EXAM

The question pattern for theory exam will be as follows:

| Course full marks | Credit | Board exam full marks (60% of course full marks) | Long question* | Short question** |
|---|---|---|---|---|
| 50 | 2 | 30 | 2 out of 3 (6 marks each) | 6 out of 8 (3 marks each) |
| 75 | 3 | 45 | 2 out of 3 (10.5 marks each) | 6 out of 8 (4 marks each) |

* Consider formulating long questions exclusively from units that receive at least 5 to 6 teaching hours. Additionally, refrain from dividing the question into more than 3 parts, ensuring that the question as a whole remains closely aligned with the unit content.

** Question setters can create short questions from any unit, while adhering to the constraint of not dividing the question into more than two parts. It is essential that these parts maintain relevance to each other.

प्राज्ञिक परिषद्को कार्यालय
कीर्तिपुर

Institute of Science & Technology
Dean's Office
Kirtipur 2045

# SEMESTER WISE COURSE STRUCTURE

The semester-wise distribution of the course is as given in Table 6. Course bearing the asterisk (*) denote allied courses.

Table 6 Semester-wise distribution of the course

| Year/Semester | Subject | Subject code and Nature | Credit |
|---|---|---|---|
| Year I<br>Semester I | 1. Applied Physics * | BFT 101 (A)<br>BFT 101 (B) | 3<br>1 |
| | 2. Engineering Mathematics* | BFT 102 (A) | 3 |
| | 3. Industrial Chemistry* | BFT 103 (A)<br>BFT 103 (B) | 3<br>1 |
| | 4. Applied Statistics* | BFT 104 (A)<br>BFT 104 (B) | 3<br>1 |
| | 5. General Biochemistry* | BFT 105 (A)<br>BFT 105 (B) | 3<br>1 |
| | 6. General Microbiology* | BFT 106 (A)<br>BFT 106 (B) | 2<br>1 |
| | | **Sub-Total** | **22** |

| Year/Semester | Subject | Subject code and Nature | Credit |
|---|---|---|---|
| Year I<br>Semester II | 7. Instrumental Techniques of Analysis * | BFT 151 (A)<br>BFT 151 (B) | 3<br>1 |
| | 8. Basic Principles of Engineering * | BFT 152 (A)<br>BFT 152 (B) | 3<br>1 |
| | 9. Food Chemistry-I | BFT 153 (A)<br>BFT 153 (B) | 2<br>1 |
| | 10. Food Microbiology | BFT 154 (A)<br>BFT 154 (B) | 2<br>1 |
| | 11. Human Nutrition | BFT 155 (A)<br>BFT 155 (B) | 2<br>1 |
| | 12. Fundamentals of Electrical Engineering * | BFT 156 (A)<br>BFT 156 (B) | 2<br>1 |
| | | **Sub-Total** | **20** |

| Year/Semester | Subject | Subject code and Nature | Credit |
|---|---|---|---|
| Year II<br>Semester III | 13. Computer Application in Food Technology * | BFT 201 (A)<br>BFT 201 (B) | 2<br>1 |
| | 14. Food Chemistry-II | BFT 202 (A)<br>BFT 202 (B) | 2<br>1 |
| | 15. Sugar Technology | BFT 203 (A)<br>BFT 203 (B) | 2<br>1 |
| | 16. Food Engineering-I | BFT 204 (A)<br>BFT 204 (B) | 2<br>1 |
| | 17. Principles of Food Processing | BFT 205 (A)<br>BFT 205 (B) | 3<br>1 |
| | 18. Principles of Food Preservation | BFT 206 (A)<br>BFT 206 (B) | 3<br>1 |
| | | **Sub-Total** | **20** |

प्राविधिक परिषद्को कार्यालय
कीर्तिपुर

Institute of Science & Technology
Dean's Office
Kirtipur 2045

| Year/Semester | Subject | Subject code and Nature | Credit |
|---|---|---|---|
| Year II<br>Semester IV | 19. Workshop Technology * | BFT 251 (A)<br>BFT 251 (B) | 2<br>2 |
| | 20. Cereals, Legumes and Oilseeds Technology | BFT 252 (A)<br>BFT 252 (B) | 2<br>1 |
| | 21. Industrial Microbiology-I | BFT 253 (A)<br>BFT 253 (B) | 2<br>1 |
| | 22. Food Engineering-II | BFT 254 (A)<br>BFT 254 (B) | 2<br>1 |
| | 23. Food Quality Control and Standards | BFT 255 (A) | 2 |
| | 24. Food Analysis | BFT 256 (A)<br>BFT 256 (B) | 3<br>1 |
| | | Sub-Total | 19 |

| Year/Semester | Subject | Subject code and Nature | Credit |
|---|---|---|---|
| Year III<br>Semester V | 25. Industrial Microbiology-II | BFT 301 (A)<br>BFT 301 (B) | 2<br>1 |
| | 26. Biochemical Engineering-I | BFT 302 (A)<br>BFT 302 (B) | 2<br>1 |
| | 27. Fats and Oils Technology | BFT 303 (A)<br>BFT 303 (B) | 2<br>1 |
| | 28. Sensory assessment | BFT 304 (A)<br>BFT 304 (B) | 2<br>1 |
| | 29. Dairy Technology-I | BFT 305 (A)<br>BFT 305 (B) | 2<br>1 |
| | 30. Meat Technology-I | BFT 306 (A)<br>BFT 306 (B) | 2<br>1 |
| | | Sub-Total | 18 |

| Year/Semester | Subject | Subject code and Nature | Credit |
|---|---|---|---|
| Year III<br>Semester VI | 31. Fruits and Vegetables, Tea, Coffee and Spices | BFT 351 (A)<br>BFT 351 (B) | 3<br>1 |
| | 32. Biochemical Engineering-II | BFT 352 (A)<br>BFT 352 (B) | 2<br>1 |
| | 33. Food Safety and Security | BFT 353 (A) | 2 |
| | 34. Confectionery and Snack Foods | BFT 354 (A)<br>BFT 354 (B) | 2<br>1 |
| | 35. Dairy Technology-II | BFT 355 (A)<br>BFT 355 (B) | 2<br>1 |
| | 36. Meat Technology-II | BFT 356 (A)<br>BFT 356 (B) | 2<br>1 |
| | | Sub-Total | 18 |

प्राविक परिषद्को कार्यालय
कीर्तिपुर

Institute of Science & Technology
Dean's Office
Kirtipur 2045

| Year/Semester | Subject | Subject code and Nature | Credit |
|---|---|---|---|
| Year IV<br>Semester VII | 37. Food Packaging | BFT 401 (A)<br>BFT 401 (B) | 2<br>1 |
| | 38. Operations Research * | BFT 402 (A)<br>BFT 402 (B) | 2<br>1 |
| | 39. Food Storage | BFT 403 (A)<br>BFT 403 (B) | 2<br>1 |
| | 40. Industrial Tour | BFT 404 (B) | 1 |
| | 41. In-plant Training | BFT 405 (B) | 2 |
| | | Sub-Total | 12 |

| Year/Semester | Subject | Subject code and Nature | Credit |
|---|---|---|---|
| Year IV<br>Semester VIII | 42. Research Methodology and Statistical Methods * | BFT 451 (A)<br>BFT 451 (B) | 2<br>1 |
| | 43. Food Plant Management and Entrepreneurship Development * | BFT 452 (A) | 2 |
| | 44. Dissertation | BFT 453 (B) | 4 |
| | 45. Class Seminar | BFT 454 (B) | 2 |
| | | Sub-Total | 11 |
| | | Grand Total | 140 |

प्राविधिक परिषद्को कार्यालय
कीर्तिपुर

Institute of Science & Technology
Dean's Office
Kirtipur 2045

# CURRICULUM

| | | |
|---|---|---|
| Course: Applied Physics | Course Code: BFT 101 (A) | Credit Hour: 3 |
| Semester: I | Teaching hours: 48 h | Full Marks: 75 |
| Nature of Course: Theory | (3 lecture hours per week) | |

Course description and objectives

Applied Physics is a foundational discipline that bridges the gap between theoretical physics and practical applications. In the context of Food Technology, it plays a crucial role in understanding the physical intricacies of food, and optimizing various physical phenomena related to food production, processing, and quality assurance.

The main objective of the course is to impart fundamental concept of physics in food technology. The student will acquire knowledge of material properties, thermodynamics, heat transfer, acoustics, optics, electromagnetic radiation, mechanics and rheology.

Course detail

| Unit | Content | Details of content | Teaching hours |
|---|---|---|---|
| 1 | Material Properties | • **Elasticity:** [2 h]<br>- Stress and strain, and their relation; Hooke's Law; different types of elastic constants and their relations; coefficient of rigidity of a cylinder, bending moment.<br>• **Surface tension:** [4 h]<br>- Surface tension and surface energy; interfacial surface tension; curved (convex/concave) interfaces; temperature dependency; concentration dependency; liquid–liquid–gas systems; solid– liquid–gas systems; kinetics of interfacial phenomena; adsorption kinetics at solid interfaces; measurement, measuring interfacial tension; measuring contact angle; dynamic measurement and applications.<br>• **Viscosity:** [3 h]<br>- Stream line motion and rate of flow; equation of continuity; Bernoulli's theorem; coefficient of viscosity; Stoke's Law; Poiseuille's method for determination of coefficient of viscosity; Ostwald viscometer. | 9 |
| 2 | Thermodynamics and Heat Transfer | • **Thermodynamics:** [5 h]<br>- Isothermal and adiabatic process; thermal equilibrium; Zeroth Law of thermodynamics; First Law of thermodynamics; Second law of thermodynamics; Carnot's engine; Carnot's reversible cycle and its efficiency; Carnot's theorem, entropy; S-T diagram; entropy of a perfect gas.<br>• **Refrigeration:** [3 h]<br>- Production of low temperature; freezing mixtures; cooling by evaporation; vapor compression refrigeration and vapor absorption refrigeration; refrigeration cycles.<br>• **Thermal radiation:** [4 h]<br>- Introduction; concept of black body radiation; Stefan-Boltzmann Law; Kirchhoff's law of black body radiation; Wein's displacement law; Planck's quantum theory of radiations; detection of thermal radiations. | 12 |
| 3 | Acoustics & Optics | • **Acoustical properties:** [3 h]<br>- Sound; speed of sound; reverberation and echo; loudness and volume; noise; ultrasonic sound; applications.<br>• **Optical properties:** [5 h]<br>- Refraction - basics, measurement of refractive index; applications for refractive index; colorimetry - light and color; physiology of color perception; color as a vector quantity; color measurement and applications; near-infrared (NIR) and ultra-violet (UV) – basics; measuring techniques and applications. | 8 |

Continued ....

| | | | |
|---|---|---|---|
| 4 | Electromagnetic Radiation | • Electromagnetic waves: [3 h]<br>- Production of electric field from moving magnetic field; production of magnetic field from moving electric field; electromagnetic waves, its properties and spectrum; Infra-red rays; ultra-violet rays – their sources, properties and applications; hazards to human health; micro-ovens.<br>• High energy radiations and health physics: [4 h]<br>- X-rays and gamma rays – their productions, properties and practical applications; isotopes and radio-isotopes; applications of radio-isotopes in medicines, industries, agricultures and scientific research; biological effect of ionizing radiations; hazards due to external and internal sources; radiation dose and radioactivity units; applications of thermal radiations. | 7 |
| 5 | Mechanics and Rheology:<br>Geometric and Rheological Properties | • Mass and density: [2 h]<br>- Mass; weighing and atmospheric buoyancy; density; temperature dependency of density; pressure dependency of density; specific gravity (relative density); methods for laboratory measurement of density; applications.<br>• Geometric properties: [4.5 h]<br>- Particle size; sizing by image analysis; equivalent diameters – geometric equivalent diameters and physical equivalent diameters; specific surface area; specific surface of individual particles; specific surface area in bulk materials; particle shape and size for crystals Form Factor – sphericity, particle size distributions; sizing by sieving, median, modal value; average particle size – integral mean, specific surface distribution, Sauter diameter; characteristics of distributions; measuring particle size by other techniques – weighing technique, sedimentation and aerodynamic classification with fluids; optical techniques, electrical techniques; applications.<br>• Rheological properties: [5.5 h]<br>- Rheological models; viscous behavior: flow, shear rate, Newtonian flow behavior, non-Newtonian flow behavior; comparison of Newtonian with non-Newtonian fluids; pseudoplastic flow behavior; thixotropic flow behavior; dilatant flow behavior, rheopectic flow behavior; plastic flow behavior; model functions for plastic fluids, Ostwald–de-Waele Law; temperature dependency of viscosity; measurement of rheological properties; rotational rheometers; measuring instruments based on other principles; funnel flow from beaker or cup; viscoelasticity; stress relaxation; creep; oscillation testing; rheology and texture of solid foods; rheological tests, texture tests; applications. | 12 |
| | | **Total** | **48** |

**Reference materials**


1. Alpen, E. L. (1997). "Radiation Biophysics". (2nd ed.), Academic Press. [ISBN 9780120530854].
2. Figura, L. O. and Teixeira, A. A. (2023). "Food Physics: Physical Properties – Measurement and Applications". (2nd ed.). Springer, Switzerland. [ISBN 978-3-031-27398-8].
3. Glaser, R. (2012). "Biophysics: An Introduction" (2nd ed.). Springer, New York. [ISBN 978-3642252129].
4. Povey, M. J., Holmes, M. J., Rafiq, S., Simone, E., Rappolt, M. and Francis, M. (2020). "Physics in Food Manufacturing: Case Studies in Fundamental and Applied Research". [ISBN ISBN 978-0-7503-2596-7].
5. Radi, H. A. and Rasmussen, J. O. (2013). "Principles of Physics: For Scientists and Engineers". Sringer-Verlag, Berlin. [ISBN 978-3642230257; 978-3642230264].

| Course: Applied Physics | Course Code: BFT 101 (B) | Credit Hour: 1 |
|---|---|---|
| Semester: I | Teaching hours: 64 h | Full Marks: 25 |
| Nature of Course: Practical + Tutorial | (Tutorial: 1 h, Lab: 3 h per session) | |

List of practical for the laboratory session

1. Determination of specific heat capacity of solid and liquid.
2. Determination of specific gravity of materials.
3. Determination of refractive index of liquid.
4. Determination of low temperature of materials.
5. Measurement of radiation energy.
6. Determination of surface tension of liquid by Jaeger's method.
7. Determination of coefficient of viscosity of given liquid by Stoke's method.
8. Determination of wavelength of sodium light by measuring diameter of Newton's ring.
9. Determination of specific rotation sugar solution by using Laurent's half-shade polarimeter.

Unit wise marks distribution for the final exam

| Unit | Title | Total (%) |
|---|---|---|
| 1 | Material properties | 20 |
| 2 | Thermodynamics and heat transfer | 25 |
| 3 | Acoustics & optics | 15 |
| 4 | Electromagnetic radiation | 15 |
| 5 | Mechanics and rheology: geometric and rheological properties | 25 |
| | Total | 100% |

प्राविधिक परिषद्को कार्यालय
कीर्तिपुर

Institute of Science & Technology
Dean's Office
Kirtipur 2045

| | | |
|---|---|---|
| Course: Engineering Mathematics | Course Code: BFT 102 (A) | Credit Hour: 3 |
| Semester: I | Teaching hours: 48 h | Full Marks: 75 |
| Nature of Course: Theory | (3 lecture hours per week) | |

Course description and objectives

Engineering Mathematics plays a crucial role in various scientific and engineering disciplines, including food technology. It provides the necessary mathematical tools and techniques to analyze, model, and solve real-world problems encountered in the food industry. In the context of food technology, engineering mathematics helps students understand and quantify various aspects related to food processing, quality control, safety, and optimization. The student should have prerequisite knowledge of Higher Secondary mathematics, especially calculus, analytic geometry and algebra.

This course aims to develop students' mathematical skills specifically for solving engineering problems related to food processing. Through the application of mathematical techniques, students learn to model food processes, optimize parameters, and predict behavior. The course prepares students to understand and apply fundamental mathematical tools relevant to Food Technology, enabling them to complete projects by effectively applying mathematical principles.

Course detail

| Unit | Content | Details of content | Teaching hours |
|---|---|---|---|
| 1 | Derivatives and their Applications | • Review of derivative and differentiability. [1 h]<br>• Indeterminate forms, types and their real-life examples, L- Hospital's Rule. [2 h]<br>• Higher order derivatives, Leibnitz theorem. [2 h]<br>• Power series of single valued functions: Taylor's series, Maclaurin's series. [3 h]<br>• Asymptotes to cartesian and polar curves. [2 h] | 10 |
| 2 | Antiderivatives and their Applications | • Review of definite and indefinite integrals. [1 h]<br>• Differentiation under integral sign. [2 h]<br>• Improper integrals. [1 h]<br>• Beta and Gamma functions and their applications. [2 h]<br>• Area and arc length in plane for cartesian curves. [3 h]<br>• Centroid and moment of inertia under area of curve. [1 h] | 10 |
| 3 | Ordinary Differential Equations and their Applications | • Review of order, degree, solution of first order first degree differential equations by variable separation method and solution of Homogeneous equations. [1 h]<br>• Linear differential equation and equations reducible to linear differential equation: Bernoulli's equation. [1 h]<br>• First order and higher degree differential equations; Clairaut's form. [2 h]<br>• Application in physical sciences and engineering: [3 h]<br>- Exponential growth and decay model; modelling heating system using Newton's Law of cooling; modelling electric circuit; mixing problems; modelling chemical reaction; modelling blood sugar distribution in human body, motion under gravity, modelling rain fall problems.<br>• Second order and First Degree differential equations with constant coefficient and variable coefficients reducible to constant coefficients; modelling mass spring system; Cauchy's equations. [3 h] | 10 |
| 4 | Plane Analytic Geometry | • Transformation of coordinates: translation and rotation. [2 h]<br>• Equation of conic in cartesian and polar form: identification of conics. [2 h] | 4 |
| 5 | Three-dimensional Geometry | • Review of planes. [1 h]<br>• The straight line: symmetrical and general form. [2 h]<br>• Coplanar lines. [2 h] | 5 |

Continued ...

| | | | | |
|---|---|---|---|---|
| 6 | Matrices | • Rank of matrices and its application in system of linear equations.<br>• Vector space, linear dependence and independence.<br>• Eigen values, Cayley Hamilton theorem and its applications.<br>• Eigen vectors, diagonalization of matrices. | [2 h]<br>[1 h]<br>[1 h]<br>[2 h] | 6 |
| | | | Total | 48 |

Reference materials


1. Dutta, D. (2005). "Textbook of Engineering Mathematics" Vol. I and II (Revised 2nd ed.). New Age International Pvt. Ltd, India. [ISBN 81-224-1689-6].
2. Jeffery A. (2001). "Advanced Engineering Mathematics". Academic Press. [ISBN 9780123825926].
3. Kreyszig, E. (2019). "Advanced Engineering Mathematics" (10th ed.). John Willey & Sons, USA. [ISBN 9781119571094].
4. O'Neill, P.V. (2011). "Advanced Engineering Mathematics". (7th ed.). Cengage. [ISBN 9781111427412].
5. Parajuli, V. etc., (). A Course Book on Engineering Mathematics-I, Asmita Publication, Nepal.
6. Sastry, S. S. (2008). "Engineering Mathematics". (Vol I and II, 4th ed.). Prentice Hall of India Learning Pvt. Ltd., New Delhi. [978-81-203-3616-2 (Vol. I), 978-81-203-3617-9 (Vol. II)].
7. Thomas, G. B., Finny, R. L. and Weir, M. D. (1998). "Calculus and Analytic Geometry" (9th ed.). Narosa Publishing House, India
8. Wylie C. R., Barrett, L. C. (2017). "Advanced Engineering Mathematics", (6th ed.). McGraw-Hill India. [ISBN 9780070582378].


**Unit wise marks distribution for the final exam**

| Unit | Title | Total (%) |
|---|---|---|
| 1 | Derivatives and their applications | 25 |
| 2 | Antiderivatives and their applications | 25 |
| 3 | Ordinary differential equations and their applications | 25 |
| 4 | Plane analytic geometry | 8 |
| 5 | Three-dimensional geometry | 8 |
| 6 | Matrices | 9 |
| | Total | 100% |

प्राविधिक परिषद्को कार्यालय
कीर्तिपुर

Institute of Science & Technology
Dean's Office
Kirtipur 2045

| | | |
|---|---|---|
| Course: Industrial Chemistry | Course Code: BFT 103 (A) | Credit Hour: 3 |
| Semester: I | Teaching hours: 48 h | Full Marks: 75 |
| Nature of Course: Theory | (3 lecture hours per week) | |

Course description and objectives

Industrial Chemistry applies physical and chemical processes to transform raw materials into products beneficial to humanity. It lies at the intersection of science, engineering, and economics. It deals with chemical processes used to manufacture everyday products, from plastics and pharmaceuticals to food, food additives and fuels.

The Industrial Chemistry course aims to equip students with essential knowledge and skills related to industrial processes, chemical engineering, and entrepreneurship. Throughout the course, students learn to understand chemical reactions in food processing and preservation. They also apply their chemical knowledge to assess food quality, predict shelf-life, and optimize food processing methods.

Course detail

| Unit | Content | Details of content | Teaching hours |
|---|---|---|---|
| 1 | Introduction | • Industrial processes, major chemical industries, raw materials for chemical industries, difference between classical and industrial chemistry. [1 h]<br>• Quality control, safety and environmental concerns, pollution control technologies, sustainable industrial chemistry, green chemistry. [1 h]<br>• Industrially important chemical reactions, excess and limiting reactants, fractional conversion, selectivity, yield, extent of reaction, stoichiometry, catalysts. [2 h]<br>• Chemical kinetics, rates of reaction, first order and second order reactions, collision theory. [2 h]<br>• Chemical equilibrium, chemical reaction equilibrium constant, reactor performance. [1 h] | 7 |
| 2 | Chemical Engineering Principles | • Mass, moles, composition, process variables, temperature, pressure, volume, density, concentration, flow rates, block flow diagrams, process flow diagrams. [1 h]<br>• Material balances with chemical reactions, material balance with multiple process units, mole balances with industrial applications, material balance with recycling, material balance with multiple chemical reactions. [4 h]<br>• Fluid flow: momentum balances, fluid properties, pump types, centrifugal pump, positive displacement pump, piping and valves, flow measurement devices. [2 h]<br>• Safety and health: material safety data sheet (MSDS), fire and flammability, explosive limits, chemical reactivity, toxicology, hazard and operability analysis (HAZOP). [1 h] | 8 |
| 3 | Separation Principles and Technologies | • Mixtures, phases, classification of separation technologies, unit processes, unit operations. [1 h]<br>• Equilibrium-based separations: crystallization, evaporation, condensation, distillation, batch distillation, flash distillation, continuous multistage distillation, packed towers, absorption, adsorption. [3 h]<br>• Water treatment: hardness of water, softening of water, zeolite process, ion-exchange, chemical analysis of water. [1 h]<br>• Pollution control technologies: air pollution control, cyclones, electrostatic precipitator, filters, scrubbers. [1 h]<br>• Water pollution control: industrial waste treatment, aerobic and anaerobic oxidation, biochemical oxygen demand (BOD), chemical oxygen demand (COD), anaerobic digestion. [1 h] | 7 |

Continued ...

| | | | |
|---|---|---|---|
| 4 | Thermodynamics and Heat Transfer | • First, second and third laws of thermodynamics, enthalpy, Gibbs free energy, thermochemistry, energy balance equation, forms of energy, internal energy, enthalpy calculation, modes of energy transfer, entropy, energy balance with chemical reaction. [3 h]<br>• Heat transfer equipment, heat transfer coefficient, energy conversion processes, heat exchangers, heat engine, fuel cells. [2 h] | 5 |
| 5 | Inorganic Chemical Industries | • Extractive metallurgy: mineral processing, extraction of metals, corrosion. [1 h]<br>• Chlor-alkali industries, sulfuric acid, sodium hydroxide. [1 h]<br>• Industrial gases: ammonia, nitrogen, oxygen, hydrogen, carbon dioxide, acetylene. [2 h]<br>• Fertilizer, cement, lubricants, pulp and paper, glass, ceramics, paints, refractories. [2 h<br>• Rubber: latex processing, mastication, vulcanization, synthetic rubbers. [1 h] | 7 |
| 6 | Organic Chemical Industries | • Petroleum processing, catalytic cracking, catalytic reforming, knocking, octane number, gasoline, diesel, diesel index, kerosene, aviation fuel, asphalt, flue gas analysis. [3 h]<br>• Fuels: Classification, calorific value calculations, coal classification, coal analysis, coking. [1 h]<br>• Plastics and Polymers: nomenclature, functionality, classification, polymerization processes, molding, thermoplastics, thermosetting plastics, polymer additives. [2 h]<br>• Fermentation process, ethanol, pharmaceuticals, soaps, detergents, sugar. [2 h] | 8 |
| 7 | Introduction to Chemical Analysis | • Volumetric and gravimetric analysis, Karl Fischer titration. [1 h]<br>• Chromatography, gas chromatography, liquid chromatography. [1 h]<br>• Atomic spectroscopy: Beer-Lambert's Law, UV-visible absorption spectroscopy, atomic emission spectrometer (AAS), inductively coupled plasma emission spectrometer (ICP-AES). [2 h]<br>• Fourier transform infrared (FTIR) spectroscopy, mass spectrometry. [1 h]<br>• Electrochemical analysis: pH, conductivity, potentiometry, cyclic voltammetry. [1 h] | 6 |
| | | Total | 48 |

**Reference materials**


1. Heaton, A. (1996). "An Introduction to Industrial Chemistry" (3rd ed.). Springer Science + Business Media, Dordrecht. [ISBN 978-94-011-0613-9].
2. Hipple, J. (2017). "Chemical Engineering for Non-Chemical Engineers". John Wiley & Sons Inc. New Jersey. [ISBN 9781119309635].
3. Murphy, R. M. (2022). "Introduction to Chemical Processes: Principles, Analysis, Synthesis". McGraw Hill Education (India). [ISBN 9781260791372].
4. Tyrell, J. A. (2014). "Fundamentals of Industrial Chemistry: Pharmaceuticals, Polymers, and Business". John Wiley & Sons, Inc., New Jersey. [ISBN 9781118708668].


प्राविधिक परिषद्को कार्यालय
कीर्तिपुर

Institute of Science & Technology
Dean's Office
Kirtipur 2045

| Course: Industrial Chemistry | Course Code: BFT 103 (B) | Credit Hour: 1 |
|---|---|---|
| Semester: I | Teaching hours: 64 h | Full Marks: 25 |
| Nature of Course: Practical + Tutorial | (Tutorial: 1 h, Lab: 3 h per session) | |

List of practical for the laboratory session

1. Empirical formula of a compound by gravimetric analysis.
2. Dissolved oxygen in water.
3. Chemical oxygen demand (COD) in water.
4. Biochemical oxygen demand (BOD) in water.
5. Total dissolved solids (TDS) in water.
6. Total Suspended Solids (TSS) in water.
7. Saponification value of oil.
8. Moisture and fatty acid content of soap.
9. Viscosity, pH, conductivity of detergents.
10. Use of FTIR to determine polypropylene degradation.
11. Trace metals in lubricating oil.
12. Study of catalytic converters in motor vehicles.
13. Stack emissions from various industries.
14. Heat released during a combustion reaction using bomb calorimeter.
15. Process flow diagrams of various industries.

**Unit wise marks distribution for the final exam**

| Unit | Title | Total (%) |
|---|---|---|
| 1 | Introduction | 15 |
| 2 | Chemical engineering principles | 15 |
| 3 | Separation principles and technologies | 18 |
| 4 | Thermodynamics and heat transfer | 10 |
| 5 | Inorganic chemical industries | 15 |
| 6 | Organic chemical industries | 17 |
| 7 | Introduction to chemical analysis | 10 |
| | Total | 100% |


| | | |
|---|---|---|
| Course: Applied Statistics | Course Code: BFT 104 (A) | Credit Hour: 3 |
| Semester: I | Teaching hours: 48 h | Full Marks: 75 |
| Nature of Course: Theory | (3 lecture hours per week) | |

Course description and objectives

The Applied Statistics course focuses on an overview of descriptive statistical analysis, probability and some probability distributions, conceptual details and applications of inferential statistics such as estimation, testing of hypothesis using parametric tests for testing the significance of single mean, single proportion, two means, two proportions, and non-parametric test for the test of significance of associations of two independent attributes. The course also deals with the concepts and applications of simple correlation and regression analysis with the concept of multiple linear regression model. It also explains the concepts and applications of some design of experiment techniques. Concepts and applications of some statistical quality control tools such as, $\bar{X}$, R, p, and d chart with special reference to quality prospects of food technology related data.

This course is designed to disseminate the knowledge of descriptive and inferential statistics focusing on analyzing quality control related data problems. Besides this, different tools for statistical quality control techniques will be discussed for handling data in the relevant field.

Course detail

| Unit | Content | Details of content | Teaching hours |
|---|---|---|---|
| 1 | Fundamental Concepts of Statistics | • Difference between descriptive and inferential statistics, data measurement scale, histogram, stem-and-leaf display, applications of measures of central tendency, measures of dispersion, measures of shape of the data distribution, exploratory data analysis, and their applications in quality control related data. | 4 |
| 2 | Probability and Probability Distributions | • Concept of probability, marginal, joint, conditional probability, Baye's theorem and decision tree and their applications, expectations, binomial, Poisson and normal distribution with their main characteristics, applications of these distributions in quality control process. | 6 |
| 3 | Sampling and Sampling Distributions | • An overview of different sampling techniques, sampling distribution of mean and proportion, central limit theorem and its applications. | 3 |
| 4 | Estimation and Testing of Hypothesis | • Theory of estimation, point estimation, interval estimation and their interpretations, estimation of sample size, hypothesis testing, level of significance, Type I and Type II error, power of the test, algorithm for testing of hypothesis, traditional and p-value approach for decision making in testing of hypothesis. | 4 |
| 5 | Statistical Tests | • Statistical test for single mean, single proportion, two proportions, independent t- test, paired t-test, F-test for the test of two variances, linkage between confidence interval estimation and testing of hypothesis, rationale of applying non-parametric tests, test of significance of two categorical independent variables, assumptions of these statistical tests and their applications in drawing inferences about process quality, problem specific interpretations of the statistical decisions. | 11 |
| 6 | Design of Experiments | • Basic concepts of design of experiment:<br>- Completely randomized design (CRD): Layout, and analysis with equal and unequal number of observations, and their applications.<br>- Randomized block design (RBD): Layout, analysis, and its applications.<br>- Latin square design (LSD): Layout, analysis, and its applications.<br>- Concept of Response surface methodology (RSM). | 8 |

Continued ...

| | | | |
|---|---|---|---|
| 7 | Correlation and Regression Analysis | • Simple linear correlation and its assumptions, simple linear regression and its fitting, interpretations of regression coefficient, coefficient of determination and its interpretation, prediction in regression, assumptions of linear regression, regression diagnostics, concept of multiple regression analysis, use of these techniques in the relevant field, and their problem specific interpretations. | 6 |
| 8 | Statistical Quality Control | • Introduction to quality and quality improvements, different dimensions of quality, concept of quality characteristics and quality engineering, brief discussion on Deming's framework for implementing quality and productivity improvement, quality systems and standards, national guidelines for quality standards of Nepal, statistical process control, control charts, 3-$\sigma$ control limits, tools for Statistical Quality Control(SQC), control charts for variables: $\bar{X}$ and R chats, control limits for $\bar{X}$ - chart and R-chart, construction of control chart for $\bar{X}$ and R, criterion for detecting lack of controls in $\bar{X}$ and R charts, interpretation of $\bar{X}$ and R charts; Control charts for attributes: p-chart for fraction defective, control chart for number of defectives(d-chart), interpretation of p-chart, control chart for number of defects per unit(c-chart), its limits, and applications, discussion on six sigma principles. | 6 |
| | | Total | 48 |

**Reference materials**


1. Crawley, M. J. (2015). "Statistics: An Introduction Using R" (1st ed.). John Wiley & Sons Inc. New Jersey. [ISBN 978-1118941096].
2. Field, A. (2024). "Discovering Statistics Using IBM SPSS Statistics" (6th ed.). Sage Publication. California, USA. [ISBN 978-1-5296-3001-5].
3. Gupta, S. C. and Kapoor, V. K. (2014). "Fundamentals of Applied Statistics" (4th ed.). Sultan Chand & Sons, India. [ISBN 978-8180547058].
4. Hines, W. W., Montgomery, D. C., Goldsman, D. M. and Borror, C. M. (2004). "Probability and Statistics in Engineering" (4th ed.). Wiley, New York. [ISBN 0-471-24087-7].
5. Hogg, R. V., Tanis, E. A. and Zimmerman, D. L. (2019). "Probability and Statistical Inference" (10th ed.). Pearson. [ISBN 978-0135189399].
6. Montgomery, D. C. (2009). "Introduction to Statistical Quality Control" (6th ed.). John Wiley & Sons, Inc. New Jersey. [ISBN 978-0-470-16992-6].

| | | |
|---|---|---|
| Course: Applied Statistics | Course Code: BFT 104 (B) | Credit Hour: 1 |
| Semester: I | Teaching hours: 64 h | Full Marks: 25 |
| Nature of Course: Practical + Tutorial | (Tutorial: 1 h, Lab: 3 h per session) | |

**Course description and objectives**

This course is designed to make the students able to analyze numerical data based on the theories and concepts studied in Applied Statistics [(BFT 104 (A)]. It is focused to develop student's hands on capacity to analyze the quality control related data using any statistical software such as SPSS, STATA, R or any whichever is convenient for them. After completion of this course students will be able to analyze data using appropriate statistical tool(s) through statistical software, and able to make problem specific interpretations.

The course concentrates on the applications of different statistical tool(s) learned in theory paper, appropriately by recognizing the data structure, exclusively using statistical software. It also deals with the appropriate interpretations of the software generated results with reference to the data problems in the relevant field. The details of the coverage of the practical problems which need to be performed in computer laboratory, are listed in the following coverage of the practical problems.

**List of practical for the laboratory session**

| S.N. | Unit of the theory paper | Details | No. of practical problems to be performed (at least) |
|---|---|---|---|
| 1 | 1 | Descriptive statistics including stem-and leaf display and box plot for summarizing data | 1 |
| 2 | 2 | Normal distribution | 1 |
| 3 | 3 | Explaining the sampling distribution of mean and standard error (taking sample with and without replacement) | 1 |
| 4 | 4, 5 | Test of significance of single mean with confidence interval | |
| | | Test of significance of single proportion with confidence interval | 1 |
| | | Test of significance of two independent means | 1 |
| | | Test of significance of two proportions | 1 |
| | | Test of significance of two means (related case) | 1 |
| | | Test of significance of two variances | 1 |
| | | Test of significance of association between two independent attributes | 1 |
| 5 | 6 | Design of experiments: Completely Randomized Design (CRD) | 1 |
| | | Design of experiments: Randomized Block Design (RBD) | 1 |
| | | Design of experiments: Latin Square Design (LSD) | 1 |
| 6 | 7 | Simple correlation and simple linear regression analysis | 1 |
| 7 | 8 | $\bar{X}$ and R chart | 1 |
| | | p- chart | 1 |
| | | c-chart | 1 |
| | | | 1 |
| | | Total | 16 |

**Unit wise marks distribution for the final exam**

| Unit | Title | Total (%) |
|---|---|---|
| 1 | Fundamental concepts of statistics | 10 |
| 2 | Probability and probability distributions | 10 |
| 3 | Sampling and sampling distributions | 5 |
| 4 | Estimation and testing of hypothesis | 5 |
| 5 | Statistical tests | 25 |
| 6 | Design of experiments | 20 |
| 7 | Correlation and regression analysis | 10 |
| 8 | Statistical quality control | 15 |
| | Total | 100% |

| | | |
|---|---|---|
| Course: General Biochemistry | Course Code: BFT 105 (A) | Credit Hour: 3 |
| Semester: I | Lecture hour: 48 h | Full Marks: 75 |
| Nature of Course: Theory | (3 lecture hours per week) | |

Course description and objectives

Biochemistry is a dynamic field that explores the molecular intricacies of life. In this one semester course, students gain foundational knowledge about the chemical processes that drive living organisms. The course emphasizes the structure and function of biomolecules, cellular processes, and metabolic pathways.

The course aims to provide students with a comprehensive understanding of essential topics in biochemistry. Students explore biomolecules (such as proteins, nucleic acids, lipids, and carbohydrates), delve into enzymology (including enzyme kinetics and regulation), study metabolic pathways, investigate cell signaling mechanisms, grasp genetic information (DNA, RNA, transcription, and translation), and gain practical skills in biochemical techniques. By covering these areas, students develop a strong foundation in biochemistry and its applications.

Course detail

| Unit | Content | Details of content | Teaching hours |
|---|---|---|---|
| 1 | Biomolecules | • **Water, pH and buffer.**<br>• **Cell:** structure, functions of organelles.<br>• **Chemistry of carbohydrate:** definition, classification, function.<br>• **Chemistry of protein:** definition, classification, organization.<br>• **Chemistry of lipid:** definition, classification, functions.<br>• **Bio-membrane:** structure, function and transportation across membrane.<br>• **Nucleotides and nucleic acid.**<br>• **Vitamins:** definition, classification, water soluble and lipid soluble. | 8 |
| 2 | Enzymology | • **Enzyme:** definition, unit, classification, co-enzymes, cofactors.<br>• **Mechanism and Kinetics:** Michaelis-Menten equation, types of mechanism, types of reaction.<br>• **Enzyme inhibition and regulation.**<br>• **Industrial and clinical applications of enzyme.** | 4 |
| 3 | Metabolism | • **Digestion and absorptions of nutrients.**<br>• **Vitamins as coenzymes, RDA, sources, deficiency syndrome.**<br>• **Thermodynamics and Bioenergetics.**<br>• **Glycolysis and TCA Cycle.**<br>• **Electron Transport Chain and Oxidative phosphorylation.**<br>• **Pentose Phosphate Pathway and gluconeogenesis, glycogen metabolism:** synthesis and breakdown.<br>• **Metabolism of carbon skeleton of amino acids and biosynthesis of non-essential amino acids.**<br>• **Ammonia Transport and Urea Cycle and specialized product of amino acids.**<br>• **Biosynthesis of fatty acids and β-oxidation of fatty acids, ketogenesis.**<br>• **Biosynthesis and degradation of cholesterol and other sterols.**<br>• **Purine and pyrimidine biosynthesis and catabolism.**<br>• **Integration of metabolism and xenobiotics metabolism.** | 12 |

Continued ...

| | | | |
|---|---|---|---|
| 4 | Cell Signaling | • Hormones: classification, mechanism of action, regulations.<br>• Neurotransmitters: classification, mechanism of action, regulations.<br>• Immunoglobulins: structure, function, antibody diversity, class, switching.<br>• Autoimmunity and hypersensitive reactions, clinical and industrial applications of antibodies. | 4 |
| 5 | Genetic information | • DNA organization and function.<br>• DNA replication.<br>• DNA damage and repair.<br>• Transcription and RNA processing.<br>• Mutation, genetic code, translation and post-translational modification.<br>• Regulation of gene expression, operon concept.<br>• Non-coding RNAs, siRNA, miRNA.<br>• Molecular techniques: PCR, DNA fingerprinting,<br>• Recombinant DNA technology: vectors, restriction endonuclease, gene cloning, genomic library.<br>• CRISPR gene editing, blotting techniques. | 10 |
| 6 | Biochemical Techniques | • Definition, classification and applications of different separating techniques: centrifugation, filtration, dialysis, etc.<br>• Colorimetry, spectrophotometry, spectrofluorometry.<br>• Turbidimetry, nephelometry.<br>• Mass spectrometry.<br>• Chromatography: paper, thin layer, gel filtration, ion-exchange, affinity chromatography, chromatofocusing.<br>• HPLC, gas chromatography.<br>• Electrophoresis: SDS-PAGE, agarose gel electrophoresis, isoelectric focusing.<br>• Tracer techniques, radioisotope, radioimmunoassay (RIA), autoradiography.<br>• Immunodiffusion, immuno-electrophoresis, Enzyme Linked Immunosorbent assay (ELISA) and Chemiluminescence Immunoassay (CLIA).<br>• Densitometry and hydrometry.<br>• Ion selective electrode and polarimetry.<br>• Hybridoma technology. | 10 |
| | | Total | 48 |

**Refence materials**


1. Nelson, D. L., Cox, M. M. and Hoskins, A. A. (2021). "Lehninger Principles of Biochemistry" (8th ed.). Austin: Macmillan Learning. [ISBN 978-1319228003].
2. Berg, J. M., Tymoczko, J. L., Gatto, G. J. and Stryer, L. (2019). "Biochemistry". (9th ed.). Macmillan International, Higher Education, New York. [978-1319114671].
3. Kennelly, P. J., Botham, K. M., McGuinness, O., Rodwell, V. W. and Weil, P. A. (2023). "Harper's Illustrated Biochemistry" (32nd ed.). McGraw Hill Lange, New York. [ISBN 978-1-26-046995-0].
4. Ferrier, D. R. (2017). "Lippincott Illustrated Reviews: Biochemistry" (Lippincott Illustrated Reviews Series) (7th ed.). Lippincott Williams and Wilkins, New York. [ISBN 978-1456363541].
5. Vasudevan, D.M., Sreekumari, S. and Vaidyanathan, K. (2019). "Textbook of Biochemistry for Medical Students" (9th ed.). Jaypee Brothers Medical Publishers, New Delhi. [ISBN 978-9389034981].
6. Chatterjea, M. N. and Shinde, R. (2012). "Textbook of Medical Biochemistry" (8th ed.). Jaypee Brothers Medical Publishers, New Delhi. [ISBN 9789350

7. Satyanarayana, U. and Chakrapani, U. (2015). "Biochemistry (with Clinical Concepts & Case Studies). (4th ed). Elsevier Health Sciences APAC, New Delhi. [ISBN 9788131236017].
8. Roitt, I. M. (1997). "Essential Immunology" (9th ed.). Blackwell Science, Oxford. [ISBN 9780865427297].
9. Punt, J., Stranford, S., Jones, P. and Owen, J. A. (2019). "Kuby Immunology". (8th ed., North American edition). Macmillan Education, New York. [ISBN 9781319114701].
10. Wilson, K., Walker, J. M, Hofmann, A. and Clokie, S. (2018). "Wilson and Walker's Principles and Techniques of Biochemistry and Molecular Biology" (8th ed.). Cambridge University Press, New York. [ISBN 9781107162273].
11. Freifelder, D. (1982). "Physical Chemistry for Students of Biology and Chemistry". Science Books International, Boston. [ISBN 9780867200027].
12. Plummer, D. T. (1987). "An Introduction to Practical Biochemistry" (3rd ed.). McGraw-Hill, London. [ISBN 9780070841659].
13. Sadasivam, S. and Manickam, A. (2008). "Biochemical Methods" (3rd ed.). New Age International, New Delhi. [ISBN 9788122421408].

प्राविधिक परिषद्को कार्यालय
कीर्तिपुर

Institute of Science & Technology
Dean's Office
Kirtipur 2045

| | | |
|---|---|---|
| Course: General Biochemistry | Course Code: BFT 105 (B) | Credit Hour: 1 |
| Semester: I | Teaching hours: 64 h | Full Marks: 25 |
| Nature of Course: Practical + Tutorial | (Tutorial: 1 h, Lab: 3 h per session) | |

List of practical for the laboratory session

1. Preparation of buffers of different pH and measurement of pH by different methods.
2. Color reaction reactions of carbohydrate and identification of carbohydrate from unknown samples.
3. Verification of Beer's and Lambert's law and identification of $\lambda_{max}$.
4. Extraction of starch and sugars from plant sources and determination of reducing sugars by Nelson-Somogyi method.
5. Estimation of glucose in food and biological samples.
6. Color reaction reactions of amino acids and proteins and identification of amino acids and proteins from unknown samples.
7. Separation and identification of amino acids by paper chromatography.
8. Extraction of proteins from various food sources (e.g., milk, meat, egg, plant products, etc.) using isoelectric precipitation, ammonium sulphate fractionation, centrifugation and different chromatographic techniques.
9. Estimation of proteins by Biuret, Kjeldahl and Folin-Wu method.
10. Separation of proteins by SDS PAGE.
11. Identification of lipids in unknown sample: Determination of saponification number and iodine number in a given sample.
12. Effect of different factors (Temperature, pH, cofactors, inhibitors and activators) on enzymatic activity (e.g., catalase, amylase, etc.).
13. Isolation and characterization of DNA.
14. Amplification of DNA using PCR and agarose gel electrophoresis.
15. Detection and quantitation of antigen and antibody by immunodiffusion and ELISA techniques.
16. Measurement of specific gravity of the food samples by hydrometer, densitometer, etc.

**Unit wise marks distribution for the final exam**

| Unit | Title | Total (%) |
|---|---|---|
| 1 | Biomolecules | 15 |
| 2 | Enzymology | 10 |
| 3 | Metabolism | 25 |
| 4 | Cell signaling | 10 |
| 5 | Genetic information | 20 |
| 6 | Biochemical techniques | 20 |
| | Total | 100% |

प्राविधिक परिषद्को कार्यालय
कीर्तिपुर

Institute of Science & Technology
Dean's Office
Kirtipur 2045

| Course: General Microbiology | Course Code: BFT 106 (A) | Credit Hour: 2 |
|---|---|---|
| Semester: I | Teaching hours: 32 | Full Marks: 50 |
| Nature of Course: Theory | (2 lecture hours per week) | |

Course description and objectives

General microbiology focuses on general principles of microbiology that provides students foundational knowledge on biology of microorganisms. It covers general aspects of microbiology and microbial techniques and roles of essential biomolecules in microbial life.

The course aims to equip students with a foundational understanding of microbiology. Throughout the course, students learn about the structures of microorganisms, become familiar with various bacteriological techniques, explore microscopy principles and staining techniques, and gain insights into microbial growth, nutritional requirements, and the factors that affect growth.

Course detail

| Unit | Content | Details of content | Teaching hours |
|---|---|---|---|
| 1 | Introduction to Microbiology and Classification of Microorganisms | • Introduction to microbiology; scope and different disciplines of microbiology; harmful and beneficial microorganisms; important scientists and discoveries in microbiology. [1 h]<br>• Theories of spontaneous generation and germ theory of disease (Louis Pasteur, Robert Koch). [1 h]<br>• Basic understanding of classification of bacteria, viruses, fungi and parasites. [1 h]<br>• Classification, nomenclature and characterization of bacteria according to Bergey's Manual of Systematic Bacteriology. [1 h] | 4 |
| 2 | Morphology of microorganisms | • Structure of bacteria. [1 h]<br>• Fine structure of cell organelles and their functions; differences between Gram-negative and Gram-positive bacteria. [1 h]<br>• General structure of virus. [1 h]<br>• Morphology of parasites and fungi. [1 h]<br>• Spore, capsule, biofilm, slimes of bacteria. [1 h] | 5 |
| 3 | Microscopy and Different Staining Techniques | • Introduction, types and uses of microscopes (light, stereo, dark field, phase contrast, electron, fluorescence, atomic force). [3 h]<br>• Types of staining and nature of dyes/stains; different types of staining methods for microorganisms. [2 h] | 5 |
| 4 | Laboratory Equipment, Culture Media and Techniques in Control of Microorganisms | • Introduction, principle and uses of autoclave, incubator, hot air oven, laminar hood, bio-safety cabinet and other equipment in microbiology laboratory. [1 h]<br>• Pure culture, ATCC; different types of culture media for bacteria; common ingredients of culture media and their role; biochemical tests. [2 h]<br>• Virus culture; fungi culture media. [1 h]<br>• Techniques for isolation and enumeration of bacteria (streak plate technique, pour plate technique, spread plate technique, membrane filtration, most probable number method, direct microscopic count). [2 h]<br>• Methods of culture of aerobic and anaerobic bacteria; culture preservation methods. [1 h]<br>• Definitions, principles, procedures and applications of disinfection and sterilization- temperature, D-value, TDT value, Z-value, F-value; pasteurization, irradiation, ultrasonication, filtration, chemicals, antibiotics and chemotherapeutic agents; aseptic techniques in microbiology. [3 h] | 10 |

Continued ...

| | | | |
|---|---|---|---|
| 5 | Growth and Nutrition of Microorganisms | • Nutritional types of bacteria (photolithotrophic, chemolithotrophic, photoorganotrophic, chemoorganotrophic). [1 h]<br>• Bacterial growth; growth curve; factors affecting growth (pH, temperature, osmotic pressure, light, essential elements). [2 h]<br>• Oxygen-classification of microorganisms on the basis of $O_2$ requirements, oxygen toxicity, protective mechanisms against toxic effects of oxygen). [1 h] | 4 |
| 6 | Biomolecules and their Roles in Microbial Life | • Biochemical explanation of living things; the elements of life; chemical elements present in living organisms; organic compounds found in living cells; water: the solvent for life. [1 h]<br>• Introduction, functions, classification, structure, important properties of: carbohydrates, amino acids, proteins, enzymes, lipids, and nucleic acids. [3 h] | 4 |
| | | Total | 32 |

Reference materials


1. Collins, C. H, Patricia, M. and Lyne, J. M. (1995). "Collins and Lynes Microbiological Methods" (7th ed.). Grange, Butterworth-Heinemann, Oxford. [ISBN 978-0750606530].
2. Cappucino, J. G and Welsh, C. T. (2021). "Microbiology, A Laboratory Manual" (12th ed.). Pearson, USA. [ISBN 978-0137546527].
3. Pelczar, M. J., Chan, E. C. S. and Krieg, N. R. (1993). "Microbiology" (5th ed.). Tata McGraw-Hill, India. [ISBN 978-0-07-462320-6].
4. Madigan, M. T., Bender, K. S., Buckley, D. H., Sattley, W. M. and Stahl, D. A. (2019). "Brock Biology of Microorganism" (15th ed.). Pear Education Ltd., UK. [ISBN 978-1-292-23510-3].
5. Atlas, R. M. (1988). "Microbiology-Fundamentals and Applications" (2nd ed.). Macmillan Publishing Co., New York. [ISBN 9780023043000].
6. Greenwood, D., Slack, R. C. B., Barer, M. R. and Irving, W. L. (2012). "Medical Microbiology" (18th ed.). Elsevier, London. [ISBN 9780702051197].
7. Jay, J. M., Loessner, M. J. and Golden, D. A. (2005). "Modern Food Microbiology" (7th ed.). Springer, USA. [ISBN 978-0387231808].
8. Dubey, R. C., Maheshwari, D. K. (2023). "Practical Microbiology". (4th ed.). S. Chand & Company Ltd., New Delhi. [ISBN 978-9355017451].
9. Banwart, G. J. (2012). "Basic Food Microbiology" (2nd ed.). Springer, USA. [ISBN 978-1468464535].
10. Frazier, C. W., Westhoff, C. W (2017). "Food Microbiology" (5th ed.). McGraw Hill Education (India) Private Limited. [ISBN 978-9339203221].
11. Dubey, R. C. and Maheshwari, D. K. (2023). "A Textbook of Microbiology" (5th ed.). S. Chand & Company Ltd., New Delhi. [ISBN 978-9355015273].
12. Stainer, R. Y., Ingraham, J. L., Wheelis, M. L. and Painter, R. R. (1999). "General Microbiology" (5th ed.). Palgrave Macmillan, London. [ISBN 978-0333763643].
13. Powar, C. B. and Daginawala, H. F. (2010). "General Microbiology" (2nd ed.), Vol. I and II. Himalaya Publishing House, Bombay. [ISBN 978-9350240892 (Vol. I), ISBN 978-9350240908 (Vol. II)].



| Course: General Microbiology | Course Code: BFT 106 (B) | Credit Hour: 1 |
|---|---|---|
| Semester: I | Teaching hours: 64 h | Full Marks: 25 |
| Nature of Course: Practical | (Lab session of 4 h) | |

List of practical for the laboratory session

1. To learn laboratory rules and laboratory safety measures.
2. To learn working principle of microscope and operate it.
3. To operate and learn working principle of: Hot air oven, autoclave, incubator, BOD incubator, bio-safety cabinet, UV safety hood and spectrophotometer.
4. To perform staining of bacteria: Simple staining, Gram's staining, negative staining, flagella staining, spore staining and capsule staining.
5. To prepare microbiological culture media: Nutrient agar, MacConkey agar, blood agar, potato dextrose agar, broth media.
6. To perform the biochemical tests of bacteria: Catalase test, oxidase test, urease test, sugar fermentation, indole test, MR tests, VP test, citrate test, TSI test, nitrate reduction test.
7. To perform starch hydrolysis, lipid hydrolysis, protein hydrolysis tests of bacteria.
8. To perform isolation and enumeration of bacteria by streak plate technique, spread plate technique, pour plate technique.
9. To enumerate bacteria in water sample by MPN and MF method.
10. To determine the motility of bacteria by hanging drop method.
11. To measure the bacterial growth and prepare growth curve.
12. To study effect of temperature, pH, salt concentration, sugar concentration on microbial growth
13. To perform yeast and mold count.
14. To perform culture and identify fungi based on morphological characteristics.
15. To perform culture of anaerobic bacteria.
16. To perform MBRT and enumerate total coliforms in milk sample.
17. To perform total plate count (TPC) & total coliforms in meat sample.

**Unit wise marks distribution for the final exam**

| Unit | Title | Total (%) |
|---|---|---|
| 1 | Introduction to microbiology and classification of microorganisms | 10 |
| 2 | Morphology of microorganisms | 15 |
| 3 | Microscopy and different staining techniques | 15 |
| 4 | Laboratory equipment, culture media and techniques in control of microorganisms | 35 |
| 5 | Growth and nutrition of microorganisms | 15 |
| 6 | Biomolecules and their roles in microbial life | 10 |
| | **Total** | **100%** |

प्राविधिक परिषद्का कार्यालय
कीर्तिपुर

Institute of Science & Technology
Dean's Office
Kirtipur 2045

| Course: Instrumental Techniques of Analysis | Course Code: BFT 151 (A) | Credit Hour: 3 |
|---|---|---|
| Semester: II | Teaching hours: 48 h | Full Marks: 75 |
| Nature of Course: Theory | (3 lecture hours per week) | |

Course description and objectives

Instrumental techniques of analysis as an academic course introduces students to the principles, methodologies, and applications of instrumental techniques commonly employed in chemical analysis. Since it has interdisciplinary applications, the course can bridge gaps between disciplines. This course is designed to provide students with a comprehensive understanding of instrumental methods used in the analysis of food products. It covers a wide range of techniques for the evaluation of food quality, safety, and authenticity. Students will learn theoretical principles, practical applications, and data interpretation of instrumental analysis in the food industry.

By completing this course, students will understand the fundamental principles underlying instrumental analysis techniques, identify and apply appropriate analytical methods for analyzing various food components, interpret and critically evaluate analytical data obtained from instruments, and develop practical skills in operating and maintaining laboratory equipment used in chemical analysis.

Course detail

| Unit | Content | Details of content | Teaching hours |
|---|---|---|---|
| 1 | Introduction to Instrumental Methods | • **Analytical methods and classification: classical and instrumental.**<br>• **Common instrumental methods of analysis and applications of their principles.**<br>• **Performance characteristics of instruments (define terms used only); accuracy, precision, and degree of confidence in instrumental analysis.** | 3 |
| 2 | Spectroscopic Techniques | • **Introduction to spectroscopy:** [3 h]<br>- Interaction between EMR and matter<br>- Energy levels: atomic and molecular<br>- Spectra: atomic, molecular, absorption and emission<br>- Absorption laws (derivation of Beer's Law), adsorption and absorptivity.<br>- Classification of molecular spectra: electronic, vibrational and rotational<br>- Spectroscopic technique and instrument nomenclature (spectroscopy, spectrometry, spectrophotometry, photometer, and spectrograph)<br>• **Atomic Spectroscopy:** [5h]<br>- Atomic absorption spectrometry (AAS): principle, basic instrumentation, interferences, and analytical applications of AAS<br>- Flame atomic emission spectroscopy (flame photometry): principle, basic instrumentation, interferences, analytical applications of flame photometry, a brief introduction to plasma emission spectroscopy (based on ICP-AES).<br>• **Molecular Spectroscopy:** [4 h]<br>- Ultraviolet-visible (UV-Vis) molecular spectroscopy: principle, instrumentation, UV spectra and the structure of organic molecules, and analytical applications.<br>- Infrared spectroscopy: absorption of IR radiation by molecules, modes of vibration, IR instrumentation, the difference between traditional IR spectroscopy and FT-IR, and analytical applications of IR spectroscopy (with examples of some common IR spectra of functional groups).<br>• **Magnetic Resonance Spectroscopy:** [3 h]<br>- Introduction to resonance spectroscopy.<br>- Principle of nuclear magnetic resonance (1H-NMR).<br>- Instrumentation.<br>- Chemical shift (shielding, deshielding, upfield, and downfield) and spin-spin coupling.<br>- Analytical applications of NMR: qualitative analyses (molecular structure determination), $^1H$ spectra of some compounds. | 15 |

Continued ...

| | | | |
|---|---|---|---|
| 3 | Chromatographic Techniques | • Principles of chromatography: [3 h]<br>- Introduction: definition, general principle, and basic terminologies<br>- Chromatographic process and classification of chromatography<br>- Qualitative chromatography: analyte identification.<br>- Quantitative measurements in chromatography: peak area and peak height<br>• Paper Chromatography, Thin Layer Chromatography (TLC), and Column Chromatography: [3 h]<br>- General principle, basic instrumentation and applications<br>• High-Performance Liquid Chromatography (HPLC): [3 h]<br>- Principle, instrumentation, and applications of HPLC.<br>• Gas Chromatography (GC): [3 h]<br>- Principles, derivatization, instrumentation, GC instrument operation, and applications in food analysis.<br>• Electrophoresis: [2 h]<br>- Capillary Zone Electrophoresis (CZE), sample injection, detection and modes of CE. | 14 |
| 4 | Electroanalytical Methods:<br>pH and Conductometric, Potentiometry, Voltammetry [polarography], Coulometry) | • **Introduction to electroanalytical chemistry:** [3 h]<br>- Electrochemical cells, potentials in electroanalytical cells, electrode potentials, calculation of cell potentials from electrode potentials, currents in electrochemical cells, and types of electroanalytical methods.<br>• **Potentiometry:** [3 h]<br>- Introduction to electrodes (standard hydrogen, reference, and glass membrane), general principles, instruments for measuring cell potentials, and potentiometric titration of redox reactions.<br>• **Voltammetry (Polarography):** [2 h]<br>- Excitation signals, Dropping Mercury Electrode (DMF), general principle, instrumentation, applications of voltammetry.<br>• **pH titrations:** [2 h]<br>- Introduction to pH and pH scale, buffer solutions, general principle, basic instrumentation, applications in acid/base titrations.<br>• **Conductometric titrations:** [2 h]<br>- Introduction to conductance of electrolytes, specific conductance, equivalent conductance and molar conductance, general principle, instrumentation and applications in acid/base titrations. | 12 |
| 5 | Refractometry and Polarimetry | • **Introduction to refractometry, specific and molecular refractivity and factors affecting refractive index, basic principle and instrumentation (Abbe's Refractometer), and applications (qualitative and quantitative analysis).** [2 h]<br>• **Introduction to polarimetry, optical activity and specific rotation, basic principle of polarimeter, instrumentation of polarimeter and applications.** [2 h] | 4 |
| | | **Total** | 48 |

Reference materials


1. Chatwal, G. R. and Anand, S. (2011). "Instrumental Methods of Chemical Analysis". Himalayan Publishing House India. [ISBN 9350248360, 978-9350248362].
2. Bahl, A., Bahl, B. S. and Tuli, G. D. (2022). "Essentials of Physical Chemistry" (28th ed.). S Chand and Company Ltd. [ISBN 9355010605, 978-935501060[illegible]].
3. Shrestha, S., Yadav, P. N., and Shakya, B. (2021). "Basic Analytical Chemistry". Garuda Publication Pvt. Ltd. Nepal. [ISBN 978-9937-0-9579-2].


Institute of Science & Technology
Dean's Office
Kirtipur 2045

प्राज्ञिक परिषद्को कार्यालय
कीर्तिपुर

4. Yadav, P. N., Shakya, B. and Shrestha, S. (2021). "Basics of Molecular Spectroscopy". Heritage Publishers and Distributors Pvt. Ltd., Nepal. [ISBN 978-9937-9431-2-3].
5. Skoog, D. A., Holler, F. J. and Crouch, S. R. (2018). "Principles of Instrumental Analysis" (7th ed.). Cengage Learning, USA. [ISBN 1337468037, 9781337468039].
6. Skoog, D. A., West, D. M., Holler, F. J. and Crouch, S. R. (2004). "Fundamentals of Analytical Chemistry" (8th ed., International Student edition), Books/Cole Cengage Learning, USA. [ISBN 0357450434, 9780357450437].
7. Khopkar, S. M. (2008). "Basic Concepts of Analytical Chemistry". New Age International Pvt. Ltd., New Delhi. [ISBN 9788122420920].
8. Silverstein, R. M., Webster, F. X., Kiemale, D. J. and Bryce, D. L. (2015). "Spectrometric Identification of Organic Compounds" (8th ed.). John Wiley & Sons, Inc., New York. [ISBN 978-0-470-61637-6].
9. Mendharm, J., Denny, R.C., Branes, J. D. and Thomas, M. (2008). "Vogel's Textbook of Quantitative Chemical Analysis" (6th ed.). [ISBN 0582226287, 9780582226289].
10. Morrison, R. T., Boyd, R. N. and Bhattacharhjee, S. K. (2010). "Organic Chemistry" (7th ed.), Pearson Education, India. [ISBN 9788131704813].

प्राविधिक परिषद्को कार्यालय
कीर्तिपुर

Institute of Science & Technology
Dean's Office
Kirtipur 2045

| | | |
|---|---|---|
| Course: Instrumental Techniques of Analysis | Course Code: BFT 151 (B) | Credit Hour: 1 |
| Semester: II | Teaching hours: 64 h | Full Marks: 25 |
| Nature of Course: Practical + Tutorial | (Tutorial: 1h, Lab.: 3 h per session) | |

List of practical for the laboratory session

1. Acid/base titrations using a pH meter (SA/SB, WA/SB, SA/WB and (SA+WA)/SB).
2. Redox titrations by using a potentiometer (perform a redox titration of Mohr's salt using potassium dichromate/potassium permanganate as an oxidizing agent).
3. Determination of $\lambda_{max}$ and concentration of an unknown solution ($CuSO_4$/ascorbic acid) by using a colorimeter.
4. Acid/base titrations by using a conductometer (SA/SB, WA/SB, SA/WB and (SA+WA)/SB.
5. Separation of the mixtures (binary mixtures of inorganic cations/amino acids) by paper chromatography.
6. Separation of the mixture of ortho and para nitroaniline by TLC.
7. Separation of the cations from the given mixture by column chromatography using cellulose.
8. Determination of Na/K/Ca by flame photometer.
9. Determination of viscosity-average molecular weight of the polymer by using a Ubbelohde capillary viscometer.
10. Estimation of fats/oil present in the food products (e.g., mustard, soyabean) by Soxhlet extraction method.
11. To study the provided FTIR and $^1$H-NMR spectra.
12. Operation of semi-automatic Kjeldahl digestion and distillation unit.
13. Operation of polarimeter.

**Unit wise marks distribution for the final exam**

| Unit | Title | Total (%) |
|---|---|---|
| 1 | Introduction to instrumental methods | 5 |
| 2 | Spectroscopic techniques | 30 |
| 3 | Chromatographic techniques | 30 |
| 4 | Electroanalytical methods: (potentiometry, voltammetry (polarography), coulometry, pH and conductometric) | 25 |
| 5 | Refractometry and polarimetry | 10 |
| | Total | 100% |

प्राविधिक परिषदका कार्यालय
कीर्तिपुर

Institute of Science & Technology
Dean's Office
Kirtipur 2045

| Course: Basic Principles of Engineering | Course Code: BFT 152 (A) | Credit Hour: 3 |
|---|---|---|
| Semester: II<br>Nature of Course: Theory | Teaching hours: 48 h<br>(3 lecture hours per week) | Full Marks: 75 |

Course description and objectives

This course is designed to provide an overview and importance of different branches of engineering in the area of Food Technology. The students will be able to obtain knowledge on measurement, use and interpretation of engineering data of the field for analysis to provide design parameters in the area of Food Technology Projects.

The course aims to provide students with foundational knowledge in engineering concepts. It introduces various materials commonly used in engineering work, emphasizing their properties. Additionally, the book familiarizes students with conventional drawing practices and standard symbols across different engineering fields. It covers essential topics such as basic thermodynamics, heat transfer, fluid mechanics, mechanical power transmission systems, measurement techniques, and fundamental electrical power systems (including AC/DC, 1-phase, and 3-phase systems).

Course detail

| Unit | Content | Details of content | Teaching hours |
|---|---|---|---|
| 1 | Introduction | • **Scope of the subject**<br>• **Types of materials:**<br>- Metal, ceramics, glass, synthetic polymers, cementing materials, insulating materials, etc.<br>• **Properties of material:**<br>- Physical, mechanical, thermal, electrical and other properties of material<br>• **Material selection and use:**<br>- Based on composition and engineering properties of material – steel, stainless steel, cast iron, galvanized iron, HDP/CPVC pipe, ceramics, etc.<br>• **Introduction of basic engineering and its importance in food technology projects and practices.** | 5 |
| 2 | Basic Engineering Drawing | • **Introduction:** inter relationship between drawing and food technology.<br>• **Introduction to the graphic language, principles of the projection of points, straight lines, planes, solid, isometric projection and intersection.**<br>• **Unit of measurements and their conversion with special emphasis on SI system.**<br>• **Use of scales, measurement units and dimensioning system.**<br>• **Plane geometrical construction:**<br>- Proportional division of lines, arc and line tangents; Introduction to orthographic projection, principal planes, four quadrants or angles.<br>- First and third angle projection, orthographic drawings: making an orthographic drawing, visualizing objects (pictorial view) from the given views.<br>• **Standard symbols for civil, agricultural, mechanical and industrial components, electronics, communication and computer components, topographical symbols, standard piping symbols and piping drawing.**<br>• **Study and copying of simple building floor plan, section and elevation of industrial or food-lab building and layout of machines.** | 6 |
| 3 | Basic Electrical Engineering | • AC / DC concept, converters, transformers, principles and types of electric motors, fuse, switches, basic understanding of electric circuit, series circuit, parallel network, power and energy.<br>• Constituent parts of an electrical system (source, load, communication and control), current flow in a circuit, electromotive force and potential difference, electrical units, voltage and current sources. | 6 |

Continued ...

| Course: Basic Principles of Engineering | Course Code: BFT 152 (A) | Credit Hour: 3 |
|---|---|---|
| Semester: II | Teaching hours: 48 h | Full Marks: 75 |
| Nature of Course: Theory | (3 lecture hours per week) | |

Course description and objectives

This course is designed to provide an overview and importance of different branches of engineering in the area of Food Technology. The students will be able to obtain knowledge on measurement, use and interpretation of engineering data of the field for analysis to provide design parameters in the area of Food Technology Projects.

The course aims to provide students with foundational knowledge in engineering concepts. It introduces various materials commonly used in engineering work, emphasizing their properties. Additionally, the book familiarizes students with conventional drawing practices and standard symbols across different engineering fields. It covers essential topics such as basic thermodynamics, heat transfer, fluid mechanics, mechanical power transmission systems, measurement techniques, and fundamental electrical power systems (including AC/DC, 1-phase, and 3-phase systems).

Course detail

| Unit | Content | Details of content | Teaching hours |
|---|---|---|---|
| 1 | Introduction | • **Scope of the subject**<br>• **Types of materials:**<br>- Metal, ceramics, glass, synthetic polymers, cementing materials, insulating materials, etc.<br>• **Properties of material:**<br>- Physical, mechanical, thermal, electrical and other properties of material<br>• **Material selection and use:**<br>- Based on composition and engineering properties of material – steel, stainless steel, cast iron, galvanized iron, HDP/CPVC pipe, ceramics, etc.<br>• **Introduction of basic engineering and its importance in food technology projects and practices.** | 5 |
| 2 | Basic Engineering Drawing | • **Introduction:** inter relationship between drawing and food technology.<br>• **Introduction to the graphic language, principles of the projection of points, straight lines, planes, solid, isometric projection and intersection.**<br>• **Unit of measurements and their conversion with special emphasis on SI system.**<br>• **Use of scales, measurement units and dimensioning system.**<br>• **Plane geometrical construction:**<br>- Proportional division of lines, arc and line tangents; Introduction to orthographic projection, principal planes, four quadrants or angles.<br>- First and third angle projection, orthographic drawings: making an orthographic drawing, visualizing objects (pictorial view) from the given views.<br>• **Standard symbols for civil, agricultural, mechanical and industrial components, electronics, communication and computer components, topographical symbols, standard piping symbols and piping drawing.**<br>• **Study and copying of simple building floor plan, section and elevation of industrial or food-lab building and layout of machines.** | 6 |
| 3 | Basic Electrical Engineering | • AC / DC concept, converters, transformers, principles and types of electric motors, fuse, switches, basic understanding of electric circuit, series circuit, parallel network, power and energy.<br>• Constituent parts of an electrical system (source, load, communication and control), current flow in a circuit, electromotive force and potential difference, electrical units, voltage and current sources. | |

Continued ...

| | | | |
|---|---|---|---|
| 3 | Basic Electrical Engineering | • Introduction to single phase and three phase system<br>• Electrical Machines:<br>- Instrument transformers: potential transformer (PT) and current transformer (CT).<br>• Introduction to auto transformer:<br>- Construction, working principle and Cu saving, three phase transformers.<br>• Basic electrical symbols. | |
| 4 | Fluid mechanics and Hydraulics | • Definition and properties of a fluid; types and uses of valve; pressure variations in a fluid; unit of pressure, absolute and gauge pressure; manometers.<br>• Measurement of fluid flow:<br>- Obstruction meters for incompressible and compressible fluids, variable area flow meter, measurement of fluid velocities, pressure probes.<br>• Experiment on fluid flow and temperature measurement.<br>• Static characteristics of measurement system: introduction; accuracy and precision, tolerance, range or span, linearity, sensitivity of measurement, threshold, resolution, sensitivity to disturbance, hysteresis effects, dead space, pressure intensity at a point.<br>• Fluid flow:<br>- Laminar and turbulent flow; frictional resistance to flow in pipes; Darcey-Weisbach equation, friction factor, use of Moody diagram, head loss in pipe flow; head losses in bends, joint expansions, valves; loss coefficients; hydraulic and energy grade lines (EGL). | 7. |
| 5 | Fundamentals of Thermodynamics and Heat Transfer | • Definition and scope of engineering thermodynamics; system, surroundings, boundary and universe; closed systems, open systems, and isolated systems.<br>• Thermodynamic properties:<br>- Intensive, extensive and specific properties; thermodynamic equilibrium<br>• Common properties:<br>- Pressure, specific volume, temperature; energy and its meaning.<br>• Refrigeration:<br>- Principles of refrigeration, basic refrigeration cycles and concept of vapor compression cycle.<br>• Refrigerants:<br>- Ammonia, freon brines and their properties and comparison<br>• Introduction to humidity, relative humidity, water activity, dew point; Importance of humidity in food.<br>• Psychometry:<br>- Psychometric properties.<br>- Psychometric process.<br>- Psychometric chart and its use.<br>• Sensible heating and cooling, cooling and dehumidification, heating and humidification, mixing of two streams of air, humidification and dehumidification.<br>• Evaporative cooling/adiabatic humidification.<br>• Temperature/pressure measuring devices and their application.<br>• Properties of common substances:<br>- Two phase (liquid and vapor) systems: phase change; subcooled liquid, saturated liquid, wet mixture, critical point, quality, moisture content, saturated vapor and superheated vapor. | 10 |

Continued ...

| | | | |
|---|---|---|---|
| 5 | Fundamentals of Thermodynamics and Heat Transfer | • Definitions:<br>- First Law and Second Law of thermodynamic for control volume and control mass; reversible and irreversible processes, entropy; process relation for an ideal gases and incompressible substances; heat engine and thermal efficiency, heat pump; refrigerator and coefficient of performance (COP); basic concepts and modes of heat transfer, heat radiation; Stefan's Law; absorptivity; reflectivity and transmissivity; black body, white body and gray body.<br>• Cold storage:<br>- Introduction, functional requirements, condition of storage for perishable products. | |
| 6 | Mechanical Power Transmission System | • **Mechanical power transmission:**<br>- Methods and principles; gear system and hydraulic transformation; bearings, coupling, crank, shaft, etc.<br>• **Pumps:**<br>- Type, working principle and industrial application of centrifugal and reciprocating pumps, specific speed, pump head, pump characteristics, energy loss, cavitation, efficiency, effect of viscosity, series and parallel combination; selection of pump.<br>• **Common mechanical measurement system and transducers:**<br>- Temperature measurement: use of bi-materials, pressure thermometer, thermoelectric thermometry, thermo-resistive elements, thermocouples and circuitry, linear quartz thermometer, pyrometer.<br>• **Pressure measurement:**<br>- Static and dynamic pressure measurement systems, pressure transducers types, measurement of low pressure, measurement of high pressure, acoustical measurement.<br>• **Pneumatic system:**<br>- Definition, components, working and application of pneumatics, use of pneumatics, advantages and disadvantages of pneumatics, hydraulic system versus pneumatic system. | 8 |
| 7 | Boilers and Steam Generation | • **Boilers and steam generation, steam generators/steam boilers, basics of boiler and boiler process, types of boilers, steam generation devices and their utilization.**<br>• **Types and characteristics of fuels used in thermal power generation.**<br>• **Properties of steam, T-Q diagram, heat recovery system.**<br>• **Steam nozzles and types; flow of steam through nozzles.**<br>• **Advantages and disadvantages of steam system – compared to hot water and thermal oil system** | 6 |
| | | Total | 48 |

Reference materials


1. Arora, S. C. and S. Domkundwar, S. (2020). "A Course in Refrigeration & Air-conditioning" (8th ed.). Cengage Learning, USA. [ISBN 9780357122273].
2. Nag, P. K. (2017). "Engineering Thermodynamics" (6th ed.). McGraw Hill Education. New York. [ISBN 9789[illegible]606429].
3. Mathur, S. B. and Domkundwar, S. (2019). "Elements of Mechanical Engineering" (5th ed.). Dhanpat Rai and Sons, New Delhi. [ISBN 9788177000287].
4. Bhatt, N. D. (2011). "Engineering Drawing" (50th ed., Revised and enlarged). Charotar Publishing House Pvt. Ltd. Gujarat, India. [978-9380358178].
5. Doebelin, E. O. (1990). "Measurement Systems: Application and Design" (4th ed.), Mc Graw-Hill, USA. [ISBN 0-07-017338-9].

6. Beckwith, T. G., Marangoni, R. D. and Lienhar V, J. H. (2006). "Mechanical Measurements" (6th ed.). Pearson, London. [ISBN 0201847655]
7. Rathakrishnan, E. (2006). "Fundamentals of Engineering Thermodynamics" (5th ed ). PHI Pvt. Ltd., India. [ISBN 9788120327900].
8. Howell, J. R. and Buckius, R. O. (1987). "Fundamentals of Engineering Thermodynamics" McGraw-Hill Book Co., New York. [ISBN 0-07-079663-7].
9. Sonntag, R. E., Borgnakke, C. and Van Wylen, G. J. (2002). "Fundamentals of Thermodynamics" (6th ed.). Wiley, New Jersey. [ISBN 0471152323].
10. Fox, R. W., McDonald, A. T. and Pritchard, P. J. (2010). "Introduction to Fluid Mechanics" (10th ed.). Wiley, New York. [ISBN 9780470567930].
11. Kumar, D. S. (2010). "Fluid Mechanics", S. K. Katarai and Sons, India. [978-9380027654].
12. Singer, J. G. (1981). "Combustion: Fossil Power Systems" (3rd ed.). Combustion Engineering, Windsor. [ISBN 978-0096059748].

Institute of Science & Technology
Dean's Office
Kirtipur 2045

प्राविधिक परिषद्को कार्यालय
कीर्तिपुर

| | | |
|---|---|---|
| Course: Basic Principles of Engineering<br>Semester: II<br>Nature of Course: Practical + Tutorial | Course Code: BFT 152 (B)<br>Teaching hours: 64 h<br>(Tutorial: 1 h, Lab: 3 h per session) | Credit Hour: 1<br>Full Marks: 25 |

List of practical for the laboratory session

1. Simple engineering drawing.
2. Third angle projection method.
3. Use of 3-D modeling software, e.g., Sketchup.
4. Exercises in relation to dimensional conversions.
5. Exercises in relation to uses of steam table.
6. Exercises in relation to uses of psychometric charts.
7. To study different parts and refrigeration controls of the following:
   - Refrigerator.
   - Water cooler.
   - Deep freezer, compare their cooling coil and internal systems.
8. Measurement of power in 3-phase circuit:
   - For balance load.
   - For unbalanced load by watt meters and power meters.
9. Polarity test, no load test, efficiency and regulation test of single-phase transformer.
10. Study of various measuring instruments.
11. Calculation of refrigeration load.
12. Layout of machines on building plan.
13. Measurement of Fluid viscosity and density.
14. Fluid flow in piping, friction losses in liquid flow.
15. Performance characteristics of different types of pumps.

**Field Visit:**

Two days field visit to nearby lab for lab-work and nearby industry/college to study the layout of different types of machines in the industry.

***Attendance in fieldwork is compulsory**

**Field visit practical:**

1. Demonstration of the energy and momentum equations.
2. Pressure distribution for flow through a Venturimeter.
3. Force developed by a steady impinging jet flow.
4. Calibration of flow: orifice, weir.
5. The hydraulic jumps.

**Unit wise marks distribution for the final exam**

| Unit | Title | Total (%) |
|---|---|---|
| 1 | Introduction | 10 |
| 2 | Basic engineering drawing | 15 |
| 3 | Basic electrical engineering | 15 |
| 4 | Fluid mechanics and hydraulics | 15 |
| 5 | Fundamentals of thermodynamics and heat transfer | 20 |
| 6 | Mechanical power transmission system | 15 |
| 7 | Boilers and steam generation | 10 |
| | Total | 100% |

Institute of Science & Technology
Dean's Office
Kirtipur 2045

प्राविधिक परिषद्को कार्यालय
कीर्तिपुर

| | | |
|---|---|---|
| Course: Food Chemistry-I | Course Code: BFT 153 (A) | Credit Hour: 2 |
| Semester: II | Teaching hours: 32 | Full Marks: 50 |
| Nature of Course: Theory | (2 lecture hours per week) | |

Course description and objectives

Food Chemistry (Part I) offers students a deep knowledge of the chemical aspects concerning food composition, structure, and properties. Through a combination of theory and practical applications, students will gain a comprehensive understanding of various chemical processes involved in the production, preservation, and analysis of food. This course serves as an essential foundation for the more advanced Food Chemistry-II, which will be offered in the following semester.

In this course, students will be introduced to the fundamental principles and concepts of food chemistry. They will gain an understanding of the chemical components that make up food and explore their functional properties. Additionally, the course will delve into the crucial role of chemistry in food processing and preservation techniques. Practical skills related to the chemical analysis of food constituents will also be developed.

Course detail

| Unit | Content | Details of content | Teaching hours |
|---|---|---|---|
| 1 | Introduction to Food | • **Definitions, examples, classification, composition and utilization in human body.**<br>• **Food Composition Table and its applications.** | 2 |
| 2 | Moisture in Food | • **Forms of moisture, role of moisture in food.**<br>• **Determination of moisture in food:** direct/ indirect methods, physical/chemical methods.<br>• **Water activity and food stability; Moisture sorption isotherm:** types and applications. | 3 |
| 3 | Carbohydrates | • **Definition, classification and examples.**<br>• **Monosaccharides:** isomerism, chemistry and uses.<br>• **Oligosaccharides:** glycosidic bond, chemistry of important disaccharides and uses.<br>• **Polysaccharides:** classifications, origin and uses.<br>• **Manufacture of starch, chemistry of starch, gelatinization and retrogradation of starch, modified, resistant starch, chemistry of cellulose, glycogen, inulin and hemicellulose.**<br>• **Crude and dietary fiber in food:** sources, functions and harmful effects.<br>• **Pectin:** sources, chemistry, extraction of pectin, gel formation chemistry of pectin; pectic enzymes and their applications. | 11 |
| 4 | Lipids | • **Classifications and examples.**<br>• **Fatty acids:** chemistry, classifications, PUFA and their nutritional significance.<br>• **Triglycerides:** composition, physical, chemical and functional properties.<br>• **Characteristics of cooking, frying, salad, hydrogenated fat/oil.**<br>• **Characteristics of fat from animal sources.**<br>• **Rancidity:** types, mechanism, negative impacts, measurement of rancidity and control measures. | 7 |
| 5 | Protein | • **Amino acids:** chemistry, classification, importance of D and L- amino acid.<br>• **Protein and peptides:** peptide bond, structure of protein, properties of protein (precipitation/coagulation, denaturation, gelation, hydrolysis).<br>• **Assay of protein by qualitative and quantitative methods.**<br>• **Peptides and their biological role.** | 5 |

Continued ...

| | | | |
|---|---|---|---|
| 6 | Vitamins and their Classification | • Sources, physiological roles, deficiency and stability of fat-soluble and water-soluble vitamins. | 2 |
| 7 | Minerals | • Micro and macro minerals.<br>• Role of minerals in human body.<br>• Important sources, interactions with food components of iron, calcium, phosphorus, iodine and zinc.<br>• Heavy metals and their harmful impact in human body. | 2 |
| | | Total | 32 |

Reference materials


1. Barbosa-Cánovas, G. V., Fontana Jr, A. J., Schmidt, S. J. and Labuza, T. P. (2020). "Water Activity in Foods: Fundamentals and Applications" (2nd ed.). John Wiley & Sons, Inc., USA. [ISBN 9781118768310].
2. Bertolini, A. (2009). "Starches: Characterization, Properties, and Applications" (1st ed.). CRC Press, Boca Raton. [ISBN 9780429141720].
3. Damodaran, S. and Parkin, K. L. (2017). "Fennema's Food Chemistry" (5th ed.). CRC Press, Boca Raton. [ISBN 9781482208146].
4. Eliasson, A. C. (2017). "Carbohydrates in Foods: An Introduction" (3rd ed.). Springer, New York. [eBook DOI: 10.1007/978-0-387-69940-0_3].
5. Gunstone, F. D. (2011). "Vegetables Oils in Food Technology: Composition, Properties and Uses" (2nd ed.). John Wiley & Sons, Ltd., Chichester, UK. [ISBN 978-1-4443-3268-1].
6. deMan, J. M., Finley, J. W., Hurst, W. J. and Lee, C. Y. (2018). "Principles of Food Chemistry" (4th ed.). Springer, USA. [ISBN 978-3-319-63607-8].
7. KC, J. B. and Rai, B. K. (2015). "Essentials of Food Chemistry" (2nd ed.). Ms. Maya KC, Kathmandu. [978-99946-2-970-1].
8. Shi, Y. C., and Maningat, C. C. (2013). "Resistant Starch: Sources, Applications and Health Benefits" (1st ed.). Wiley-Blackwell, USA. [ISBN 978-0813809519].
9. Sikorski, Z. E. (2006) "Chemical and Functional Properties of Food Components" (3rd ed.). CRC Press, Boca Raton. [ISBN 9780429124686].
10. Stephen, A. M. and Phillips, G. O. (2006). "Food Polysaccharides and their Applications" (2nd ed.). [ISBN 9780429116162].
11. KC, J. B. and Rai, B. K. (2019). "Basic Food Analysis Handbook" (3rd ed.). Ms. Maya KC, Kathmandu. [ISBN 9789994627967].



| | | |
|---|---|---|
| Course: Food Chemistry-I | Course Code: BFT 153 (B) | Credit Hour: 1 |
| Semester: II | Teaching hours: 64 h | Full Marks: 25 |
| Nature of Course: Practical | | |

List of practical for the laboratory session

1. Determination of moisture content of food by different methods.
2. Determination of water activity of food.
3. Construction of moisture sorption isotherm of various foods.
4. Determination of reducing sugar by different methods.
5. Determination of total sugar present in food.
6. Determination of starch content by hydrolysis methods.
7. Determination of fat by solvent extraction method.
8. Determination of acid value and FFA of fat/oil.
9. Determination of various physic-chemical properties of fat/oil.
10. Quantitative measurement of protein by different method.
11. Qualitative testing of presence of amino acid and protein in food.
12. Qualitative and quantitative measurements of vitamins.
13. Determination of calcium and iron by gravimetric and spectrophotometric method.
14. Qualitative testing of heavy metals present in foods.

**Unit wise marks distribution for the final exam**

| Unit | Title | Total (%) |
|---|---|---|
| 1 | Introduction to food | 7 |
| 2 | Moisture in food | 10 |
| 3 | Carbohydrates | 35 |
| 4 | Lipids | 20 |
| 5 | Protein | 18 |
| 6 | Vitamins and their classification | 5 |
| 7 | Minerals | 5 |
| | Total | 100% |

| | | |
|---|---|---|
| Course: Food Microbiology<br>Semester: II<br>Nature of Course: Theory | Course Code: BFT 154 (A)<br>Teaching hours: 32<br>(3 lecture hours per week) | Credit Hour: 2<br>Full Marks: 50 |

Course description and objectives

Food Microbiology is a foundational course designed for students pursuing a bachelor's degree in Food Technology. This course is intended to build upon the knowledge and skills acquired in a Food microbiology course and provide specific understanding of how microorganisms impact quality of food, food borne disease acquired through the consumption of contaminated food, and beneficial effect of microorganisms in food. Students will gain knowledge of the microorganisms present in food, their impact on food quality, and various types of foodborne illnesses. This course integrates both theoretical concepts and practical applications to enhance students' understanding and prepare them for future careers in the food industry or research. The course covers introduction to the subject, microbial spoilage, foodborne illness and safety, microbial safety and management guidelines and systems (GLP, GMP, FSMS, etc.).

In this course, students will become familiar with various types of spoilage caused by microorganisms in food. They will gain an understanding of major diseases caused by foodborne pathogens. Additionally, students will learn various techniques used to determine microorganisms and their products in food. The course also aims to provide an understanding of the beneficial role of microorganisms in food and introduce students to food safety management.

Course detail

| Unit | Content | Details of content | Teaching hours |
|---|---|---|---|
| 1 | Microbial Sources and Factors Affecting Microorganisms | • Primary sources of microorganisms in food. [1 h]<br>• Microorganisms important in food: Major groups of bacteria, yeast and mold. [2 h]<br>• Factors affecting growth of microorganisms in food: Intrinsic and extrinsic factors. [1 h] | 4 |
| 2 | Food Contamination and Spoilage | • Contamination and spoilage of cereals and cereal product. [1 h]<br>• Poultry products, eggs, fish: [1 h]<br>• Fruits and vegetables, spices. [1 h]<br>• Beverages. [1 h]<br>• Milk and milk products. [1 h]<br>• Meat and meat products. [1 h]<br>• Canned foods. [1 h] | 7 |
| 3 | Analytical Techniques in Food Microbiology | • Sampling techniques, electrical methods, ATP bioluminescence. [1 h]<br>• Microscopy techniques: direct epifluorescent filter technique (DEFT). [1 h]<br>• Immunological techniques: immunochromatography, enzyme-linked immunofluorescent assays (ELIFA), agglutination techniques. [1 h]<br>• Genetic techniques: polymerase chain reaction (PCR), nucleic acid sequence-based amplification (NASBA), hybridization; biosensors for microbiological analysis of food. [2 h] | 5 |
| 4 | Food Poisoning and Disease | • Food borne disease: introduction, types, toxins, infectious dose; Indicator organisms; Investigation of food borne disease outbreak. [2 h]<br>• Microbiology, epidemiology, pathogenesis, laboratory diagnosis; prevention and control of food poisoning by microorganisms: Gram positive bacteria (*Staphylococcus aureus, Listeria monocytogenes, Clostridium botulinum, Clostridium perfringens, Bacillus cereus*). [2 h]<br>• Gram negative bacteria (*Campylobacter, Salmonella, Shigella, Escherichia coli, Vibrio cholerae*). [2 h]<br>• Mycotoxins (aflatoxins, fumonisins). [1 h]<br>• Foodborne viruses (Hepatitis, Norovirus). [1 h]<br>• Parasites (*Giardia lamblia, Entamoeba histolytica*). [1 h] | 9 |

| | | | |
|---|---|---|---|
| 5 | Food Safety Management | • Good hygienic practice (GHP), good manufacturing practice (GMP), hazard analysis critical control points (HACCP), microbiological criteria for food products. | 4 |
| 6 | Beneficial Use of Microorganisms in Food | • Probiotics, bacteriocin, nutraceutical: Introduction, types and uses. | 3 |
| | | Total | 32 |

Reference materials


1. Jay, J. M., Loessner, M. J. and Golden, D. A. (2005). "Modern Food Microbiology" (7th ed.). Springer, USA. [ISBN 978-0387231808].
2. Banwart, G. J. (2012). "Basic Food Microbiology" (2nd ed.). Springer, USA. [ISBN 978-1468464535].
3. Frazier, C. W., Westhoff, C. W (2017). "Food Microbiology" (5th ed.). McGraw Hill Education (India) Private Limited. [ISBN 978-9339203221].
4. Ray, B. and Bhunia, A. (2014). "Fundamental Food Microbiology" (5th ed.). CRC Press, Boca Raton. [ISBN 978-1-4665-6444-2].
5. Cappucino, J. G and Welsh, C. T. (2021). "Microbiology, A Laboratory Manual" (12th ed.). Pearson, USA. [ISBN 978-0137546527].
6. FDA. (1998). "FDA's Bacteriological Analytical Manual (BAM)" (continuous online update). Association of Official Analytical Chemists, Chicago Division of Microbiology, Center for Food Safety and Applied Nutrition, U.S. Food and Drug Administration. Available at: https://www.fda.gov/food/laboratory-methods-food/bacteriological-analytical-manual-bam.
7. Adams, M. R., Moss, M. O. and McClure, P. (2015). "Food Microbiology" (4th ed.). Royal Society of Chemistry, London. [ISBN 9781849739603].
8. Shen, C. and Zhang, Y. (2023). "Food Microbiology Laboratory for the Food Science Student: A Practical Approach" (2nd ed.). Springer Nature, Switzerland. [ISBN 978-3-031-26197-8].

| | | |
|---|---|---|
| Course: Food Microbiology | Course Code: BFT 154 (B) | Credit Hour: 1 |
| Semester: II | Teaching hours: 64 h | Full Marks: 25 |
| Nature of Course: Practical | (Lab session-of 4 h) | |

List of practical for laboratory session

1. To perform MBRT and enumerate total coliforms in milk sample.
2. To determine microbial quality of meat and meat products.
3. To determine microbial quality of milk and milk products.
4. To determine microbial quality of bakery product, beverages, fruits and vegetable.
5. To enumerate bacteria in water sample by MPN and MF method.
6. To isolate and identify *Bacillus cereus* from different food samples.
7. To isolate and identify *Salmonella* spp. from food samples.
8. To isolate and screen aflatoxigenic fungi from different food samples.
9. To detect aflatoxin by TLC.
10. To perform (demonstrate) PCR for identification of bacteria.
11. To isolate and screen probiotic lactic acid bacteria from fermented food.
12. Investigation of food borne disease outbreak / Design HACCP module for pasteurized milk, meat and other perishable food product (group work/ assignment).

**Unit wise marks distribution for the final exam**

| Unit | Title | Total (%) |
|---|---|---|
| 1 | Microbial sources and factors affecting microorganisms | 15 |
| 2 | Food contamination and spoilage | 20 |
| 3 | Analytical techniques in food microbiology | 15 |
| 4 | Food poisoning and disease | 30 |
| 5 | Food safety management | 10 |
| 6 | Beneficial use of microorganisms in food | 10 |
| | Total | 100% |

Babita

प्राविधिक परिषदको कार्यालय
कीर्तिपुर

Institute of Science & Technology
Dean's Office
Kirtipur 2045

| | | |
|---|---|---|
| Course: Human Nutrition | Course Code: BFT.155 (A) | Credit Hour: 2 |
| Semester: II | Teaching hours: 32 | Full Marks: 50 |
| Nature of Course: Theory | (2 lecture hours per week) | |

Course description and objectives

Approximately two-thirds of the population in developing countries suffer from various nutritional problems. Most of these issues are linked to food intake and its utilization, which significantly impact physical and mental development. Achieving good nutritional status relies on consuming a balanced diet and effectively utilizing its nutrients within the body. To achieve this, individuals need knowledge about energy and nutritional values, nutrient requirements, and the effects of different nutritional disorders and infections.

The course covers essential topics such as nutrition principles, malnutrition problems, nutritional disorders, and nutrition throughout the life cycle. By addressing these subjects, the course aims to produce skilled professionals in this field.

Course detail

| Unit | Content | Details of content | Teaching hours |
|---|---|---|---|
| 1 | Introduction | • **Introduction to nutrition:** definition and scope; historical and geographical development of nutritional science; key terminologies.<br>• **Nutrition and human development:** role of nutrition in physical and cognitive growth, nutritional impact on socio-economic development; case studies across regions. | 2 |
| 2 | Nutritional Physiology | • **Human body composition at different levels and measurement.**<br>• **Digestive and circulatory system.** | 2 |
| 3 | Food Nutrients and Energy | • **Nutrients and food classification:** nutrients and their functions; nutritional classification of food.<br>• **Digestion, absorption and metabolism of carbohydrates, protein, and fat and their utilization.**<br>• **Protein quality and nitrogen balance:** protein quality of food and **Protein quality and nitrogen balance:** determination of protein quality; body nitrogen balance, way to improve protein quality of food.<br>• **Energy and metabolism:** energy value of foods (gross and physiological value) and determination; energy and nutrients requirement and allowance; measurement of energy requirement and expenditure (direct and indirect methods), factors influencing energy requirement; basal metabolism, determination of basal metabolism, standard for basal metabolism, basal conditions and factors affecting BMR.<br>• **Dietary standards:** concept of RDA and RDA for specific nutrients. | 6 |
| 4 | Nutritional Status and Measurement | • **Definition and factors influencing the nutritional status; nutritional status of Nepalese population.**<br>• **Measurement of nutritional status (direct and indirect method):** nutritional anthropometry; anthropometric measurement, indices and indicators; classification of nutritional status based on anthropometric measurement.<br>• **Biochemical assessment:** limitations and advantages.<br>• **Clinical assessment:** limitations and advantages.<br>• **Dietary assessment:** methods, data analysis and interpretation; limitations and advantages.<br>• **Classification of nutritional status:**<br>and anthropometric classifications: Gomez classification, Howard classification, Waterlow classification.<br>Body mass index (BMI): BMI classification categories; methods of BMI measurement; factors influencing BMI; uses of BMI in nutritional assessment. | 5 |

| | | | |
|---|---|---|---|
| 5 | Malnutrition and Nutrient Deficiency Disorders and their Prevention | • Malnutrition: definition, forms and types of malnutrition.<br>• Major nutrient deficiency disorders: protein energy malnutrition (PEM), Vit A deficiency (VAD), iodine deficiency disorder (IDD), nutritional anemia, rickets, osteomalacia and osteoporosis, beriberi, pellagra, scurvy.<br>• Public health aspects: prevalence of nutrient deficiency diseases, prevention strategies, management approaches. | 5 |
| 6 | Nutrition of Life Cycle | • Nutrition of infant, preschool children, pregnant and lactating mother, and old people. | 3 |
| 7 | Diet and Diet Therapy | • Balanced diet and dietary standards: definition and components of a balanced diet, dietary standards and reference values.<br>• Diet therapy: principles of diet therapy, objectives of therapeutic diets, considerations in dietary planning for health conditions.<br>• Diet planning and using food exchange list: application of food exchange lists for diabetic individuals, use of food exchange lists for general family meal planning.<br>• Healthy eating concepts: concept of healthy food, dietary guidelines for optimal nutrition, basic five food groups, food pyramid as a visual guide to balanced eating. | 3 |
| 8 | Supplementary and Complementary Foods | • Supplementary vs. Complementary Foods: definitions, key differences, and use cases.<br>• Infant food and weaning food: definitions, need, formulation, and preparation. | 2 |
| 9 | Food Habit | • Introduction, social function of food, influencing factors, and dynamics of food habit. | 2 |
| 10 | Food Fortification and Enrichment | • Principles and purposes of fortification and enrichment; guidelines for implementation; common food fortification practices in Nepal. | 1 |
| 11 | Applied Nutrition Program | • Introduction; nutrition education and protective food preparation (brief overview); nutrition programs and policies; current nutrition initiatives at national and international levels. | 1 |
| | | Total | 32 |

Reference materials


1. Adelp P. den Hortlog and Wija A. van Staveren (1985). Manual for social survey on food habits and consumption in developing countries.
2. Begum, M. R. (2008). "A Textbook of Foods, Nutrition & Dietetics" (3rd ed.). Sterling Publishers Pvt Ltd., New Delhi. [978-8120737143].
3. Jelliffe, D. B. and World Health Organization. (1966). "The Assessment of the Nutritional Status of the Community". Available at: https://iris.who.int/handle/10665/41780.
4. Whitney, E. N. and Rolfes, S. R. (2010). "Understanding Nutrition" (12th ed.). Wadsworth Publishing, New York. [ISBN 9780538734653].
5. FNRI. (2014). "Food Exchange Lists for Meal Planning" (4th ed.). Department of Science and Technology, the Philippines.
6. Byrd-Bredbenner, C., Berning, J. R. Kelly, D. S. and Moe, G. (2019). "Wardlaw's Perspectives in Nutrition" (11th ed.). McGraw-Hill Publication, USA. [ISBN 9781260163964].
7. WHO. (1979). "Health Aspects of Food and Nutrition: A Manual for Developing Countries in the Western Pacific Region of the World Health Organization" (3rd ed.). World Health Organization, Geneva.
8. Joshi, S.A. (2015). "Nutrition and Dietetics" (4th ed.). Tata McGraw-Hill Education (India) Pvt. Ltd. [ISBN 9789339220167].
9. Garrow, J. S. and James, W. P. T. (1998). "Human Nutrition and Dietetics" Churchill Livingstone, London. [ISBN 9780443041211]
10. Swaminathan, M. (2011). Essentials of Food and Nutrition, Vol I & II: (2nd ed. 2nd revision). Bangalore Printing and Publishing Co. Ltd.

| Course: Human Nutrition | Course Code: BFT 155 (B) | Credit Hour: 1 |
|---|---|---|
| Semester: II | Teaching hours: 64 h | Full Marks: 25 |
| Nature of Course: Practical | (Lab session of 4 h) | |

List of practical for laboratory session

1. Determination of energy value of foods by Bomb calorimeter and food composition table.
2. Calculation of energy requirement and expenditure – individual adult and family.
3. Preparation of weaning food.
4. Preparation of balanced diet.
5. Exercise on menu planning for weight gain and reduction, diabetic person, normal individual and family.
6. Nutrition survey in the school children community.
7. Food consumption survey.
8. Determination of BMI of adult students.
9. Estimation of body fat, fat free mass and other composition based on body densitometry and Bio Electric Impedance Analysis (BIA).

**Unit wise marks distribution for the final exam**

| Unit | Title | Total (%) |
|---|---|---|
| 1 | Introduction | 5 |
| 2 | Nutritional physiology | 5 |
| 3 | Food and energy | 20 |
| 4 | Nutritional status | 15 |
| 5 | Malnutrition and nutrient deficiency disorders and their prevention | 15 |
| 6 | Nutrition of life cycle | 10 |
| 7 | Diet and diet therapy | 10 |
| 8 | Supplementary and complementary foods | 5 |
| 9 | Food habit | 5 |
| 10 | Food fortification and enrichment | 5 |
| 11 | Applied nutrition program | 5 |
| | Total | 100% |

| Course: Fundamentals of Electrical Engineering | Course Code: BFT 156 (A) | Credit Hour: 2 |
|---|---|---|
| Semester: II | Teaching hours: 32 | Full Marks: 50 |
| Nature of Course: Theory | | |

Course description and objectives

Electrical Engineering is a foundational discipline that permeates various fields of engineering. Whether it is designing electronic devices, analyzing power systems, or understanding control systems, electrical principles are essential. As an allied course, this "fundamentals of electrical engineering" aims to provide students with a solid grounding in these principles, regardless of their primary engineering focus.

In this introductory electrical engineering course, students will gain a comprehensive understanding of AC and DC electrical circuits, machinery, and the underlying principles and laws.

Course detail:

| Unit | Content | Details of content | Teaching hours |
|---|---|---|---|
| 1 | DC Fundamentals | • General concept of current, voltage and resistance.<br>• Electric circuit components: source, conductor, load, controlling device and protective device.<br>• Electrical sources: ideal and practical voltage and current sources, symbol and characteristic source conversion method.<br>• Ohm's law, limitation and application.<br>• Series and parallel circuit, current divider rule, voltage divider rule.<br>• Electric power and energy.<br>• Kirchhoff's law and its application. | 6 |
| 2 | DC Network Analysis | • Nodal analysis method.<br>• Mesh analysis method.<br>• Star/Delta, Delta/Star transformation.<br>• Superposition theorem.<br>• Thevenin's theorem.<br>• Norton's theorem.<br>• Maximum power transfer theorem.<br>• Reciprocity theorem. | 8 |
| 3 | AC Fundamentals | • Introduction of AC quantities.<br>• Generation of alternating sinusoidal voltage.<br>• Different terminologies of AC system.<br>• RMS and average value: definition, derivation, and importance. form factor, peak factor.<br>• Ways of phasor representation of AC quantities. conversion from one form to another, complex algebra (addition, subtraction, multiplication and division).<br>• General concept of Inductance, capacitance, inductive reactance and capacitive reactance.<br>• Single phase AC circuit analysis with R, L, C, RL, RC, RLC series and parallel circuits.<br>• Introduction of three phase AC system.<br>• Advantages of three phase AC system.<br>• Generation of three phase sinusoidal voltage; wave and phasor diagram; phase sequence. | 12 |

Continued ...

| | | | |
|---|---|---|---|
| 3 | AC Fundamentals | • Interconnection of three phase coils; line and phase quantities in Star and Delta connections and their relationship.<br>• Voltage, current, power and power factor computation in balanced and unbalanced load. | |
| 4 | Electrical Machines | • DC motor: introduction, construction and working principle<br>• Back EMF and its significance, types and application of DC motor.<br>• Transformer: introduction, construction and working principle of transformer.<br>• EMF equation, transformation ratio, types and application of transformer.<br>• Three-phase induction motor: introduction construction, working principle, types and application of three-phase induction motor. | 6 |
| | | Total | 32 |

Reference materials


1. Cogdell, J. R. "Foundations of Electrical Engineering" (2nd ed.). Prentice-Hall, USA. [ISBN 9780130927019].
2. Rizzoni, G. and Kearns, J. (2022). "Fundamentals of Electrical Engineering" (2nd ed.). McGraw-Hill, New York. [ISBN 1266370773].
3. Alexander, C. K. and Sadiku, M. (2021). "Fundamentals of Electric Circuits" (7th ed., International Student Edition). MC Graw-Hill Education, New York. [ISBN 9781260570793].
4. Sahdev, S. K. (2017). "Basic Electrical Engineering". Pearson Education, India. [ISBN 978-9332576797; 978-9332578739].
5. HimaBindu, V., Madhuri, V. V. S. and Chandrashekar, D. (2014). "Basic Electrical Engineering". Gokaraju Rangaraju Institute of Engineering and Technology (Autonomous).
6. Gönen, T. (2023). "Electrical Machines and Their Applications". CRC Press. [ISBN 978-0367655013].
7. Vinod, A. and Yadagiri, J. (2022). "Laboratory Manual: Basic Electrical Engineering Lab". Mam Laxman Reddy Institute of Technology and Management, India.
8. Asadi, F. (2023). "Electric Circuit Laboratory Manual". Springer Nature, Switzerland. [ISBN 978-3-031-24552-7].

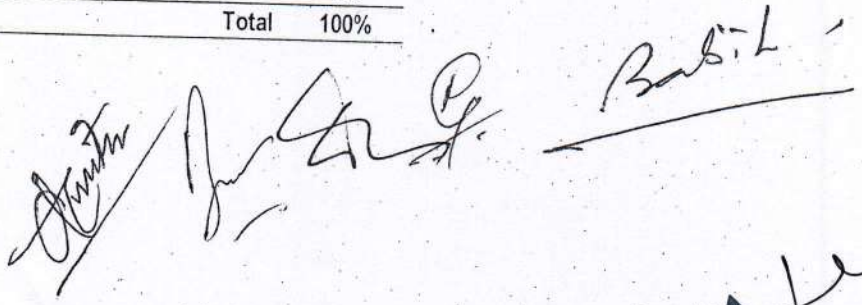

| | | |
|---|---|---|
| Course: Fundamentals of Electrical Engineering<br>Semester: II<br>Nature of Course: Practical + Tutorial | Course Code: BFT 156 (B)<br>Teaching hours: 64<br>(Tutorial: 1 h, Lab: 3 h per session) | Credit Hour: 1<br>Full Marks: 25 |

List of practical for laboratory session

1. Verification of Ohm's Law.
2. Series and parallel circuit analysis.
3. Verification of Kirchhoff's Law.
4. Verification of superposition theorem.
5. Verification of maximum power transfer theorem.
6. Verification of reciprocity theorem.
7. Analysis of RL, RC series circuit.
8. Analysis of RL, RC parallel circuit.
9. Measurement of power in single-phase circuit.
10. Measurement of line and phase voltage in Star and Delta connection.
11. Transformation ratio test of single-phase transformer.
12. Measurement of speed (rpm) of DC Motor.
13. Measurement of rotor's EMF, frequency of rotor's EMF, and slip of three phase induction motor.

**Unit wise marks distribution for the final exam**

| Unit | Title | Total (%) |
|---|---|---|
| 1 | DC fundamentals | 20 |
| 2 | DC network analysis | 25 |
| 3 | AC fundamentals | 35 |
| 4 | Electrical machines | 20 |
| | Total | 100% |




(2)

| | | |
|---|---|---|
| Course: Computer Application in Food Technology<br>Semester: III<br>Nature of Course: Theory | Course Code: BFT 201 (A)<br>Teaching hours: 32 h<br>(2 lecture hours per week) | Credit Hour: 2<br>Full Marks: 50 |

Course description and objectives

This course provides an essential introduction to computer applications in food technology, emphasizing efficient use of office productivity tools (i.e., Office Suites), analytical software and data analysis techniques, basic Python programming, and industry-relevant computational methods. This will enable the students to apply computational approaches in food quality control, process optimization, and research.

Course detail

| Unit | Content | Details of content | Teaching hours |
|---|---|---|---|
| 1 | Introduction to Office Productivity Tools (Word, Excel, PowerPoint, Publisher) | • **Overview of Office Suites:**<br>- Components (word processor, spreadsheet, presentation), file formats, templates, version control, etc.<br>• **Document creation and formatting:**<br>- Styles, sections, headers/footers, tables, images, captions, etc.<br>• **Presentation principles:**<br>- Slide layouts, master slides, use of text vs. visuals.<br>• **Collaboration and sharing:**<br>- Track changes, comments, cloud saving. | 2 |
| 2 | Spreadsheets Basics for Data Entry and Visualization | • **Spreadsheet interface and navigation:**<br>- Worksheets, workbooks, cell referencing, etc.<br>• **Data entry and cleaning:**<br>- Data types, input validation, find and replace, etc.<br>• **Basic formulas and functions:**<br>- Arithmetic operators, SUM, AVERAGE, COUNT, etc.<br>• **Introduction to charts:**<br>- Bar, line, pie charts; Selecting the right chart type. | 2 |
| 3 | Advanced Spreadsheets for Graphical, Statistical and Process Analysis | • **Complex formulas and Lookup functions:**<br>- VLOOKUP/HLOOKUP, INDEX/MATCH<br>• **Statistical functions:**<br>- STDEV, VAR, CORREL, LINEST.<br>• **What-If analysis tools:**<br>- Data tables, Goal Seek, Solver basics.<br>• **Process modelling with spreadsheets:**<br>- Building simple process-flow calculators. | 2 |
| 4 | Python Programming Fundamentals | • **Introduction to Python:**<br>- Interpreter vs. Script, IDEs (Jupyter, VS Code).<br>• **Basic Syntax and Data types:**<br>- Variables, strings, lists, dictionaries.<br>• **Control structures:**<br>- if/else statements, for- and while-loops.<br>• **Functions and modules:**<br>- Defining functions, importing standard libraries. | 6 |

Continued ...

| | | | |
|---|---|---|---|
| 5 | Data Analysis Techniques in Python (Pandas, NumPy, Matplotlib) | • NumPy Refresher and Pandas for tabular data: [2 h]<br>- n-dimensional arrays; vectorized math operations; random sampling for simulations; reading/writing CSV and Excel; indexing, filtering, groupby aggregations.<br>• Basic statistical tests and data visualization with Matplotlib): [2 h]<br>- Line, bar, scatter, histogram, labels, legends, subplots.<br>- Using scipy.stats for t-tests, ANOVA.<br>- Interpreting p-values and confidence intervals<br>• Introduction to machine learning (ML) & Key ML libraries and workflows: [2 h]<br>- Supervised vs. unsupervised learning.<br>- Train–test splits, cross-validation fundamentals.<br>- scikit-learn: LinearRegression, KMeans, IsolationForest, etc.<br>- Workflow example: feature selection → model training → evaluation.<br>• Neural networks overview: [2 h]<br>- When to use TensorFlow / Keras vs. scikit-learn.<br>- Building a simple feed-forward network.<br>• AI in food science case studies: [2 h]<br>- Shelf-life prediction and similar.<br>- Image-based defect detection and similar. | 10 |
| 6 | Computational Methods | • Statistical process control (SPC) fundamentals and control chart types and interpretation: [2 h]<br>- Concepts of variation, in-control vs. out-of-control.<br>- Role of SPC in food manufacturing.<br>- $\bar{X}$ - and R-charts for continuous data.<br>- p- and np-charts for attribute data.<br>- Reading control limits and detecting signals.<br>• Process Capability analysis (Cp, Cpk) and Monte Carlo Simulation: [2 h]<br>- Defining specification limits (USL/LSL).<br>- Calculating and interpreting Cp and Cpk indices.<br>- Visualizing capability with histograms overlaid by normal.<br>- Random sampling from common distributions (normal, uniform).<br>- Estimating output variability and risk.<br>- Applications: shelf-life, ingredient mixing variability. | 4 |
| 7 | Project and Case Studies Integration | • Project work should have at least one activity/learning from each unit above (group work in lecture and lab class). | 6 |
| | | Total | 32 |

Reference materials


1. Campbell, A. (2021). "Python Programming for Beginners – Comprehensive Guide to the Basics of Programming, Machine Learning, Data Science and Analysis with Python". Independently Published, United States. [ISBN 979-8467134574].
2. Géron, A. (2019). "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems" (2nd ed.), O'Reilly Media, Sebastopol, CA. [ISBN 978-1492032649].
3. McKinney, W. (2017). "Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython", (2nd ed.), O'Reilly Media, Sebastopol, CA. [ISBN 978-1491957660].
4. Montgomery, D. C. (2020). "Introduction to Statistical Quality Control" (8th ed.), John Wiley and Sons, Hoboken, [ISBN 978-1119557118].
5. Singh, R. P. (1996). "Computer Applications in Food Technology: Use of Spreadsheets in Graphical, Statistical, and Process Analysis". Academic Press, Toronto. [ISBN 0-12-646382-4].

| Course: Computer Application in Food Technology | Course Code: BFT 201 (B) | Credit Hour: 1 |
|---|---|---|
| Semester: III | Teaching hours: 64 h | Full Marks: 25 |
| Nature of Course: Practical | (Lab: 4 h per session) | |

List of practical for the laboratory session

1. **Unit 1**
   - Create a formatted report with a table of contents, figures, and references and practice real-time collaboration: share, edit, use comments and track changes and review a document with peer feedback. [6 h]
   - Build a slide deck summarizing a simple food-tech concept using master slides. [2 h]
2. **Unit 2**
   - Enter and clean a small dataset of food-quality measurements. [4 h]
   - Use built-in functions to compute summary statistics, create and format three to four different chart types to visualize key trends. [4 h]
3. **Unit 3**
   - Use INDEX/MATCH to merge two food-sensor datasets. [2 h]
   - Compute and interpret standard deviation, correlation, and regression outputs. [3 h]
   - Run a one-variable Data Table to see how changing cook time affects moisture content and build a small "Process Calculator" for pasteurization time vs. lethality. [3 h]
4. **Unit 4**
   - Fundamentals in a Food Technology Context. [4 h]
     - Write Python scripts to parse and clean a CSV of food-quality measurements (unit conversions, missing-value handling, basic statistics).
     - Implement core data structures (lists, dicts, tuples) to store ingredient recipes and lookup nutrient values via functions.
   - Applied Food-Science Tasks [6 h]
     - Develop loops and comprehensions to simulate batch-wise heating profiles (e.g. compute temperature-time curves and plot with matplotlib).
     - Build and test small reusable functions for key calculations and conversion (such as pH ↔ $[H^+]$, °F ↔°C), first-order reaction kinetics) and package them into a module.
5. **Unit 5**
   - Data Loading and Cleaning and Exploratory Data Analysis: [2 h]
     - Import a CSV of food-quality metrics into pandas.
     - Handle missing values and type conversions.
     - Compute group means and standard deviations.
     - Plot time series of pH and histograms of moisture.
   - Statistical Testing and Linear Regression with scikit-learn: [8 h]
     - Perform a two-sample t-test on two process batches, and perform ANOVA.
     - Report the test statistic, p-value, and practical interpretation.
     - Predict moisture content from temperature and time.
     - Evaluate with $R^2$ and mean squared error metrics.
   - Clustering with K-Means: [2 h]
     - Apply k-means to multivariate sensor data.
     - Visualize clusters and interpret centroids.
   - Anomaly Detection: [2 h]
     - Use IsolationForest to flag outliers in process data.
     - Overlay anomalies on control-chart-style plots.
   - Neural-Net Mini-Project: [2 h]
     - Build a small Keras model to classify samples (e.g., spoiled vs. fresh).
     - Train/test split, then plot loss and accuracy curves.

6. **Unit 6**
   - Control Charts and Process Capability exercises in Python: [6 h]
     - Load batch data into Pandas and compute subgroup means/ranges.
     - Use Matplotlib (or the spc library) to plot X- and R-charts.
     - Identify any out-of-control points
     - Calculate Cp and Cpk from a sample dataset.
     - Plot a histogram with normal curve and spec-limit lines.
     - Interpret whether the process meets specifications.
7. **Unit 7**
   - Project work: [8 h]

**Unit wise marks distribution for the final exam**

| Unit | Title | Total (%) |
|---|---|---|
| 1 | Introduction to Office productivity tools (Word, Excel, PowerPoint, Publisher) | 10 |
| 2 | Spreadsheets basics for data entry and visualization | 10 |
| 3 | Advanced spreadsheets for graphical, statistical and process analysis | 10 |
| 4 | Python programming fundamentals | 20 |
| 5 | Data analysis techniques in Python (Pandas, Numpy, Matplotlib) | 35 |
| 6 | Computational methods | 15 |
| | **Total** | **100%** |

---


| | | |
|---|---|---|
| Course: Food Chemistry - II | Course Code: BFT 202A | Credit Hour: 2 |
| Semester: III | Teaching hours: 32 h | Full Marks: 50 |
| Nature of Course: Theory | (2 lecture hours per week) | |

Course description and objectives

Food Chemistry-II is an advanced course that builds upon the concepts learned in Food Chemistry-I. This course focuses on exploring the chemistry behind food quality, flavor, sensory analysis, and food stability.

Course detail

| Unit | Content | Details of content | Teaching hours |
|---|---|---|---|
| 1 | Food Additives | • Definition and classification (direct/indirect, natural/synthetic, GRAS).<br>• Antioxidants, emulsifiers, stabilizers, flavor enhancer, sweeteners and their synergistic effects, and humectant.<br>• Synthetic *vs.* natural *vs.* nature-identical flavor compounds (volatile organic compounds).<br>• Certification, labeling and regulatory aspects (FDA, Codex Alimentarius). | 5 |
| 2 | Browning in Foods | • Definition, classification, advantages and disadvantages.<br>• Chemistry, toxicant formation and flavor development of Maillard reaction, caramelization, ascorbic acid browning, lipid peroxidation and enzymatic browning in foods.<br>• Prevention of browning in foods. | 5 |
| 3 | Food Components and their Interactions | • Protein-polyphenol interactions.<br>• Protein-carbohydrate Interactions: stabilization of emulsions and foams, thickening and gelling effect.<br>• Protein-lipid interactions: effect on texture, flavor release and emulsion stability.<br>• Minerals interactions with food components: examples. | 4 |
| 4 | Natural Pigment Chemistry | • Source, chemistry and stability of natural pigments: chlorophyll, anthocyanins, carotenoids, betalains, etc.<br>• Natural food colorant: annatto, turmeric, saffron. | 3 |
| 5 | Nutraceutical and Bioactive Compounds | • Definition, classifications and examples.<br>• Extraction and characterization of polyphenols (e.g., curcumin), phytosterols, peptides.<br>• Stability, bioavailability and metabolism of nutraceuticals. | 3 |
| 6 | Toxins, toxicants and Contaminants in Food | • Naturally occurring toxins (lectins, solanine, cyanogenic glycosides).<br>• Process-induced toxins (acrylamide, PAHs, heterocyclic amines).<br>• Heavy metals contamination in foods.<br>• Sources, health impacts, detection and mitigation strategies.<br>• Non-food dyes and toxicants detection (rhodamine B, malachite green, metanil yellow, formalin in fish, calcium carbide residue). | 5 |
| 7 | Surface Chemistry in Food | • Interfacial phenomena, colloidal systems.<br>• Surface active agents: chemistry and working mechanism.<br>• Food applications. | 3 |
| 8 | Effect of Processing on Food Components | • Effect of frying on fat/oil quality.<br>• Trans fat, its formation, and health implications.<br>• Effect of heating on carbohydrate and protein quality. | |

| | | | |
|---|---|---|---|
| 9 | Emerging Trends and Research | • 3D-printed foods (chemical binding mechanisms).<br>• AI/ML applications in food chemistry research.<br>• Integration of IOT. | 2 |
| | | Total | 32 |

Reference materials


1. Bagchi, D. (2018). "Food Toxicology". CRC Press, USA. [ISBN 978-1-4987-6273-2].
2. Belitz, H.-D., Grosch, W. and Schieberle, P. (2009). "Food Chemistry" (4th ed.). Springer, Germany. [ISBN 978-3-540-69934-7].
3. Bot, A., Flöter, E. and van Duynhoven, J. P. M. (Eds.). (2021). "Lipids in Food Structure and Functionality". Royal Society of Chemistry, UK. [ISBN 978-1-78801-752-5].
4. Coultate, T. P. (2020). "Food: The Chemistry of Its Components" (7th ed.). Royal Society of Chemistry, UK. [ISBN 978-1-78801-636-8].
5. Damodaran, S. and Parkin, K. L. (2017). "Fennema's Food Chemistry" (5th ed.). CRC Press, USA. [ISBN 978-1-4398-0453-5].
6. deMan, J. M. (2018). "Advanced Food Chemistry". Springer, USA. [ISBN 978-1-4939-7778-6].
7. deMan, J. M., Finley, J. W., Hurst, W. J. and Lee, C. Y. (2018). "Principles of Food Chemistry" (4th ed.). Springer, USA. [ISBN 978-3-319-89677-0].
8. Galanakis, C. M. (2022). "Nutraceutical and Functional Food Components" (2nd ed.). Academic Press, USA. [ISBN 978-0-12-823630-8].
9. Hettiarachchy, N. S., Sato, K., Marshall, M. R. and Kannan, A. (Eds.). (2012). "Food Proteins and Peptides: Chemistry, Functionality, Interactions and Commercialization". CRC Press, USA. [ISBN 978-1-4398-2213-3].
10. Sikorski, Z. E. (Ed.). (2017). "Chemical and Functional Properties of Food Components" (4th ed.). CRC Press, USA. [ISBN 978-1-4987-2643-7].

| | | |
|---|---|---|
| Course: Food Chemistry - II | Course Code: BFT 202 (B) | Credit Hour: 1 |
| Semester: III | Teaching hours: 64 h | Full Marks: 25 |
| Nature of Course: Practical | (Lab: 4 h per session) | |

List of practical for the laboratory session

1. Rheological analysis of hydrocolloids (rheometer).
2. Protein solubility and emulsification studies.
3. Oxidative stability of oils (Rancimat / Tbars assay).
4. In-vitro bioavailability assays of nutrients (simulated digestion models).
5. Vitamin C estimation (titrimetric/spectrophotometric).
6. Extraction and estimation of polyphenols and antioxidant activity.
7. Determination of food crude fiber and dietary fiber.
8. Enzymatic browning inhibition experiments.
9. Study of Maillard reaction under different conditions.
10. Analysis of food additives (e.g., benzoates, sulfites).
11. Colorant identification (paper chromatography).
12. Determination of natural toxicants in food.
13. Determination of trans fat and total polar compounds of processed fat/oil.
14. Measurement of surface tension (drop count method) of food emulsions.
15. Study the effect of pH, light, and temperature on pigments (e.g. anthocyanins, chlorophyll, carotenoids etc.).
16. Quantitative determination of chlorophyll.

**Unit wise marks distribution for the final exam**

| Unit | Title | Total (%) |
|---|---|---|
| 1 | Food additives | 15 |
| 2 | Browning in foods | 10 |
| 3 | Food components and their interactions | 20 |
| 4 | Pigment and flavor chemistry | 15 |
| 5 | Nutraceuticals and bioactive compounds | 10 |
| 6 | Toxicants and contaminants in food | 15 |
| 7 | Surface chemistry in food | 5 |
| 8 | Effect of processing on food components | 5 |
| 9 | Emerging trends and research | 5 |
| | Total | 100% |

Institute of Science & Technology
Dean's Office
Kirtipur 2045

| | | |
|---|---|---|
| Course: Sugar Technology<br>Semester: III<br>Nature of Course: Theory | Course Code: BFT 203 (A)<br>Teaching hours: 32 h<br>(2 lecture hours per week) | Credit Hour: 2<br>Full Marks: 50 |

Course description and objectives

Sugar technology is a specialized field that focuses on the production of sugar from sugar cane. Through this course, students will learn about the various methods employed for the extraction and refining of sugar from different sources (with emphasis on sugar cane), as well as the technology and equipment used in the sugar industry. The course will also cover the byproduct and co-product processing associated with sugar cane production, further enhancing students' understanding of the industry.

Course detail

| Unit | Content | Details of content | Teaching hours |
|---|---|---|---|
| 1 | Introduction to Sugar Industry | • History and global significance of sugar production.<br>• Sources of sugar (sugarcane, sugar beet, etc.).<br>• Industrial applications of sugars and their standards.<br>• Overview of the sugar industry and its economic impact. | 2 |
| 2 | Chemistry of Sugars | • Review of structures and properties of sucrose, glucose, and fructose.<br>• Chemical reactions of sucrose (hydrolysis, inversion, caramelization).<br>• Enzymes involved in sugar processing (invertase, amylase, dextranase, etc.) | 3 |
| 3 | Cultivation and Harvesting of Sugarcane/Sugar Beet | • Agricultural practices for sugarcane and sugar beet.<br>• Factors affecting yield and sugar content.<br>• Harvesting techniques and post-harvest handling. | 3 |
| 4 | Sugar Production Process | • Raw sugar production: [8.5 h]<br>- Extraction: milling, diffusion, and juice extraction.<br>- Purification: clarification, liming, carbonation, sulfitation, and filtration.<br>- Specifications of chemicals and equipment detail.<br>- Evaporation and crystallization: multiple-effect evaporators, vacuum pans, seeding.<br>- Centrifugation and drying: separation of molasses, sugar drying, and conditioning, types of centrifuge and dryers.<br>• Refining of raw sugar: [3 h]<br>- Affination process.<br>- Carbonation and phosphotation.<br>- Decolorization (bone char, activated carbon, ion exchange).<br>- Crystallization and final refining.<br>• Manufacture of brown sugar and sulfurless sugar. [0.5 h] | 12 |
| 5 | Steam and Energy Audit in Sugar Refineries | • Energy performance index (EPI).<br>• Boiler efficiency assessment.<br>• Steam distribution system audit.<br>• Steam utilization in process equipment.<br>• Condensate and waste heat recovery.<br>• Electrical energy audit. | 2 |
| 6 | Co-products and By-products of Sugar Industry | • Composition and utilization of molasses, bagasse and press mud, beet pulp and molasses. | 3 |
| 7 | Quality Control and Analysis in Sugar Industry | • Pol, brix, and purity measurements.<br>• Reducing sugars and color analysis.<br>• Laboratory techniques for sugar testing. | 1 |

| | | | |
|---|---|---|---|
| 8 | Automation and Modern Technologies in Sugar Industry | • Role of automation in sugar mills.<br>• Advances in sugar processing (membrane filtration, enzymatic processes).<br>• Energy efficiency and waste reduction techniques. | 2 |
| 9 | Glucose Syrup and Glucose Powder | • Glucose syrup and applications.<br>• Production of glucose syrup from starch by enzymatic and chemical hydrolysis process.<br>• Production of glucose powder, high-fructose corn syrup (HFCS). | 2 |
| 10 | Post Production Operations | • Grading of sugar, packing of sugar.<br>• Keeping quality of sugar in storage and storage requirements<br>• Storage of molasses. | 2 |
| | | Total | 32 |

**Reference materials**


1. Asadi, M. (2006). "Beet-Sugar Handbook". John Wiley and Sons, USA. [ISBN 978-0-471-76327-4].
2. Baikow, V. E. (1982). "Manufacturing and Refining of Raw Sugar" (2nd ed.). Krieger Publishing Company, USA. [ISBN 978-0-88275-885-2].
3. Chen, J. C. P. and Chou, C. C. (1993). "Cane Sugar Handbook: A Manual for Cane Sugar Manufacturers and Chemists" (12th ed.). John Wiley and Sons, USA. [ISBN 978-0-471-93070-7].
4. Chou, Chung Chi (2000). "Handbook of Sugar Refining: A Manual for the Design and Operation of Sugar Refining Facilities." John Wiley and Sons, New York. [ISBN 9780471183570].
5. Honig, P. (Ed.). (1953–1963). "Principles of Sugar Technology" (Vols. I–V). Elsevier, Netherlands. [ISBN varies by volume; reprints available].
6. Hugot, E. (1986). "Handbook of Cane Sugar Engineering" (3rd ed.). Elsevier, Netherlands. [ISBN 978-0-444-42748-1].
7. Jenkins, G. H. (2013). "Introduction to Cane Sugar Technology." Elsevier, Amsterdam. [ISBN 9781483255200].
8. Mathur, R. B. L. (1975). "Handbook of Cane Sugar Technology: Together with Description of the Machinery." Oxford and IBH Publishing Company, New Delhi. [ISBN 9780862494971].
9. Park, G. M. (1975). "Manufacture of Sugar from Sugar Cane". Park Publishing, UK.
10. van der Poel, P. W. (1998). "Sugar Technology: Beet and Cane Sugar Manufacture". Bartens, Germany. [ISBN 978-3-87040-067-2].
11. Zerban, F. W. (1948). By-Products of the Cane Sugar Industry. Elsevier, Netherlands. [ISBN unavailable; reprints available].

| | | |
|---|---|---|
| Course: Sugar Technology | Course Code: BFT 203 (B) | Credit Hour: 1 |
| Semester: III | Teaching hours: 64 h | Full Marks: 25 |
| Nature of Course: Practical | (Lab: 4 h per session) | |

List of practical for the laboratory session

1. Determine the pH and titratable acidity of sugarcane juice and molasses.
2. Determine the brix of the given sample by brix hydrometer and hand refractometer
3. Determine sucrose content of given sample of juice.
4. Determine the purity of syrup and molasses.
5. Determine the Pol % and moisture of the bagasse.
6. Determine the phosphate contents in the given sample by spectrophotometer.
7. Determine the reducing sugar content.
8. Determine residual $SO_2$ in white sugar.
9. Sugar analysis of juice (polarimetry).
10. Estimate total ash and sulphated ash in sugar samples.
11. Evaluate the separation of molasses from sugar crystals (centrifugation efficiency).
12. Observe and monitor the crystallization process in lab-scale pans.
13. Study the effect of lime and heat on juice clarification.
14. Steam economy calculations.
15. Visits to sugar mills/refineries.

**Unit wise marks distribution for the final exam**

| Unit | Title | Total (%) |
|---|---|---|
| 1 | Introduction to sugar industry | 5 |
| 2 | Chemistry of sugars | 10 |
| 3 | Cultivation and harvesting of sugarcane/sugar beet | 10 |
| 4 | Sugar production process | 35 |
| 5 | Steam and energy audit in sugar refineries | 10 |
| 6 | By-products of sugar industry | 5 |
| 7 | Quality control and analysis in sugar industry | 10 |
| 8 | Automation and modern technologies in sugar industry | 5 |
| 9 | Glucose syrup and glucose powder production | 5 |
| 10 | Post production operations | 5 |
| | **Total** | **100%** |

चीनी के परिषदको कार्यालय
कीर्तिपुर

Institute of Science & Technology

| | | |
|---|---|---|
| Course: Food Engineering-I | Course Code: BFT 204 (A) | Credit Hour: 2 |
| Semester: III | Teaching hours: 32 h | Full Marks: 50 |
| Nature of Course: Theory | (2 lecture hours per week) | |

Course description and objectives

Food Engineering-I is a foundational course that focuses on the fundamental principles of food engineering, providing students with a strong foundation in the core concepts and techniques essential for understanding the physical, chemical, and biological processes in food production. Topics include mass and energy balances, thermodynamics, fluid mechanics, heat transfer, and the application of engineering principles to food preservation and processing methods. This course serves as a precursor to Food Engineering-II and lays the groundwork for advanced topics.

Course detail

| Unit | Content | Details of content | Teaching hours |
|---|---|---|---|
| 1 | Basic Concepts and Material Properties | • Dimensions and units: base, derived, supplementary.<br>• Quantity of materials.<br>• Classification of matter.<br>• Properties of solid, liquid, and gas. | 1 |
| 2 | Unit Operation | • System:<br>- Introduction, system properties, system process, equilibrium state.<br>• Material balances:<br>- Definition, overall balance, component balance.<br>• Energy balances:<br>- Definition, overall balance, component balance.<br>• Solving mass and energy balance problems. | 4 |
| 3 | Fluid Flow in Food Processing | • Basic concepts of fluid pressure: [1 h]<br>- Introduction on absolute pressure, gauge pressure, vacuum pressure.<br>• Steady flow of fluids: [2 h]<br>- Energy equation (pressure energy, kinetic energy, potential energy, frictional energy loss).<br>- Continuity equation and Bernoulli's theorem (derivation, application).<br>• Fluid dynamics: [6 h]<br>- Fluid flow patterns.<br>- Flow measurement (pitot tube, orifice meter, venturimeter, rotameter).<br>- Viscosity (introduction, viscosity measuring equipment - capillary viscometer, falling ball viscometer, rotational viscometer).<br>- Reynold's number.<br>- Newtonian fluids, non-Newtonian fluids.<br>- Flow of air and industrial gases.<br>• Pump selection (Ref. BFT 152, unit 6): [1 h]<br>- Centrifugal pumps, gear pumps, peristaltic pumps.<br>- Net positive suction head.<br>- Pump performance characteristics. | 11 |

Continued ....

| | | | |
|---|---|---|---|
| 4 | Heat Transfer in Food Processing | • **Thermal properties of food:** [1 h]<br>- Specific heat, thermal conductivity, and thermal diffusivity (introduction).<br>• **Introduction to heat transfer: Steady and unsteady heat transfer.**<br>• **Conduction:** [5 h]<br>- Fourier's law.<br>- Conduction through a slab and a cylinder.<br>- Heat conduction in multilayered systems.<br>- Resistance in series.<br>• **Convection:** [3 h]<br>- Natural and forced convection.<br>- Surface coefficient and overall heat transfer coefficient.<br>- Dimensionless numbers and their application.<br>• **Heat exchangers:** [3 h]<br>- Batch and continuous heat exchangers.<br>- Parallel flow and countercurrent flow heat exchangers.<br>- LMTD, NTU and NTU analysis.<br>- Shell and tube heat exchangers (single shell pass and multi tube pass).<br>- Plate heat exchanger.<br>- Steam infusion heat exchanger.<br>- Fouling factors.<br>- Insulation materials. | 12 |
| 5 | Extrusion | • **Introduction to extruders:** [2 h]<br>- Definition and terminology<br>- Mechanism of extrusion cooking.<br>- Functions and application of extruders.<br>- Advantages of extrusion over conventional cooking.<br>• **Types of extruders:** [2 h]<br>- Single screw extruder (classification based on extent of shear, heat generation, design).<br>- Twin screw extruder (classification based on the basis of screw position).<br>- Components of extruders.<br>• **Extrusion processing variables:** [1 h]<br>- Dependent variables.<br>- Independent variables.<br>- Final product characteristics. | 4 |
| | | **Total** | 32 |

**Reference materials**


1. Berk, Z (2018) "Food Process Engineering and Technology" Academic Press, Cambridge. [ISBN 979-0-12-812018-7]
2. Raiz, M. N. (2000). "Extruders in Food Applications". CRC Press, Boca Raton. [ISBN 978-1-56676-779-8].
3. Rizvi, S. S. H. (2024). "Food Engineering Principles and Practices: A One-Semester Course". Springer Nature, Switzerland. [ISBN 978-3-031-34123-6].
4. Singh, P. R., and Heldman. D.R., Erdogdu, F (2023). "Introduction to Food Engineering". California: Academic Press. [ISBN 978-0-12-823129-6].
5. Toledo, R. T (2007). "Fundamentals of Food Process Engineering". Springer Science + Business Media, Germany. [ISBN 978-0-387-29019-5].

| | | |
|---|---|---|
| Course: Food Engineering-I<br>Semester: III<br>Nature of Course: Practical | Course Code: BFT 204 (B)<br>Teaching hours: 64 h<br>(Lab: 4 h per session) | Credit Hour: 1<br>Full Marks: 25 |

List of practical for the laboratory session

1. Measurement of basic and derived units using laboratory instruments (length, mass, time, temperature, pressure, volume).
2. Determination of physical properties of solids, liquids, and gases (density, specific gravity, phase transitions).
3. To compute mass and energy balance.
4. Determination of viscosity using capillary viscometer, falling ball viscometer and Brookfield viscometer.
5. Determination of flow rate using flow meters: pitot tube, orifice meter, venturimeter, rotameter.
6. Calculation of Reynolds number for flow characterization.
7. Comparison of Newtonian vs non-Newtonian fluids using various food liquids.
8. Determination of type of fluid flow and calculation of critical velocity.
9. Demonstration of centrifugal pump and gear pump operation and performance.
10. Determination of thermal conductivity, thermal diffusivity, and specific heat capacity of the food materials.
11. Determination of conductive heat transfer coefficient using LMTD.
12. Study of plate heat exchanger.
13. To study the heat transfer phenomena in parallel and counter current flow arrangements.
14. Demonstration of lab-scale single or twin-screw extruder.

**Unit wise marks distribution for the final exam**

| Unit | Title | Total (%) |
|---|---|---|
| 1 | Basic concepts and material properties | 5 |
| 2 | Unit operation | 15 |
| 3 | Fluid flow in food processing | 30 |
| 4 | Heat transfer in food processing | 35 |
| 5 | Extrusion | 15 |
| | Total | 100% |


| | | |
|---|---|---|
| Course: Principles of Food Processing | Course Code: BFT 205 (A) | Credit Hour: 3 |
| Semester: III | Lecture hour: 48 h | Full Marks: 75 |
| Nature of Course: Theory | (3 lecture hours per week) | |

Course description and objectives

This course introduces the fundamental concepts and techniques involved in transforming raw agricultural products into consumable food items that are more stable, convenient, and appealing. Topics include thermal processing, drying, milling, fermentation, canning (transformative steps, equipment and parameters, industrial practices, etc.) and packaging methods. Emphasis is placed on understanding the science behind food quality, safety, and shelf-life enhancement during processing.

Course detail

| Unit | Content | Details of content | Teaching hours |
|---|---|---|---|
| 1 | Size Reduction | • Introduction; size reduction of solid and liquid foods; equipment; effect on foods. | 4 |
| 2 | Screening and Mixing | • Introduction; types of screens: revolving screens, shaking screen, rotating screens, vibratory screen, horizontal screens, perforated screen, wire mesh screen; mixing of solid and fluid; equipment. | 6 |
| 3 | Separation and Extraction | • Introduction, separation techniques and equipment: [2 h]<br>• Leaching, supercritical fluid extraction, sub-critical water extraction, distillation, essence recovery. [4 h] | 6 |
| 4 | Drying | • Drying process, equipment, and applications; osmotic, IR, micro wave, radio frequency, and superheated steam drying.<br>• Changes in foods during drying. | 4 |
| 5 | Heat Processing | • Pasteurization and sterilization:<br>- Definition, time-temp combination, and equipment.<br>- Blanching and evaporation.<br>- Microwave cooking.<br>- IR, ohmic, and dielectric heating.<br>- Aseptic food processing. | 6 |
| 6 | Freezing and Crystallization | • Freezing point of food, rate of freezing, freezing curve, crystallization equilibrium, crystal growth, and nucleation.<br>• Freezing methods: air freezing, plate freezing, liquid immersion freezing, and cryogenic freezing.<br>• Thawing: principle and application<br>• Changes in food during freezing and thawing | 8 |
| 7 | Food Concentration | • General principle and applications of single- and multiple effects evaporators; freeze concentration; equipment. | 4 |
| 8 | Membrane Processing | • General principle and advantages; membrane process classification and application in food industries. | 4 |
| 9 | Extrusion Processing | • Definition and terminologies; principle; cold extrusion, extrusion cooking (single and twin); effect of extrusion on properties of foods. | 3 |
| 10 | Miscellaneous Processing | • High pressure processing; processing using light and sound; pulsed electric fields (PEFs); hurdle technology. | 3 |
| | | Total | 48 |

Reference materials


1. Fellows, P. J. (Ed.) (2000). "Food Processing Technology: Principles and Practice" (2nd ed.). England: CRC Press, Woodhead Publishing Ltd. [ISBN 978-0849308871]
2. Rahman, M. S. (Ed.) (1999). "Handbook of Food Preservation". New York: Marcel Dekker Inc. [ISBN 978-0824703317]
3. Zeuthen, P. and Bogh-Sorensen, L. (Eds.) (2003). "Food Preservation Techniques". England: CRC Press, Woodhead Publishing Ltd. [ISBN 978-1855735309]

| | | |
|---|---|---|
| Course: Principles of Food Processing | Course Code: BFT 205 (B) | Credit Hour: 1 |
| Semester: III | Teaching hours: 64 h | Full Marks: 25 |
| Nature of Course: Practical | (Lab: 4 h per session) | |

**List of practical for the laboratory session**

1. Testing for adequacy of blanching.
2. Test of adequacy of pasteurization based on microorganism or enzyme.
3. Process time calculation (from data or real time-temp. studies).
4. Test of water activity of different foods.
5. Plotting of water sorption isotherm.
6. Extraction and separation of components by distillation.
7. Pearson's square rule and its application in fluid mixing.
8. Extraction of active components from herbs and spices.
9. TDT curve.
10. One-day visit to nearby food processing industries (can be merged with one-day industrial visit for other courses of the same semester).

**Unit wise marks distribution for the final exam**

| Unit | Title | Total (%) |
|---|---|---|
| 1 | Size reduction | 10 |
| 2 | Screening and mixing | 10 |
| 3 | Separation and extraction | 10 |
| 4 | Drying | 10 |
| 5 | Heat processing | 15 |
| 6 | Freezing and crystallization | 15 |
| 7 | Food concentration | 10 |
| 8 | Membrane processing | 10 |
| 9 | Extrusion processing | 5 |
| 10 | Miscellaneous processing | 5 |
| | **Total** | **100%** |


| | | |
|---|---|---|
| Course: Principles of Food Preservation | Course Code: BFT 206 (A) | Credit Hour: 3 |
| Semester: III | Teaching hours: 48 | Full Marks: 75 |
| Nature of Course: Theory | (3 lecture hours per week) | |

Course description and objectives

This course explores the methods and principles used to prevent food spoilage and extend shelf life. Topics include refrigeration, freezing, canning (to extend shelf-life and ensure microbial safety, contamination, etc:), chemical preservation, and emerging technologies like irradiation. The focus is on maintaining nutritional value, sensory attributes, and microbial safety of food products.

Course detail

| Unit | Content | Details of content | Teaching hours |
|---|---|---|---|
| 1 | Introduction to Food Preservation | • Principles and objectives of food preservation.<br>• Factors affecting shelf life of foods. | 2 |
| 2 | Preservation by drying/ dehydration | • Definition and differences between drying and dehydration.<br>• Importance of drying/dehydration.<br>• Concept of moisture content, water activity and intermediate moisture foods<br>• Pretreatment in drying/dehydration (blanching, sulfiting, different dipping treatments).<br>• General concept of drying mechanism, drying curve, and sorption isotherm.<br>• Concept of case hardening, browning, shrinkage, rehydration properties.<br>• Principles of drying equipment's (spray drier, freeze drier, tunnel drier, drum drier, osmotic dehydration, vacuum drier, fluidized bed drier, microwave drying, infrared drying, hybrid drying).<br>• Quality evaluation of dehydrated products.<br>• Concept of rehydration and methods of improving rehydration properties of dried products. | 8 |
| 3 | Preservation by High Temperature | • Introduction and principle of food pasteurization, sterilization, conventional and modern aseptic canning process (Dole process), cold point of can, fillers used in canning.<br>• Thermo-bacteriology, 12D concept, hot pack methods, flash-18 process.<br>• Spoilage and discoloration of canned foods.<br>• Effect of heat treatments on foods. | 8 |
| 4 | Preservation by Low Temperature | • Principle and theory of food freezing (freezing curve).<br>• Pretreatments in freezing: blanching, sulfiting, different dipping treatments.<br>• Concentration effect of food freezing.<br>• Theory, methods and effect of slow freezing and quick freezing (air blast freezer, still air freezer, fluidized bed freezer, plate freezer, liquid immersion freezer, cryogenic freezer) and cryoprotectant, cold storage, chilling storage, hypobaric storage.<br>• Thawing principle, methods, effect of thawing on foods (drip, leakage, freeze burn). | 7 |
| 5 | Novel Methods of Food Preservation | • Introduction, principles, mechanisms of action, and safety considerations for food preservation technologies – including irradiation (with dose and dosimetry), high-pressure processing, ohmic heating, pulsed electric fields, magnetic fields, ultrasound, cold plasma, nanotechnology, and the hurdle concept – with emphasis on their applications.<br>• Preservation effect of genetically modified foods. | 7 |
| 6 | Traditional/ Indigenous Methods of Food Preservation | • Introduction to traditional food and indigenous foods.<br>• Classification of traditional/ indigenous foods based on raw materials used.<br>• Principle of food preservation by traditional and indigenous methods.<br>• Methods of preparing *gundruk*, *sinki*, *kinema*, *dahi*, dried fish (*sidra*), dried meat (*sukuti*), pickle (*khalpi*); associated challenges and opportunities; issues and potential improvements in traditional methods of preserving food. | 3 |

Institute of Science & Technology
Dean's Office
Kirtipur 2045

| | | | |
|---|---|---|---|
| 7 | Preservation by Fermentation | • Principles, definition and types of food fermentation; order of food fermentation, additional benefits from food fermentation.<br>• Definition, types, and process of, fruits fermentation (wine making), vegetables fermentation, grain fermentation (beer), milk fermentation (yoghurt).<br>• Vinegar: definition and types of vinegar; Mechanism of acetic acid fermentation, methods of vinegar production, post-production operations.<br>• Pickling of fruits and vegetables: introduction, process and uses of salt stock. | 3 |
| 8 | Preservation by Concentration | • Principles behind food preservation by high TSS and acidity; definition and characteristics of fruit jellies, jam, marmalade, RTS, nectar, cordials; commercial methods of jam, jelly and marmalade making; jelly strength, pectin grade, gel formations by LMPs and HMPs; problems in jelly making.<br>• Definition and methods of jam, marmalades and preserves making.<br>• Differences among jam, jelly and marmalades, jam and jelly calculation.<br>• Methods of determining end point of concentrate products.<br>• Industrial methods of making fruit concentrates. | 5 |
| 9 | Preservation by Preservatives | • Definition, classification, legislation (national and international), mode of action of food preservatives.<br>• Theory of natural preservatives (salt, sugar, alcohol, spices, herbs), chemical preservatives (sulfur di-oxide, nitrate and nitrite, sorbic acid, benzoic acid, propionic acid), and bio-preservatives (nisin, pediocin, natamycin, tetracyclines, streptomycin, competitive microflora). | 3 |
| 10 | Specific Food Preservation | • Preservation of dairy products, bakery products, confectionary products, meat and meat products, grains, and legumes. | 2 |
| | | Total | 48 |

**Reference materials**


1. Desrosier, N. W. and Desrosier, J. N. (1987). "The Technology of Food Preservation" (4th ed.). Delhi: CBS Publishers and Distributors. [ISBN 9788123911281].
2. Fellows, P. (2000). "Principles of Food Processing Technology: Principles and Practices" (2nd ed.). Woodhead Publishing Limited, Cambridge, England. [ISBN 9781855735330].
3. Insel, P., Turner, R. E. and Ross, D. (2003). "Discovering Nutrition". Massachusetts: Jones and Bartlett Publishers. [ISBN 9781284139464].
4. Meyer, L. H. (1987). "Food Chemistry". Delhi: CBS Publishers and Distributors. [ISBN 9788123909158].
5. Norman, N. P. (1978). "Food Science" (3rd ed.). USA: AVI Publishing Company. [ISBN 9780870552931].
6. Potter, N. N. and Hotchkiss, J. H. (1995). "Food Science" (5th ed.). New Delhi: CBS Publishers & Distributors Pvt. Ltd. [ISBN 9780834212657].
7. Rahman, M. S. (2007). "Handbook of Food Preservation" (2nd ed.). USA: Taylor & Francis Group. [ISBN 9781574446067].
8. Rahman, M. S. (2020). "Handbook of Food Preservation" (3rd ed.). CRC Press, Boca Raton. [ISBN 9781498740487]
9. Singh, R. P. and Heldman, D. R. "Introduction to Food Engineering". [ISBN 9780128231296].
10. Swaminathan, M. (2008). "Essentials of Food and Nutrition" (2nd ed., Vol. I and II). Bangalore: The Bangalore Printing and Publishing Co., Ltd.

| | | |
|---|---|---|
| Course: Principles of Food Preservation | Course Code: BFT 206 (B) | Credit Hour: 1 |
| Semester: III | Teaching hours: 64 h | Full Marks: 25 |
| Nature of Course: Practical | (Lab session of 4 h) | |

**List of practical for the laboratory session**

1. Study of different food processing and preservation equipment.
2. Preparation, calculations and testing of strength of fruit juices, brines and syrups
3. Construction of drying curve and sorption isotherm.
4. Tests for the pectin contents in fruit extract.
5. Drying/Dehydration of fruits and vegetables and their quality evaluation.
6. Canning of fruits and vegetables.
7. To study about canned and canned products.
8. Preparation of fruit beverage.
9. Preparation of jam, jelly and preserves.
10. Preparation of salt stock.
11. Preparation of wine.
12. Study of industrial preservation methods (visit to nearby food processing industries.)
13. A survey of traditional foods and methods of food preservation.

**Unit wise marks distribution for the final exam**

| Unit | Title | Total (%) |
|---|---|---|
| 1 | Introduction to food preservation | 5 |
| 2 | Food preservation by drying/dehydration | 20 |
| 3 | Food preservation by high temperature | 15 |
| 4 | Food preservation by low temperature | 15 |
| 5 | Novel methods of food preservation | 10 |
| 6 | Traditional/ indigenous method of food preservation | 8 |
| 7 | Principles of food preservation by fermentation. | 7 |
| 8 | Principles of food concentrate | 10 |
| 9 | Food preservation by preservatives | 5 |
| 10 | Specific food preservation | 5 |
| | Total | 100% |

Institute of Science & Technology
Dean's Office
Kirtipur 2045

| | | |
|---|---|---|
| Course: Workshop Technology | Course Code: BFT 251 (A) | Credit Hour: 2 |
| Semester: IV | Teaching hours: 32 h | Full Marks: 50 |
| Nature of Course: Theory | (2 lecture hours per week) | |

Course description and objectives

The course **Workshop Technology** is designed to equip food technology students with essential engineering workshop skills. It focuses on practical applications of mechanical operations that are integral to the food industry, such as welding, drilling, cutting, woodworking, and fabrication. A 2-credit workshop practical session is allocated in the course to provide hands-on experience with basic workshop operations relevant to food processing equipment and their maintenance.

Course detail

| Unit | Content | Details of content | Teaching hours |
|---|---|---|---|
| 1 | Introduction | • Introduction to workshop technology and its importance in food technology.<br>• Safety rules, Personal Protective Equipment (PPE) and safe chemical handling, material safety data sheet (MSDS). | 1 |
| 2 | Engineering Materials | • **Ferrous metal:** introduction, classification and properties of steel and alloy steel.<br>• **Non-ferrous metal:** introduction, aluminum and its alloy, copper and its alloy.<br>• **Non-metal:** introduction, classification, structure and properties of wood, plastics, glass, and composites. | 2 |
| 3 | Measuring Instruments | • Introduction, classifications<br>• Steel rule, try square, Vernier caliper, micrometer, height gauge, dial indicator and their calibration.<br>• Protractor, bevel protractor and all types gauges. | 2 |
| 4 | Hand Tools and Hand Operation | • Introduction to bench tools, machinist's hammers, screw drivers, punches, chisels, scraper, scribers, files, pliers and cutters, wrenches, hacksaw, bench vise (vice), hand drill, taps and dies, hand shear, rivets and other.<br>• Introduction to hand working operation, measuring, marking, sawing, filing, threading, scribing, shearing, soldering, riveting. | 3 |
| 5 | Sheet Metal Work | • Metals of sheet, tools used in sheet metal work, standards of thickness and sizes of sheet metal.<br>• **Operations:** layout preparation, shearing, cutting, bending, folding, rolling, joining (hems, seams, rivets), edge and corner preparation. | 3 |
| 6 | Welding | • Introduction, classification, application<br>• **Arc welding:** introduction, Tools and equipment, edge preparation, methods and operations.<br>• **Gas welding:** introduction and classification, tools and equipment, types of flames, method and processes.<br>• Introduction to resistant welding, thermit welding, brazing, soldering, non-conventional welding (laser beam, electron beam), TIG, MIG, metal cutting and welding testing.<br>• Hygienic welding (sanitary welding). | 4 |
| 7 | Carpentry Work | • Introduction and safety practices.<br>• **Tools and equipment:** hand tools (saws, hammers, chisels, planes, measuring tape, square, mallet); power tools (circular saw, jigsaw, scroll saw, drill, router, sander); care and maintenance of tools; fasteners and adhesives (nails, screws, bolts, wood glue).<br>• **Basic woodworking:** measuring and marking, types of joints (butt joint, lap joint, mortise and tenon, dovetail, dado); carpentry operations (cutting, planing, chiseling, boring, nailing and screwing, sanding, finishing). | 4 |

Continued ....

| | | | |
|---|---|---|---|
| 8 | Plumbing | • Introduction, classification of pipes, material used for pipes (steel, PVC, CPVC, GI, copper, PEX, HDPE), safety measures.<br>• Fittings (elbows, tees, couplings, unions, nipples, valves); Fixtures (taps, showers, basins, WC, flush tanks); sealants and joining materials (teflon tape, thread sealants, gaskets).<br>• Hand tools (pipe wrench, slide wrench, hacksaw, pliers, cutters, spanner, tape and dies); power tools (drill, pipe threading machine, pipe bender); care and maintenance of tools.<br>• Pipe work and joints: measuring, marking, and cutting pipes; threading and bending of pipes; joining methods (solvent cementing, threading, welding, compression fittings); testing for leaks and pressure.<br>• Hygienic design. | 4 |
| 9 | Machine Tools | • Drilling machine: classification, construction, working, operations (drilling, reaming, tapping, countersinking, etc.); tool holding and work holding devices; tools and accessories; safety and precaution.<br>• Lathe: classification, construction, working principle, basic Motions; lathe operations (turning, facing, taper turning, center drilling, threading, knurling, etc.); lathe accessories (chucks, centers, rests, mandrel, etc.); safety and precaution.<br>• Grinding machines: classification, construction, working; grinding wheels (materials, bonding, grades); dressing and truing of wheels; operations (grinding, lapping, honing, superfinishing, polishing and buffing, cutting tool sharpening, etc.).<br>• Shaper and planner: classification, construction, working and operations.<br>• Milling machine: classification, construction, working and operations.<br>• Introduction to non-conventional machine tools. | 8 |
| 10 | Repair and Maintenance | • Introduction, need for repair and maintenance, types (scheduled, predictive, breakdown, corrective), maintenance planning and controlling. | 1 |
| | | Total | 32 |

Reference materials


1. Choudhury, S. K., Choudhury, A. K. and Roy, N. (2010). "Workshop Technology Vol. 1, 2 and 3" (Latest ed.). Media Promoters and Publishers Pvt. Ltd., India. [ISBN 978-8185099206].
2. Raghuwanshi, B. S. (2013). "Elements of Workshop Technology Vol. 1 and 2" (13th ed.). Dhanpat Rai and Co., India. [ISBN 978-8177000120].
3. Rao, P. N. (2013). "Manufacturing Technology Vol. 1 and 2" (4th ed.). McGraw-Hill Education, India. [ISBN 978-0070681934].
4. Reddy, K. V. (2020). "Workshop Practice Manual" (6th ed.). BSP Books, India. [ISBN 978-9386584090].

| | | |
|---|---|---|
| Course: Workshop Technology | Course Code: BFT 251 (B) | Credit Hour: 2 |
| Semester: IV | Teaching hours: 128 h | Full Marks: 50 |
| Nature of Course: Practical | (Lab.: 4 h per session) | |

List of practical for the laboratory session

| S/N | Practical content | Details of practical work |
|---|---|---|
| 1 | Basic bench work practice | • Use of bench vise, hacksaw, files, chisels.<br>• Marking and measuring using scribers, punch, steel rule.<br>• Sawing and filing a rectangular metal block.<br>• Thread cutting using taps and dies. |
| 2 | Sheet metal fabrication | • Layout preparation on GI sheet.<br>• Cutting with snips, bending, folding.<br>• Forming basic shapes: tray or box.<br>• Joining with rivets, forming seams and hems. |
| 3 | Basic welding operations | • Arc welding demonstration and practice: Lap and butt joints.<br>• Gas welding: Flame setting, bead laying.<br>• Practice brazing and soldering.<br>• Safety precautions and PPE usage. |
| 4 | Basic woodworking skills | • Measuring and marking on wood, sawing, chiseling, planning.<br>• Making basic joints: Butt, lap, mortise and tenon.<br>• Assembly and finishing of a wooden stool/frame. |
| 5 | Pipe fitting and installation | • Measuring, cutting, and threading PVC or GI pipes, practice with elbow, tees, unions, valves<br>• Use of pipe wrench, hacksaw, threading dies.<br>• Joining with solvent cementing and compression fittings, leak testing. |
| 6 | Operation of basic machine tools | • Drilling machine: Centering, drilling, reaming.<br>• Lathe: Turning and facing demo, knurling.<br>• Grinding machine: Surface grinding and tool sharpening.<br>• Shaping and milling machine demonstrations.<br>• Tool and work holding demonstrations. |
| 7 | Visit to nearby workshops, Engineering institutions | • Demonstration of working of different machine tools. |

**Unit wise marks distribution for the final exam**

| Unit | Title | Total (%) |
|---|---|---|
| 1 | Introduction | 3 |
| 2 | Engineering materials | 5 |
| 3 | Measuring instruments | 5 |
| 4 | Hand tools and hand operation | 10 |
| 5 | Sheet metal work | 10 |
| 6 | Welding | 13 |
| 7 | Carpentry work | 13 |
| 8 | Plumbing | 13 |
| 9 | Machine tools | 25 |
| 10 | Repair and maintenance | 3 |
| | Total | 100% |

Institute of Science & Technology
Dean's Office
Kirtipur 2045

| Course: Cereals, Legumes and Oilseeds Technology | Course Code: BFT 252 (A) | Credit Hour: 2 |
|---|---|---|
| Semester: IV | Teaching hours: 32 h (2 lecture hours per week) | Full Marks: 50 |
| Nature of Course: Theory | | |

Course description and objectives

Cereals, legumes, and oilseeds are essential components of the human diet and play a significant role in the food industry. To exploit the full potential of these agricultural commodities, it is crucial to understand the technology involved in their processing and utilization. This course aims to provide students with a comprehensive understanding of the processing, preservation, and utilization of cereals, legumes, and oilseeds. Topics include the structural composition, nutritional value, and functional properties of these food groups. Students will explore traditional and modern processing techniques, quality assessment methods, and emerging technologies in the industry. Emphasis is placed on optimizing product development and ensuring sustainability in food production.

Course detail

| Unit | Content | Details of content | Teaching hours |
|---|---|---|---|
| 1 | Introduction | • **Formation of grain seeds; production, post-harvest handling of cereals, legumes and oilseeds.** | 1 |
| 2 | Physical Properties of Grains, Legumes and Oilseeds | • **Geometrical properties:** shape, size, volume, roundness, sphericity, porosity.<br>• **Gravimetric properties:** bulk density, specific gravity, 1000 kernel weight. | 2 |
| 3 | Structure of Grain | • **Structure of wheat, rice, maize, barley and legumes; nutrition distribution, chemical composition.** | 1 |
| 4 | Wheat Milling | • **Varieties, classification.**<br>• **Milling:**<br>- Pre-milling operation-separation: surface cleaning, conditioning and grading.<br>- Traditional milling: attrition mill, hammer mill.<br>- Modern flour milling: milling process by roller, white flour, extraction rate.<br>• **Wheat flour:**<br>- Flour quality, gluten determination.<br>- Flour bleaching and maturation, flour for various uses. | 6 |
| 5 | Dough and Its Properties | • **Dough formation and water absorption, alveograph, farinograph, extensograph.** | 2 |
| 6 | Technology of Wheat Products | • **Technology of bread, biscuits, cake, pasta products and noodles** | 5 |
| 7 | Rice | • **Varieties, classification.**<br>• **Milling:**<br>- Traditional and modern milling system: introduction, hullers mills, sheller and modern milling. | 4 |
| 8 | Parboiling and Steaming of Paddy | • Traditional and modern system of parboiling.<br>• Cooking quality of rice, processed food from rice, enrichment and ageing.<br>• Production of steam rice (light- and full steam). | 2 |
| 9 | Maize (corn) | • Dry milling of maize (corn) for maize flour, grits and meal. | 2 |
| 10 | Malting | • Malting of barley. | 1 |
| 11 | Legumes | • Legume processing, dal milling, anti-nutritional and toxic factors in legumes and oilseeds. | 2 |
| 12 | Oilseeds and Nuts | • Conventional and non-conventional oilseeds; traditional and modern oil extraction methods.<br>• Seed composition; uses of oilseed meal. | 2 |

| | | | |
|---|---|---|---|
| 13 | Protein Technology | • Protein concentrates and isolates.<br>• Meat analogs and textured vegetable protein. | 2 |
| | | Total | 32 |

Reference materials


1. Bandhopadhyaya, S. and Roy, N. C. (1992). "Rice Process Technology". Oxford and IBH Publishing, New Delhi. [ISBN 978-8120407510].
2. Chakraverty, A. and Singh, R. P. (2014). "Postharvest Technology and Food Process Engineering" (1st ed.). CRC Press, Boca Raton. [ISBN 978-1466553200].
3. Delcour, J. A. and Hoseney, R. C. (2010). "Principles of Cereal Science and Technology" (3rd ed.). AACC International (Cereals and Grains Association). [ISBN 978-1891127632].
4. Pillaiyar, P. (1988). "Rice Postproduction Manual". Wiley Eastern Ltd., New Delhi. [ISBN 978-8122400076].
5. Rosentrater, K. A. and Evers, A. D. (2017). "Kent's Technology of Cereals: An Introduction for Students of Food Science and Agriculture" (5th ed.). Woodhead Publishing, UK. [ISBN 978-0081005293].
6. Sahay, K. M. and Singh, K. K. (2004). "Unit Operations of Agricultural Processing" (2nd ed.). Vikas Publishing House, India. [ISBN 978-8125911425].


---

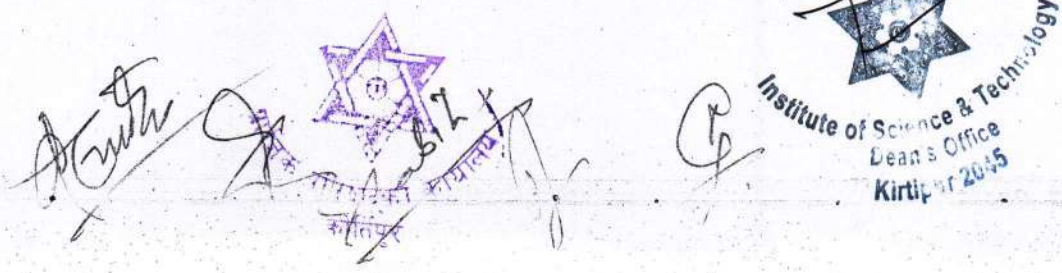
| | | |
|---|---|---|
| Course: Cereals, Legumes and Oilseeds Technology | Course Code: BFT 252 (B) | Credit Hour: 1 |
| Semester: IV | Teaching hours: 64 h | Full Marks: 25 |
| Nature of Course: Practical | (Lab: 4 h per session) | |

List of practical for the laboratory session

1. Assessment on post-harvest process of grains in Nepal.
2. Determination of moisture content of grains.
3. Determination of Geometrical Properties: Shape, size, volume, roundness, sphericity and gravimetric properties of grain.
4. Determination of gluten content of wheat flour.
5. Determine cooking quality of rice, steamed and parboiled rice.
6. Experimental malting of barley.
7. Experimental preparation of noodles and macaroni.
8. Cooking quality of roll and cut noodles.
9. Preparation of bread and its quality evaluation.
10. Preparation of biscuits and its quality evaluation.
11. Preparation of cake and its quality evaluation.
12. Determination of oil from solvent extraction, mechanical expeller.
13. Tofu preparation.
14. Production of protein concentrate and isolates.
15. Visit to cereal industries.

**Unit wise marks distribution for the final exam**

| Unit | Title | Total (%) |
|---|---|---|
| 1 | Introduction | 0 |
| 2 | Physical properties of grains, legumes and oilseeds | 10 |
| 3 | Structure of grain | 5 |
| 4 | Wheat milling | 20 |
| 5 | Dough and its properties | 5 |
| 6 | Technology of wheat products | 10 |
| 7 | Rice | 10 |
| 8 | Parboiling and steaming of paddy | 5 |
| 9 | Maize (corn) | 10 |
| 10 | Malting | 5 |
| 11 | Legumes | 10 |
| 12 | Oilseeds and nuts | 5 |
| 13 | Protein technology | 5 |
| | Total | 100% |



| | | |
|---|---|---|
| Course: Industrial Microbiology-I | Course Code: BFT 253 (A) | Credit Hour: 2 |
| Semester: IV | Teaching hours: 32 | Full Marks: 50 |
| Nature of Course: Theory | (2 lecture hours per week) | |

Course description and objectives

Industrial Microbiology-I introduces the foundational principles of industrial microbiology, emphasizing the biological, biochemical, and technological underpinnings of microbial applications in industry. Students will explore microbial physiology, metabolism, and growth dynamics in the context of industrial processes, gaining a broad understanding of microbial cell factories and their role in food, health, and biotechnology. Key techniques such as microbial cultivation, strain improvement, and growth control will be covered.

This course is designed to introduce students to the fundamental principles of industrial microbiology, with a focus on microbial physiology, energy metabolism, and tools for microbial cultivation and control. Upon successful completion of the course, students will be able to:

1. **Explain the historical development and significance** of industrial microbiology and its contributions to food systems, health, and biotechnology.
2. **Understand and describe the cellular structure, physiology, and metabolic pathways** of industrially important microorganisms, including bacteria, fungi, yeast, and algae.
3. **Differentiate between primary and secondary metabolites** and explain their relevance in industrial microbial processes.
4. **Analyze microbial growth kinetics** and interpret their importance in bioprocess development and scale-up.
5. **Understand key energy conversion processes in microbes**, including glucose metabolism, oxidative phosphorylation, photosynthesis, and nitrogen fixation.
6. **Identify and apply tools and techniques** for microbial strain cultivation, screening, preservation, and improvement to enhance industrial productivity.
7. **Formulate and optimize microbial culture media** based on microbial nutritional and physiological needs.

Course detail

| Unit | Content | Details of content | Teaching hours |
|---|---|---|---|
| 1 | Foundations of Industrial Microbiology | • History of industrial microbiology.<br>• Contributions to food systems and health.<br>• Concept of microbial cell factories.<br>• Overview of fermentation technology. | 4 |
| 2 | Microbial Physiology and Biochemistry for Industrial Use | • Anatomy and physiology of bacteria, yeast, fungi etc.<br>• Microbial metabolism: primary vs. secondary metabolites.<br>• Types of microbial growth kinetics and their relevance in bioprocess. | 8 |
| 3 | Energy Conversion in Biology | • Review on glucose metabolism.<br>• Photosynthesis and nitrogen fixation.<br>• Bacterial growth modes (aerobic and anaerobic fermentation). | 4 |
| 4 | Tools and Techniques in Industrial Microbiology | • Microbial cultivation and strain preservation techniques.<br>• Screening and selection of high yield strains.<br>• Classical and molecular strain improvement (including auxotrophy and analog resistance).<br>• Culture media formulation and optimization. | 9 |
| 5 | Bacterial Growth Control | • Sterilization techniques: physical and chemical.<br>• Monitoring of sterilization<br>• Biological competition and bio-control. | 5 |
| 6 | Microbiological Assay | • General principles, types, and examples. | 2 |
| | | Total | 32 |

Reference materials


1. Baltz, R. H., Davies, J. E. and Demain, A. L. (Eds.). (2010). "Manual of Industrial Microbiology and Biotechnology" (3rd ed.). ASM Press, USA. [ISBN 978-1-55581-512-7].
2. Casida, L. E. (1968). "Industrial Microbiology" (1st ed.). Wiley Eastern Limited, India. [ISBN 978-0471140603].
3. Hewitt, W. (1977). "Microbiological Assay: An Introduction to Quantitative Principles and Evaluation". Academic Press, USA. [ISBN 978-0-12-346450-7].
4. Thermo Fisher Scientific. (Undated). "Bacterial Growth Curves: Analysis through $OD_{600}$ Measurements". Lesson Plan. Thermo Fisher Scientific. Available at: https://assets.thermofisher.com/TFS-Assets/CAD/Flyers/genesys-od600-measurements-lesson-plan-FL64716.pdf.
5. Waites, M. J., Morgan, N. L., Rockey, J. S. and Higton, G. (2001). "Industrial Microbiology: An Introduction" (1st ed.). Wiley Blackwell, UK. [ISBN 978-0632053070].
6. Wilson, D. B., Sahm, H., Stahmann, K.-P. and Koffas, M. (2020). "Industrial Microbiology" (Latest ed.). Wiley-VCH, Germany. [ISBN 978-3-527-69729-8].


Institute of Science & Technology
Dean's Office
Kirtipur 2045

| | | |
|---|---|---|
| Course: Industrial Microbiology-I | Course Code: BFT 253 (B) | Credit Hour: 1 |
| Semester: IV | Teaching hours: 64 h | Full Marks: 25 |
| Nature of Course: Practical | (Lab: 4 h per session) | |

List of practical for the laboratory session

| S/N | Lab Title | Description / Skills Developed |
|---|---|---|
| 1 | Aseptic handling and isolation of industrial microbes | Inoculate and isolate *S. cerevisiae*, *Lactobacillus*, and *A. niger* from mixed sources. Introduce streaking, microscopy, and colony ID with industrial focus. |
| 2 | Quantitative growth analysis | $OD_{600}$ measurement across time points; construct growth curves and calculate $\mu_{max}$ and doubling time. |
| 3 | Substrate effect on growth and metabolism | Compare glucose, starch, and molasses substrates for microbial biomass and acid production. |
| 4 | Screening of fermentative molds and yeasts from *murcha* | Plate, isolate, and characterize fermentative strains from traditional starter cultures. |
| 5 | Solid-state fermentation (SSF) setup and evaluation | Ferment agricultural substrate with *Aspergillus* or yeast and evaluate biomass and enzyme activity. |
| 6 | Sterilization and contamination risk evaluation | Compare filter, heat, and chemical sterilization; inoculate to test sterility. |
| 7 | Antibiotic producer screening (crowded plate method) | Use *Bacillus* and other soil isolates to screen for antibiotic activity against *E. coli*. |

**Unit wise marks distribution for the final exam**

| Unit | Title | Total (%) |
|---|---|---|
| 1 | Foundations of industrial microbiology | 10 |
| 2 | Microbial physiology and biochemistry for industrial use | 25 |
| 3 | Energy conversion in biology | 15 |
| 4 | Tools and techniques in industrial microbiology | 30 |
| 5 | Bacterial growth control | 15 |
| 6 | Microbiological assay | 5 |
| | **Total** | **100%** |

Institute of Science & Technology
Dean's Office
Kirtipur 2045

| | | |
|---|---|---|
| Course: Food Engineering-II<br>Semester: IV<br>Nature of Course: Theory | Course Code: BFT 254 (A)<br>Teaching hours: 32<br>(2 lecture hours per week) | Credit Hour: 2<br>Full Marks: 50 |

Course description and objectives

Building upon the foundational knowledge acquired in Food Engineering-I, this advanced course emphasizes both process engineering and specialized applications in food production. Topics include advanced heat and mass transfer mechanisms, rheology and texture analysis, process engineering principles, the design and optimization of food processing equipment, and sustainable engineering practices.

Course detail

| Unit | Content | Details of content | Teaching hours |
|---|---|---|---|
| 1 | Evaporation | • **Boiling point elevation:** [0.5 h]<br>- Introduction, colligative properties, mechanism, and applications.<br>• **Types of evaporators and their working principles:** [1 h]<br>- Batch type pan evaporator.<br>- Rising-film evaporator.<br>- Falling-film evaporator.<br>- Rising/falling-film evaporator.<br>- Plate heat evaporator.<br>- Agitated thin-film evaporator.<br>• **Mass and heat balance in single-effect evaporator.** [1.5 h]<br>• **Principle of a multiple- effect evaporator (forward feed, backward feed).** [1 h] | 4 |
| 2 | Dehydration | • **Drying fundamentals:** [2 h]<br>- Unsaturated vapor-gas mixture.<br>- Equilibrium moisture content.<br>- Heat and mass transfer.<br>- Drying rate curve and drying time calculation. [2h] | 4 |
| 3 | Distillation | • **Definition and types of distillation**<br>• **Liquid-vapor equilibrium, laws of Dalton, Raoult and Henry.**<br>• **Relative volatility, boiling point diagram of binary mixtures.** [3 h]<br>• **Rectification of binary mixtures:** [4 h]<br>- Rectification column<br>- Equations of operating lines, enriching section, and stripping section<br>- Effect of feed conditions<br>- Calculation of number of plates using McCabe Thiele method<br>• Reflux ratio: [1 h]<br>- Minimum reflux ratio<br>- Number of plates for total reflux | 8 |
| 4 | Crystallization | • Basic principle, solubility, nucleation, crystal growth rate, Mier's theory, Ostwald ripening. [2 h]<br>• Mass and heat balance. [1 h]<br>• Crystallization equipment: [1 h]<br>- Tank crystallizer, agitated batch crystallizer, and vacuum crystallizer. | 4 |

Continued ...

| | | | |
|---|---|---|---|
| 5 | Mechanical Separation | • Introduction, methods.<br>• Filtration. [2 h]<br>- Theory, operating equations.<br>- Equipment (rotary filter, plate and frame filter press, centrifugal filter).<br>• Centrifugal separation 1 h]<br>- Methods and principle.<br>- Equipment (micro centrifuge, disc stack centrifuge, tubular bowl centrifuge]<br>• Settling and sedimentation: [1 h]<br>- Methods and principles<br>- Equipment (settling tanks, classifiers, thickeners).<br>• Membrane separation: [2 h]<br>- Principles.<br>- Electro dialysis systems.<br>- Reverse osmosis membrane systems.<br>- Ultrafiltration membrane systems.<br>- Types of membrane devices (plate and frame, tubular, spiral-wound, hollow-fiber). | 6 |
| 6 | Mixing | • Definition, operation, mixing mechanism, types of mixing (solid-solid, liquid-liquid, solid-liquid) (Ref. BFT 205). [2 h]<br>• Mixing time and efficiency. [1 h]<br>- Mixing index.<br>- End-point determination of mixing. | 3 |
| 7 | Size Reduction | • Definition, principles (Kick's law, Bond's law, Rittinger's law). [1 h]<br>• Screening, different screen series, factors affecting the efficiency of screening (Ref. BFT 205). [1 h]<br>• Size reduction equipment (jaw crusher, gyratory crusher, roll crusher, hammer mill, ball mill). [1 h] | 3 |
| | | Total | 32 |

Reference materials


1. Berk, Z (2018) "Food Process Engineering and Technology" Academic Press, Cambridge. [ISBN 979-0-12-812018-7]
2. de Haan, A. B., Bosch, H. (2013) "Industrial Separation Process" De Gruyter, Berlin. [ISBN 978-3-11-030669-9]
3. Heldman, D. R., Lund, D. B and Sabliov, C. M. (2019). "Handbook of Food Engineering" (3rd ed). CRC Press, Boca Raton. [ISBN 978042944973].
4. Singh, P. R. and Heldman. D.R., Erdogdu, F (2023). "Introduction to Food Engineering" (6th ed). Academic Press, California. [ISBN 978-0-12-823129-6].
5. Toledo, R. T (2007). "Fundamentals of Food Process Engineering" (3rd ed). Springer Science + Business Media, Germany. [ISBN 978-0-387-29019-5].
6. Varzakas, T. and Tzia, C (2015). "Food Engineering Handbook". CRC Press. Boca Raton. [ISBN 978-1-4822-6168-4].

| | | |
|---|---|---|
| Course: Food Engineering-II | Course Code: BFT 254 (B) | Credit Hour: 1 |
| Semester: IV | Teaching hours: 64 h | Full Marks: 25 |
| Nature of Course: Practical | (Lab session of 4 h) | |

List of practical for laboratory session

1. Determination of boiling point elevation using different solutes.
2. Calculation of mass and energy balances of multiple effect evaporator.
3. Determination of drying rate curve of the food sample.
4. Determination of equilibrium moisture content (EMC) of a food sample using the static desiccator method.
5. Separation of a binary mixture of ethanol and water using simple distillation and analyzing the composition of the distillate and residue.
6. Determination of number of theoretical plates in the rectification column using McCabe-Thiele method.
7. Conduction of the mass balance during crystallization and determination of the solubility of crystals.
8. Determination of thickness of filter cloth used in the constant pressure filtration system.
9. Separation of cream from whole milk using a centrifuge.
10. Demonstration of a disc stack centrifuge or tubular bowl centrifuge operation.
11. Determination of the settling velocity of solid particles in a liquid medium under gravitational settling.
12. Determination of mixing time in a solid-liquid system using a colored tracer.
13. Calculation of mixing index of provided binary solid particles.
14. Performing sieve analysis of the provided sample.

**Unit wise marks distribution for the final exam**

| Unit | Title | Total (%) |
|---|---|---|
| 1 | Evaporation | 15 |
| 2 | Dehydration | 10 |
| 3 | Distillation | 25 |
| 4 | Crystallization | 10 |
| 5 | Mechanical separation | 20 |
| 6 | Mixing | 10 |
| 7 | Size reduction | 10 |
| | Total | 100% |


| | | |
|---|---|---|
| Course: Food Quality Control and Standards | Course Code: BFT 255 (A) | Credit Hour: 2 |
| Semester: IV | Teaching hours: 32 | Full Marks: 50 |
| Nature of Course: Theory | (2 lecture hours per week) | |

Course description and objectives

The course is designed to provide students a comprehensive understanding of the principles, rules, regulations, and standards governing food safety and quality control.

The course aims to equip students with the necessary knowledge and skills to ensure food safety and quality in the food industry, with specific focus on the Food Act, laws, regulations, and standards of Nepal. Additionally, students will learn about international standards such as Codex, ISQ 22000, as well as various quality control tools and techniques. The course aligns with current industry practices, international standards, and academic benchmarks. It integrates both technological and managerial principles to ensure students gain a comprehensive understanding of food quality assurance systems, regulatory compliance, and risk-based control strategies.

The course structure includes:

- Core concepts of food quality and safety.
- Statistical quality control methods.
- National and international food standards.
- Inspection, certification, and auditing procedures.
- Emerging trends in food quality management.

Course detail

| Unit | Content | Details of content | Teaching hours |
|---|---|---|---|
| 1 | Quality Control | • Concept: quality and food quality control.<br>• Principles of food quality control.<br>• Dimensions of quality.<br>• Standards of quality.<br>• Quality from a food product perspective.<br>• Quality from business perspective.<br>• Methods for determining quality.<br>- Subjective methods.<br>- Objective methods.<br>• Quality control–production relationship.<br>• Quality control–vendor relationship.<br>• Quality control–customer relationship.<br>• Quality control–regulatory agency relationship. | 3 |
| 2 | Food Quality | • Concept and definitions.<br>• Food system:<br>- Product composition.<br>- Food processes.<br>• Food quality perception.<br>- Food quality attributes: Intrinsic and extrinsic attributes.<br>• Food quality from a chain perspective:<br>- Food quality perspective in food supply chains.<br>- Food quality from a food authority perspective. | 3 |

Continued ....

| | | | |
|---|---|---|---|
| 3 | Quality Assurance | • Theories and application.<br>• Methods of quality assurance.<br>• Functions of a quality assurance program (quality control, quality evaluation and quality audit-internal and external).<br>• Functions of quality assurance department (education and training, process improvement, standards, special projects, consulting), responsibilities of QA department.<br>• Types of audits in the food industry:<br>- Product manufacturing.<br>- Plant sanitation and GMP.<br>- Product quality.<br>- HACCP. | 4 |
| 4 | The Computer and Process Control | • Computer integrated management.<br>• Artificial intelligence and expert systems.<br>• Computer–controlled processing. | 2 |
| 5 | Toxicology | • Relevance of toxicology in food safety.<br>• Legislative aspects relevant to toxicity (food additives, heavy metals, toxins, pesticide residues, etc.). | 2 |
| 6 | Food Standards | • Importance of quality and safety standards.<br>• Mandatory and voluntary food standards of Nepal.<br>• Baseline for food standards (Codex, FSSAI, ESO, FDA & USDA, ARSO, etc.).<br>• Formulation process for food standards in Nepal. | 3 |
| 7 | Food Control System | • National and international Food control systems.<br>• Acts, Regulations, Policies, Plans, Guidelines, Directives relevant to food safety.<br>• Feed Act and Regulation.<br>• Drafting, promulgation and enforcement of Acts and Regulations related to food safety and quality.<br>• Importance and practicality of market surveillance and monitoring, factory inspection, hotel/restaurant categorization (star rating).<br>• Import/Export: sampling, inspection, certification, quality control. | 4 |
| 8 | Pre-requisite Program, HACCP and ISO Series | • Pre-requisites: GAP, GVP, GHP, GMP, GLP.<br>• HACCP.<br>- Concept.<br>- Scope of HACCP.<br>- Importance and advantages of HACCP.<br>- HACCP program prerequisite.<br>- Development of HACCP program.<br>- HACCP principles<br>• MS: ISO 9000 series, ISO 17000 series, ISO 22000 series. | 4 |
| 9 | Statistical Quality Control | • Tools of descriptive statistics.<br>• Tools statistical process control (SPC).<br>- Control charts for variables.<br>- Control charts for attributes.<br>• Tools for acceptance sampling.<br>- Types of sampling plans.<br>• Operating Characteristic Curve. | 3 |

| | | | |
|---|---|---|---|
| 10 | World Trade Organization | • Introduction on GATT and WTO.<br>• Structure of WTO.<br>• Napal's accession to WTO.<br>• WTO and Nepal: opportunities and challenges.<br>• Sanitary and phytosanitary agreement (SPS).<br>- Objectives.<br>- Constraints/challenges for obtaining the sanitary and phytosanitary agreements.<br>- Elements.<br>• TBT Agreement.<br>- Terminology in the TBT agreement.<br>- Technical regulation.<br>- Standard.<br>- Conformity assessment procedure.<br>- Structure and scope of the TBT agreement.<br>• SPS vs. TBT measures. | 4 |
| | | Total | 32 |

Reference materials


1. Banks, J. (1989). "Principles of Quality Control". John Wiley and Sons, New York. [ISBN: 978-0471635512].
2. Codex Alimentarius Commission. (Latest). "Relevant CODEX Texts and Guidelines on Food Quality Control and Standards". FAO/WHO.
3. DFTQC and MoALD. (Latest). "Relevant Directives and Guidelines on Food Safety". Department of Food Technology and Quality Control, Government of Nepal.
4. Gould, W.A. (2002). "Total Quality Assurance for the Food Industries" (3rd ed.). CTI Publications. [ISBN: 978-0930027322].
5. Government of Nepal. (1976). "Feed Act, 2033 and Feed Regulation, 2041". Nepal Gazette. Available via CFPCC.
6. Government of Nepal. (2023). "Food Safety and Quality Act, 2080 and Food Regulation, 2027". Nepal Gazette.
7. Government of Nepal. (Latest). "Mandatory Standards for Food and Feed Products". Nepal Gazette.
8. Herschdoerfer, S.M. (1980). "Quality Control in the Food Industry" (Vols. 1–3). Academic Press, London.
9. Hubbard, M. R. (2003). "Statistical Quality Control for the Food Industry". Springer, New York. [doi:10.1007/978-1-4615-0149-7].
10. Luning, P. A. and Marcelis, W. J. (2020). "Food Quality Management: Technological and Managerial Principles and Practices". Wageningen Academic Publishers, Wageningen. [doi:10.3920/978-90-8686-899-5].
11. Mizuno, S. (1988). "Company-Wide Total Quality Control". Asian Productivity Organization, Tokyo. [ISBN: 978-9283311003].
12. Omaye, S.T. (2004). "Food and Nutritional Toxicology". CRC Press, Boca Raton. [ISBN: 978-1587160714].
13. Ranganna, S. (1986). "Handbook of Analysis and Quality Control for Fruit and Vegetable Products" (2nd ed.). Tata McGraw-Hill, New Delhi. [ISBN: 978-0074518519].
14. Vasconcellos, J. A. (2003). "Quality Assurance for the Food Industry: A Practical Approach". CRC Press, Boca Raton. [doi:10.1201/9780203498101].


Unit wise marks distribution for the final exam

| Unit | Title | Total (%) |
|---|---|---|
| 1 | Quality control | 10 |
| 2 | Food quality | 10 |
| 3 | Quality assurance | 10 |
| 4 | The computer and process control | 5 |
| 5 | Toxicology | 5 |
| 6 | Food standards | 10 |
| 7 | Food control system | 15 |
| 8 | Pre-requisite program, HACCP and ISO series | 15 |
| 9 | Statistical quality control | 10 |
| 10 | World Trade Organization | 10 |
| | Total | 100% |

| | | |
|---|---|---|
| Course: Food Analysis | Course Code: BFT 256 (A) | Credit Hour: 3 |
| Semester: IV | Teaching hours: 48 | Full Marks: 75 |
| Nature of Course: Theory | (3 lecture hours per week) | |

Course description and objectives

This course provides a comprehensive introduction to the principles and methodologies used in the analysis of foods, focusing on chemical, physical, microbiological, and biochemical parameters. Students will learn standard analytical techniques for determining the proximate composition of foods including moisture, protein, fat, carbohydrates, fiber, and ash. Additionally, the course covers the qualitative and quantitative analysis of vitamins, phytochemicals (such as polyphenols, flavonoids, and antioxidants), minerals, and food toxicants (including pesticides, mycotoxins, and heavy metals).

The theoretical aspects are complemented by practical sessions that involve the use of modern instrumentation and standardized assays such as UV-Vis spectroscopy, chromatography, titration methods, and sensory evaluation techniques. This course prepares students for roles in food quality assurance, research and development, regulatory affairs, and safety monitoring within the food industry.

Course detail

| Unit | Content | Details of content | Teaching hours |
|---|---|---|---|
| 1 | Introduction to Food Analysis | • Introduction.<br>• Reasons for analyzing foods and types of samples analyzed:<br>- Overview, consumer trends and demands, government regulations and international standards and policies, food industry management of product quality.<br>• Steps in analysis:<br>- Selection and preparation of the sample, assaying, calculation, and interpretation of the results.<br>• Method selection:<br>- Objective of the assay, characteristics of the method, validity of the method, consideration of food composition.<br>• Official methods:<br>- AOAC International, and other endorsed methods. | 4 |
| 2 | Sampling and Sample Preparation | • Definitions:<br>- Sample, population, laboratory sample and sampling (attribute and variable sampling).<br>• Sampling plan and factors affecting the choice of sampling plans.<br>• Acceptance sampling and risk associated with sampling.<br>• Sampling procedure:<br>- Introduction and examples, homogeneous vs. heterogeneous populations, manual vs. continuous sampling, statistical considerations.<br>• Preparation of samples:<br>- General size reduction considerations, grinding, enzymatic inactivation, lipid oxidation protection, microbial growth and contamination. | 5 |

Continued ...

| | | | |
|---|---|---|---|
| 3 | Determination of Moisture Contents of Foods | • Properties of water in foods, mechanism of drying (moisture loss), factors affecting the rate of moisture removal, factors affecting sample preparation for moisture determination.<br>• Direct methods for moisture determination:<br>- Brief concept, advantages and disadvantages (oven drying, vacuum-oven drying, freeze-drying, distillation methods, Karl Fischer method, chemical desiccation, thermogravimetric analysis, gas chromatography).<br>• Indirect methods for moisture determination:<br>- Brief concept, advantages and disadvantages (refractometry, infrared absorption, near-infrared reflectance spectroscopy, microwave absorption, dielectric capacitance, conductivity, sonic and ultrasonic absorption, mass spectrometry, NMR spectroscopy). | 5 |
| 4 | Ash Analysis | • Introduction, definitions, and importance of ash in food analysis.<br>• Ash contents in foods methods:<br>- Sample preparation, dry ashing and wet ashing, acid insoluble ash (AIA) and their applications. | 2 |
| 5 | Fat Analysis | • Introduction, definitions, general classification, lipid content in foods, importance of analysis.<br>• Solvent extraction methods:<br>- Introduction, sample preparation, solvent selection.<br>- Continuous solvent extraction method: Goldfisch method,<br>- Semi-continuous solvent extraction method: Soxhlet method.<br>- Discontinuous solvent extraction methods. | 2 |
| 6 | Protein Analysis | • Introduction, classification and general considerations, importance of analysis.<br>• Introduction to methods:<br>- Nitrogen-based methods: Kjeldahl method, Dumas method.<br>- Different types of colorimetric methods: Biuret Method, Lowry method. | 3 |
| 7 | Carbohydrate and Fiber Analysis | • Introduction, sample preparation.<br>• Extraction and cleanup for determination of mono- and oligosaccharides.<br>• Total carbohydrate: phenol sulfuric acid method (principle and characteristics)<br>• Total reducing sugars (Somogyi–Nelson method and Lane and Eynon method).<br>• Total starch (principle and procedure).<br>• Crude fiber.<br>• Dietary fiber (definition, total, soluble, and insoluble dietary fiber determination – principle and procedure). | 4 |
| 8 | Vitamin Analysis | • Definition and importance of analysis, vitamin units.<br>• Analysis of vitamin (principle and procedure):<br>- Vitamin C: 2,6-dichloroindophenol titration method.<br>- Niacin: Chemical method.<br>- Riboflavin (Vitamin $B_2$) and Thiamin: Fluorometric method.<br>- Vitamin A: Rapid Carr-Price method, using spectrophotometer.<br>- Vitamin E: Furter-Meyer method in food products using HPLC | 4 |

Continued ...

| | | | |
|---|---|---|---|
| 9 | Water – Standard and Analysis | • Standards for drinking water (in context of Nepal Government).<br>• Water used for public supply purposes (physical characteristics, chemical characteristics).<br>• Bacteriological examination of water.<br>• Quality of water in dairy, fish industry, brewing and soft drink industry.<br>• Chlorination of water (chlorine demand, chlorine dose and residual chlorine) | 5 |
| 10 | Extraneous Matters in Food | • Definition of ferms, diagnostic characteristics of filth.<br>• Basic analysis:<br>- Sieving method, sedimentation method, flotation methods, objectivity/subjectivity of methods,<br>• Other techniques:<br>- Overview, X-Ray radiography, X-Ray microtomography, electrical conductance method, impact-acoustic emission, microscopy techniques, near-infrared spectroscopy, enzyme-linked immunosorbent assay (ELISA) | 4 |
| 11 | Analytical Methods for Food Additives | • **Analysis of food colors:** annatto extracts (color reaction and spectroscopic method).<br>• **Sorbic acid and its salts (gas chromatographic method).**<br>• **Benzoic acid (volumetric titration and gas chromatographic method).**<br>• **Sulfites (total and free sulfur dioxide by the modified Ripper titration and distillation method).**<br>• **Nitrites and nitrates in meat (colorimetric).**<br>• **BHA, BHT, TBHQ (colorimetric method).**<br>• **Saccharin in food (sublimation method), aspartame and saccharin (HPLC)** | 5 |
| 12 | Common Adulterants and Contaminants | • **Definition, types and effects on human health.**<br>• **Chemical contaminants (acrylamide, benzene, dioxins and polychlorinated biphenyls, melamine).**<br>• **Mycotoxins (aflatoxins, fumonisins, trichothecenes, zearalenone, citrinin, patulin).**<br>• **Heavy metals (chromium, cadmium, lead, mercury).**<br>• **Introduction to Electrochemical biosensor, piezoelectric biosensors (microbial pathogens, viruses, toxins, pesticides and heavy metals)**<br>• **Analysis of non-food colors**: malachite green, rhodamine B, Metanil yellow, etc.<br>• **Calcium carbide residue in foods.**<br>• **Formalin and its impacts.** | 5 |
| | | Total | 48 |

Reference materials


1. AOAC International. (2023). "Official Methods of Analysis of AOAC INTERNATIONAL" (22nd ed., 3-volume set). Oxford University Press, New York. [ISBN 9780197610138].
2. BeMiller, J. N., Bradley, J. R. L., Carpenter, C. E., Chang, S. K. C., Daubert, C. R., Dogan, H., Eitenmiller, R. R. and Ellefson, W. C. (2010). "Food Analysis" (4th ed.). Springer, New York. [ISBN 9781441914774].
3. Egan, H., Kirk, R. and Sawyer, R. (1981). "Pearson's Chemical Analysis of Foods" (8th ed.). Churchill Livingstone, Edinburgh. [ISBN 9780443021497].
4. FSSAI. (2012). "The Food Safety and Standards Act, 2006 with Rules and Regulations" (2nd ed.). Bloomsbury Publishing India Pvt. Ltd., New Delhi. [ISBN 9789389714470].

5. Herschdoerfer, S. M. (Ed.). (1968). "Quality Control in the Food Industry" (1st ed.). Academic Press, London. [ISBN 9780124314054].
6. Ismail, B. P. and Nielsen, S. S. (Eds.). (2024). "Nielsen's Food Analysis" (6th ed.). Springer, Cham. [ISBN 9783031506420].
7. Jha, S. N. (2016). "Rapid Detection of Food Adulterants and Contaminants: Theory and Practice" (1st ed.). Elsevier, London. [ISBN 9780124200845].
8. Nollet, L. M. L. (Ed.). (2007). "Handbook of Water Analysis" (2nd ed.). CRC Press Taylor and Francis Group, Boca Raton. [ISBN 9780849370335].
9. Park, Y. W. and Bell, L. N. (2004). Determination of moisture and ash contents of foods." *In*: L. M. L. Nollet (Ed.), "Handbook of Food Analysis" (Vol. 1, pp. 55–82). Marcel Dekker, Inc., New York. [ISBN 9780824750367].
10. Ranganna, S. (1986). "Handbook of Analysis and Quality Control for Fruit and Vegetable Products" (1st ed.). Tata McGraw-Hill Education, New Delhi. [ISBN 0074518518].
11. Sadasivam, S. and Manickam, A. (2008). "Biochemical Methods" (3rd ed.). New Age International Publishers, New Delhi. [ISBN 9789393159653].
12. Sathe, A. Y. (1999). "A First Course in Food Analysis" (1st ed.). New Age International (P) Ltd., Publishers, New Delhi. [ISBN 9788122411740].
13. Wood, R., Foster, L., Damant, A. and Key, P. (2004). "Analytical Methods for Food Additives." Woodhead Publishing, Cambridge. [ISBN 9781855737297].

Institute of Science & Technology
Dean's Office
Kirtipur 2045

| | | |
|---|---|---|
| Course: Food Analysis | Course Code: BFT 256 (B) | Credit Hour: 1 |
| Semester: IV | Teaching hours: 64 | Full Marks: 25 |
| Nature of Course: Practical | (Lab: 4 h per session) | |

List of practical for laboratory session

1. Proximate analysis of foods
2. Determination of specific gravity by pycnometer method.
3. Estimation of food additives- $SO_2$, benzoic acid, formaldehyde, boric acid.
4. D-glucose (dextrose) - enzymic assay using GOD-POD reagent (spectrophotometric).
5. Fructose-enzymic assay using hexokinase (spectrophotometric).
6. Analysis of food items like jam, jelly, instant noodles, cooking oil, biscuits with reference to minimum quality standards of Nepal Government.
7. Pectin content - spectrophotometric. m-Hydroxydiphenyl-sulfuric acid method.
8. Total reducing sugars - spectrophotometric. Somogyi Nelson and related methods.
9. Dietary fiber - gravimetric method.
10. Complete analysis of table salt with reference to minimum quality standards of Nepal Government.
11. Water analysis - physicochemical and bacteriological with reference to minimum quality standards of Nepal Government.
12. Determination of hydrocolloid content.
13. Determination of acid-insoluble ash.
14. Determination of mineral contents (calcium - volumetric method, Iron - colorimetry and calibration curve method, potassium and sodium - flame photometric method).
15. Determination of (vitamin C) (2,6-dichlorophenol indophenol titration method).
16. Determination of phytic acid, tannins, total phenolics, antioxidant activity.
17. Determination of aflatoxin.

**Unit wise marks distribution for the final exam**

| Unit | Title | Total (%) |
|---|---|---|
| 1 | Introduction to food analysis | 8 |
| 2 | Sampling and sample preparation | 10 |
| 3 | Determination of moisture contents of foods | 10 |
| 4 | Ash analysis | 5 |
| 5 | Fat analysis | 5 |
| 6 | Protein analysis | 6 |
| 7 | Carbohydrate analysis | 8 |
| 8 | Vitamin analysis | 8 |
| 9 | Water- standard and analysis | 10 |
| 10 | Extraneous matters in food and their methods of detection and removal | 8 |
| 11 | Analytical methods for food additives | 12 |
| 12 | Common adulterants and contaminants | 10 |
| | Total | 100% |

| | | |
|---|---|---|
| Course: Industrial Microbiology - II | Course Code: BFT 301 (A) | Credit Hour: 2 |
| Semester: V | Teaching hours: 32 | Full Marks: 50 |
| Nature of Course: Theory | (2 lecture hours per week) | |

Course description and objectives

Building on foundational knowledge in Industrial Microbiology - I, this course focuses on the applied aspects of industrial microbiology, highlighting the design, operation, and optimization of microbial processes for the production of foods, bioactive compounds, and industrial materials. Topics include fermentation technology, modern biosynthetic tools, microbial product safety, regulatory frameworks, and sustainable bioprocessing.

Course objectives:

This course aims to provide students with comprehensive theoretical and practical knowledge of industrial microbiology and fermentation processes. By the end of the course, students will be capable of integrating theoretical knowledge with laboratory experience to address challenges in industrial microbiology and bioprocessing, with an emphasis on innovation, safety, and sustainability.

The objective is to equip learners with the ability to:

1. **Understand and explain** the principles and applications of microbial fermentation in the production of alcohol, non-dairy fermented products, baker's yeast, and single-cell protein.
2. **Explore the microbial synthesis** of industrially relevant compounds, including biopolymers, organic acids, antimicrobials, enzymes, amino acids, vitamins, and pigments.
3. **Critically evaluate modern approaches** in microbial biotechnology such as synthetic biology, metabolic engineering, and multi-omics tools for improving microbial productivity.
4. **Apply quality control measures and regulatory standards** relevant to industrial microbiology, including pathogen monitoring, GMP, and compliance with international food and safety regulations.
5. **Analyze the sustainability and economic feasibility** of bioprocesses, emphasizing resource optimization, waste reduction, and the role of microbiology in the circular bioeconomy.
6. **Develop hands-on laboratory skills** related to fermentation, microbial biomass production, traditional food processing, enzymatic activity assays, and microbial quality assessment.

Course detail

| Unit | Content | Details of content | Teaching hours |
|---|---|---|---|
| 1 | Industrial Fermentation Processes | • **Alcoholic fermentations:**<br>- Ethyl alcohol (from molasses, lignocellulosic materials and grains).<br>- Beer (raw materials, beer types and styles, and brewing technology).<br>- Wine technology.<br>- Distilled products (brandy, whisky, and rum production).<br>• **Commercial non-dairy fermented products:**<br>- Tempeh, miso, natto, sake, and kaffir beer.<br>• Single cell protein (SCP) and microbial biomass.<br>• Production of baker's yeast. | 13 |
| 2 | Microbial Production of Industrial Compounds | - Synthesis of biomacromolecules including proteins, lipids, polysaccharides.<br>- Antimicrobial production: classical and novel (AMPs, etc.).<br>- Supplemental compounds including enzymes (invertase, lactase and lipase), vitamins (riboflavin) and flavors (diacetyl and lactones). | 6 |
| 3 | Modern Trends in Industrial Microbiology | • Overview of synthetic biology and metabolic engineering of microbes.<br>• Overview of multi-omics for high throughput screening and bioinformatics. | 3 |

Institute of Science & Technology
Dean's Office
Kirtipur 2045

| | | | |
|---|---|---|---|
| 4. | Organic Acids and Amino Acids | • Organic acids:<br>- Citric acid.<br>- Gluconic acid.<br>• Amino acids:<br>- Glutamic acid.<br>- Tryptophan.<br>- Lysine | 6 |
| 5 | Bioprocess Sustainability and Economics | • Raw materials, separation methods, and integrated systems approach.<br>• Efficient energy conservation, water consumption, reduction and reuse.<br>• Role of microbiology in circular bio-economy and sustainability. | 4 |
| | | Total | 32 |

Reference materials


1. Agrawal, R. (2024). "Textbook of Industrial Microbiology" (1st ed.), Singapore: Springer Nature. [ISBN 978-981-97-9582-6].
2. Baltz, R.H., Davies, J.E. and Demain, A.L., eds. (2010). "Manual of Industrial Microbiology and Biotechnology" (3rd ed.), Washington, DC: ASM Press. [ISBN 978-1-55581-512-7].
3. El Mansi, E.M.T., Nielsen, J., Mousdale, D., Carlson, R.P. and Stephanopoulos, G. (2019). "Fermentation Microbiology and Biotechnology" (4th ed.), Boca Raton: CRC Press. [ISBN 978-1138581029].
4. Gajbhiye, M.H., ed. (2025). "Fundamentals of Fermentation Technology". Newcastle upon Tyne: Cambridge Scholars Publishing. [ISBN 1-0364-4560-7].
5. Kristiansen, B., Linden, J., Mattey, M. (1999) "Citric Acid Biotechnology" London: Taylor and Francis. [ISBN 97807484051145].
6. Reed, G. (1982). Prescott and Dunn's Industrial Microbiology (4th ed). Westport, CT: AVI Publishing Company. [ISBN 9780870553745].
7. Yokota, A. and Ikeda, M. (2017) "Amino Acid Fermentation". Advances in Biochemical Engineering/Biotechnology, Vol. 159. Tokyo: Springer. [9784431568100].


कीर्तिपुर

Institute of Science & Technology
Dean's Office
Kirtipur 2045

| | | |
|---|---|---|
| Course: Industrial Microbiology - II<br>Semester: V<br>Nature of Course: Practical | Course Code: BFT 301 (B)<br>Teaching hours: 64<br>(Lab: 4 h per session) | Credit Hour: 1<br>Full Marks: 25 |

List of practical for laboratory session

| S/N | Lab Title | Description / Skills Developed |
|---|---|---|
| 1 | Ethanol production from sugar substrates (batch) | Ferment glucose/sucrose/molasses; monitor ethanol yield, pH, $CO_2$ evolution. |
| 2 | Ethyl alcohol yield, analysis and efficiency analysis | Calculate yield (g/L), productivity, and fermentation efficiency using alcoholmeter/pycnometer. |
| 3 | Citric acid fermentation and recovery | Ferment using *A. niger*; precipitate and analyze citric acid output. |
| 4 | Wine fermentation from local fruits | Prepare fermented beverages; monitor sugar content, pH, and flavor profile. |
| 5 | Traditional fermented foods: preparation and improvement proposals | Prepare foods (e.g., *kinema, gundruk*); document and propose process improvements. |
| 6 | SCP production using yeast/algae | Cultivate, harvest, and quantify biomass from protein-rich fermentations. |
| 7 | Microbial enzyme production via SSF | Use mold cultures on solid substrates to produce amylase or protease; analyze activity. |
| 8 | GMP and contamination monitoring in fermented products | Microbial plating of end products; identify contamination and calculate CFUs. |

**Unit wise marks distribution for the final exam**

| Unit | Title | Total (%) |
|---|---|---|
| 1 | Industrial fermentation processes | 40 |
| 2 | Microbial production of industrial compounds | 20 |
| 3 | Modern trends in industrial microbiology | 10 |
| 4 | Organic acids and amino acids | 20 |
| 5 | Bioprocess sustainability and economics | 10 |
| | **Total** | **100%** |

Institute of Science & Technology
Dean's Office
Kirtipur 2045

| | | |
|---|---|---|
| Course: Biochemical Engineering - I | Course Code: BFT 302 (A) | Credit Hour: 2 |
| Semester: V | Teaching hours: 32 (2 lecture hours per week) | Full Marks: 50 |
| Nature of Course: Theory | | |

Course description and objectives

Biochemical Engineering – I is a foundational course designed to provide students with a comprehensive understanding of the interaction between biochemistry, microbiology, chemical engineering and allied areas, with a focus on biochemical engineering. Students will learn about mass and heat transfer phenomena, various fermentation processes and the essential prerequisites for the advanced course, i. e. Biochemical Engineering - II.

This course serves as the essential groundwork for Biochemical Engineering – II, where students build on fundamental concepts and delve deeper into advanced biochemical processes. The first course provides a strong understanding of mass transfer, microbial kinetics, aeration, agitation, and sterilization – key principles that are further expanded in Biochemical Engineering – II.

Course detail

| Unit | Content | Details of content | Teaching hours |
|---|---|---|---|
| 1 | Introduction | • Interaction of biochemistry, microbiology, chemical engineering and other allied areas with biochemical engineering. | 1 |
| 2 | Mass and Heat Transfer | • Different types of mass transfer in bio-processes, Mass transport phenomenon in microbial system, nutrient uptake rate of microorganisms.<br>• Basic mass transfer concept, gas-liquid mass transfer process, inter-phase mass transfer (two film theory), diffusion and forced convective mass transfer.<br>• Measurement of dissolved oxygen concentration and volumetric oxygen transfer coefficient in a fermentation system (methods and principles).<br>• Factors affecting $K_La$ and oxygen transfer rate in bio-process and determination of $K_La$ by different techniques.<br>• Heat transfer in bio-process. | 9 |
| 3 | Enzyme Kinetics | • Enzyme catalyzed reaction, activation energy of enzyme catalyzed reaction, experimental rate parameters and interpretation of $K_m$ and $V_{max}$. | 2 |
| 4 | Microbial Kinetics | • Microbial growth kinetics.<br>• Microbial death kinetics. | 2 |
| 5 | Kinetics of Substrate Utilization and Product Formation | • Stoichiometry of microbial growth, substrate utilization and product formation.<br>• Kinetics of substrate utilization.<br>• Kinetics of product formation.<br>• Relationship between growth yield, substrate utilization and product formation coefficient. | 3 |
| 6 | Fermenter Design | • Basis of design /design criteria for fermenter.<br>• Function of the fermenter.<br>• Aseptic operation and containment.<br>• Design of component parts of a fermenter and its functions.<br>• Types of fermenters. | 3 |

| | | | |
|---|---|---|---|
| 7 | Air Sterilization | • Objectives of air sterilization.<br>• Methods of air sterilization.<br>• Types of filters used and its limitations.<br>• Mechanism of air sterilization through filter (absolute and depth).<br>• Theory and kinetics of fibrous filter (log penetration theory).<br>• Design of fibrous filter (calculation with examples).<br>• Filtration efficiency.<br>• Effect of velocity on design parameter and filtration efficiency. | 3 |
| 8 | Media Sterilization | • Objectives of media sterilization (with consideration on nutrient and microbial destruction).<br>• Methods of media sterilization.<br>• Theory and kinetics of media sterilization by thermal destruction mechanism.<br>• Kinetics of nutrients destruction by heat.<br>• Arrhenius equation, Del factor, sterilization cycle, nutrient quality criteria.<br>• Continuous sterilization performance chart and its significance.<br>• Design of batch and continuous sterilization process (calculation with examples).<br>• Effect of media volume on nutrient quality criteria and del factor during media sterilization in batch process.<br>• Bigalow's Bio theory. | 4 |
| 9 | Aeration and Agitation | • Objectives, functions and importance of agitation and aeration.<br>• Oxygen requirement in aerobic process (justification with various mathematical expression/models).<br>• Formation of separate air bubbles, swarm of bubbles.<br>• Effect of bubble size, shape and ascending velocity on the performance of aerobic bioreactor.<br>• Bubble aeration with mechanical agitation.<br>• Power requirement for mechanical agitation in both gassed and non-gassed system in Newtonian fluid using dimensionless equation.<br>• Relationship between operating variables and $K_La$. | 5 |
| | | Total | 32 |

Reference materials


1. Aiba, S., Humphrey, A.E. and Millis, N.F. (1973). "Biochemical Engineering". 2nd ed. New York and London: Academic Press, Inc..
2. Bailey, E.J. and Ollis, D.F. (1986). "Biochemical Engineering Fundamentals" (2nd ed.), New Delhi: Tata McGraw-Hill Publishing. [ISBN: 9780070032125].
3. Geankoplis, C.J., Hersel, A. and Lepek, D.H. (2018). "Transport Processes and Separation Process Principles (Includes Unit Operations)" (4th ed.), Upper Saddle River, NJ: Prentice Hall. [ISBN: 9780134181028].
4. Katoh, S., Horiuchi, J. and Yoshida, F. (2009). "Biochemical Engineering: A Textbook for Engineers, Chemists and Biologists". (2nd completely revised and enlarged ed.) Singapore: Wiley-VCH Verlag GmbH and Co. KGaA. [ISBN: 9783527338047].
5. Shuler, M.L. and Kargi, F. (2017). "Bioprocess Engineering: Basic Concepts" (2nd ed.), Eastern Economy Edition. New Delhi: Prentice-Hall of India Pvt. Ltd. [ISBN: 9780137062706]
6. Stanbury, P.F., Whitaker, A. and Hall, S.J. (1999). "Principles of Fermentation Technology" (2nd ed.), Gurugram, Haryana: Elsevier, a division of Reed Elsevier India Pvt. Ltd. [ISBN: 9780750645010].

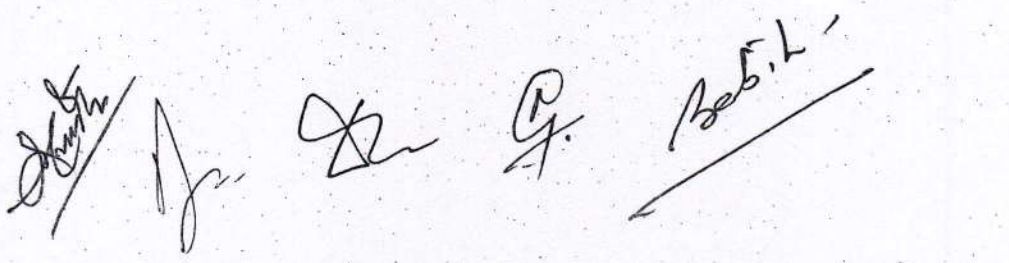
| | | |
|---|---|---|
| Course: Biochemical Engineering - I | Course Code: BFT 302 (B) | Credit Hour: 1 |
| Semester: V | Teaching hours: 64 | Full Marks: 25 |
| Nature of Course: Practical | (Lab: 4 h per session) | |

List of practical for laboratory session

1. Layout of a fermenter.
2. Heat inactivation of enzymes.
3. Determination of $K_m$ and $V_{max}$ in an enzyme catalyzed reaction.
4. Plotting of growth curve (biomass vs time) of yeast culture (batch).
5. Design of batch sterilization of media by thermal degradation.
6. Design of fibrous filter for air sterilization by filtration
7. Effect of scale up on the batch sterilization process.
8. Calculation of oxygen demand of aerobic fermentation system.
9. Measurement of Kıa of the aerobic fermenter.
10. Study on the kinetics of product formation in bio-process.
11. Study on the kinetics of substrate utilization in bio-process.
12. Study on the kinetics of microbial growth and growth curve.
13. Study on the effect of aeration and agitation on the productivity of aerobic bio-process.

**Unit wise marks distribution for the final exam**

| Unit | Title | Total (%) |
|---|---|---|
| 1 | Introduction | 5 |
| 2 | Mass and heat transfer | 30 |
| 3 | Enzyme kinetics | 5 |
| 4 | Microbial kinetics | 5 |
| 5 | Kinetics of substrate utilization and product formation | 10 |
| 6 | Fermenter design | 10 |
| 7 | Air sterilization | 10 |
| 8 | Media sterilization | 10 |
| 9 | Aeration and agitation | 15 |
| | **Total** | **100%** |




| | | |
|---|---|---|
| Course: Fats and Oils Technology | Course Code: BFT 303 (A) | Credit Hour: 2 |
| Semester: V | Teaching hours: 32 | Full Marks: 50 |
| Nature of Course: Theory | (2 lecture hours per week) | |

Course description and objectives

This Fats and Oils Technology course covers the chemistry, processing, and applications of edible fats and oils, including refining, bleaching, hydrogenation, deodorization, winterization, extraction, expeller operation, and transesterification. It emphasizes quality control, regulatory standards, and sustainability, with practical sessions in oil processing and analysis. By the end, students will gain essential skills to evaluate, process, and optimize fats and oils for food and industrial applications.

Course detail

| Unit | Content | Details of content | Teaching hours |
|---|---|---|---|
| 1 | Introduction to Fats and Oils | • **Basic chemistry of fats and oils:** Definition and classification of lipids; structure of triglycerides and fatty acids; saturated vs. unsaturated fats; *cis* and *trans* fatty acids; physicochemical properties and constants (melting point, saponification value, iodine value, free fatty acid, refractive index, RM value). [2 h]<br>• **Sources and classification of edible oils:** animal vs. vegetable fats; common edible oils (soybean, palm, olive, coconut, mustard, sunflower, rice bran, cottonseed, niger seed, etc.). [2h]<br>• **Importance in food processing and nutrition:** role of fats in food texture and flavor; essential fatty acids and health benefits; shortening and margarine. [1 h] | 5 |
| 2 | Solvent Extraction and Expeller Operation | • **Principles of solvent extraction:** solvent selection and efficiency; hexane extraction process. [2 h]<br>• **Expeller operation and oil recovery:** traditional methods (dunedi, pecha, and kol/ghani), screw press mechanism; optimization of yield and quality. [2 h] | 4 |
| 3 | Crude Oil Processing and Refining | • **Crude oil storage and handling:** storage conditions and oxidation prevention; contaminants and spoilage factors. [1 h]<br>• **Degumming and neutralization processes:** removal of phospholipids and impurities (gums): alkali neutralization. [1 h]<br>• **Refining techniques and quality parameters:** physical vs. chemical refining; quality indicators (FFA, PV, IV). [2 h] | 4 |
| 4 | Bleaching and Hydrogenation | • **Bleaching of vegetable oils:** adsorbents used in bleaching; removal of pigments and impurities (bleaching and filtration process); chemical bleaching. [1 h]<br>• **Hydrogenation process and its impact on oil properties:** catalysts and reaction conditions; formation of *trans* fats; outline of hydrogen gas production and storage; industrial hydrogenation process to produce hydrogenated vegetable oil (vanaspati); selective hydrogenation. [3h] | 4 |
| 5 | Deodorization and Winterization | • **Principles of deodorization:** steam stripping and vacuum deodorization; removal of volatile compounds. [2 h]<br>• **Winterization and fractionation techniques:** separation of high-melting fractions; applications in margarine and shortening. [2 h] | 4 |
| 6 | Animal Fat Processing | • **Extraction and refining of lard/tallow:** rendering techniques for animal fats. [1 h])<br>• **Ghee and butter making:** principles and methods. [1 h] | 2 |
| 7 | Special Vegetable Oil Extraction | • **Commercial production:** cocoa butter, crude palm oil and coconut oil. | 2 |

| | | | |
|---|---|---|---|
| 8 | Trans-esterification and Regulatory Aspects | • Mechanism and applications of interesterification: modification of fat for food applications. [2 h]<br>• Oil quality management and regulatory standards: food safety regulations; Analytical techniques for quality control. [1 h] | 3 |
| 9 | By-products in fat and oil processing | • By-products: types, utilization. | 1 |
| 10 | Spoilage and Deterioration of Fats and Oil | • Flavor reversion.<br>• Rancidity: definition, types, mechanism, detection and prevention (Ref. BFT 153A).<br>• Microbial spoilage: causes and prevention | 3 |
| | | Total | 32 |

Reference materials


1. Cheong, L-Z and Xu, X. (2019). "Rice Bran and Rice Bran Oil: Chemistry, Processing and Utilization". AOCS Press, London. [ISBN 978-0-12-812828-2].
2. FSSAI. (2016). "Manual of Methods of Analysis of Foods: Oils and Fats". Food Safety and Standards Authority of India, Ministry of Health and Family Welfare, Government of India.
3. Gupta, M. K. (2017). "Practical Guide to Vegetable Oil Processing", (2nd ed.). AOCS Press. USA. [ISBN 978-1630670504].
4. Lai, O-M., Tan, C-P. and Akoh, C. C. (2012). "Palm Oil Production, Processing, Characterization, and Uses" AOCS Press. Urbana. [ISBN 978-0-9818936-9-3].
5. List, G. R. (2009). "Bleaching and Purifying Fats and Oils: Theory and Practice" (2nd ed.). AOCS Press. Urbana. [ISBN 978-1-893997-91-2].
6. List, G. R. and King, J. W. (2011). "Hydrogenation of Fats and Oils: Theory and Practice" (2nd ed.). AOCS Press, Urbana, USA. [ISBN 978-1-893997-93-6].
7. O'Brien, R. D., Farr, W. E. and Wan, P. J. (2000). "Introduction to Fats and Oils Technology". (2nd ed). AOCS Press, Illinois. [ISBN 1-893997- 13-8].
8. Sabine Krist, S. (2020). "Vegetable Fats and Oils". Springer, Switzerland. [ISBN 978-3-030-30314-3 (eBook)].
9. Shahidi, F. (2005). "Bailey's Industrial Oil and Fat Products: Edible Oil and Fat Products: Chemistry, Properties, and Health Effects" (6th ed.) Vol. 1. John Wiley and Sons, Inc. [ISBN 0-471-38546-8 (v. 6)].
10. Vadke, V. S. (2024). "Principles of Vegetable Oil Extraction" (1st ed.). CRC Press, Boca Raton. [9781003309475 (ebk)].

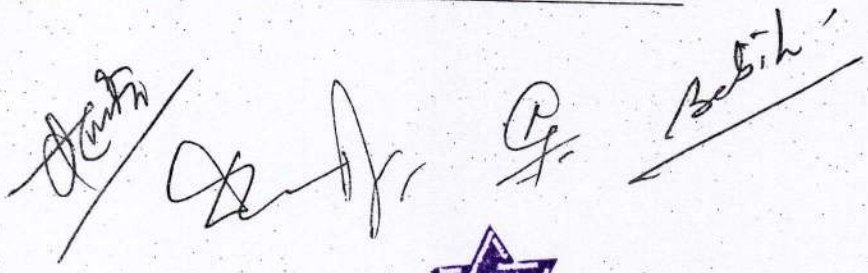
| | | |
|---|---|---|
| Course: Fats and Oils Technology | Course Code: BFT 303 (B) | Credit Hour: 1 |
| Semester: V | Teaching hours: 64 | Full Marks: 25 |
| Nature of Course: Practical | (Lab: 4 h per session) | |

List of practical for laboratory session

1. Determination of iodine value, saponification value, free fatty acid, refractive index, melting point of fat, and moisture of crude and refined oil.
2. Holde test, Crismer test, Halphen test, and Baudouin test.
3. Refining loss after alkali neutralization and bleaching of crude oil, residual soap test (in alkali neutralization).
4. Soxhlet extraction of oilseed, Gerber methods for butter and cream.
5. Calculation of holding capacity of vessels (conical bottom with heating/cooling coils) and high-pressure hydrogen storage cylinders.
6. Lab-scale bleaching (color reduction) test against various temperatures, methylene blue adsorption test of activated carbon, use of Lovibond tintometer.
7. Determination of trans fat.
8. Determination of peroxide value.
9. Determination of deterioration of bleachability index (DOBI).
10. Operate oil expeller and determine oil yield.
11. Visit to nearby fat and oil plant (expeller or refinery).

**Unit wise marks distribution for the final exam**

| Unit | Title | Total (%) |
|---|---|---|
| 1 | Introduction to fats and oils | 15 |
| 2 | Crude oil processing and refining | 15 |
| 3 | Bleaching and hydrogenation | 15 |
| 4 | Deodorization and winterization | 10 |
| 5 | Animal fat processing | 5 |
| 6 | Solvent extraction and expeller operation | 15 |
| 7 | Special vegetable fat extraction | 15 |
| 8 | Interesterification and regulatory aspects | 10 |
| | **Total** | **100%** |




| | | |
|---|---|---|
| Course: Sensory Assessment | Course Code: BFT 304 (A) | Credit Hour: 2 |
| Semester: V | Teaching hours: 32 | Full Marks: 50 |
| Nature of Course: Theory | (2 lecture hours per week) | |

Course description and objectives

This course introduces students to the principles, methodologies, and applications of sensory evaluation in food technology. It focuses on the integration of sensory science with chemometry to analyze and interpret data effectively. Topics include the physiology of human sensory systems, sensory testing methods, sensory panel management, and the statistical analysis of sensory data using chemometric techniques. Laboratory sessions will provide hands-on experience in conducting sensory tests, including discrimination, descriptive, and consumer preference analyses. The course emphasizes the role of sensory assessment in food quality control and product development, with a focus on applying chemometric tools to enhance decision-making processes.

Course detail

| Unit | Content | Details of content | Teaching hours |
|---|---|---|---|
| 1 | Introduction | • **Definition, scope, terminologies; historical background; human subjects as instruments; factors to consider during sensory evaluation.** | 2 |
| 2 | **Sensory Attributes and Human Senses in Sensory Evaluation** | • **Sensory attributes:**<br>- Appearance.<br>- Odor/aroma.<br>- Consistency and texture.<br>- Flavor and taste.<br>• **Human senses:**<br>- Vision/sight.<br>- Olfaction.<br>- Gestation.<br>- Hearing.<br>- Touch and their interactions.<br>- Chemical/trigeminal factors.<br>• **Factors influencing sensory evaluation results:**<br>- Physiological.<br>- Psychological and cultural factors.<br>- Physical conditions of panelist. | 4 |
| 3 | **Laboratory Setup and Facilities** | • **Test control:**<br>- Design.<br>- Location.<br>- Test room design: booth, evaluation and training area, preparation area, facilities, entrance and exit area, storage.<br>- General design factors: color, lighting, air circulation, temperature and humidity, construction materials.<br>• **Product control:**<br>- Equipment.<br>- Sample preparation (supplies and equipment, materials, procedure).<br>- Sample presentation: container, sample size, order, coding, etc.<br>- Product sampling.<br>• Panelists control:<br>- Panel training or orientation.<br>- Product / time of day.<br>- Panelist environment.<br>• Reception and briefing area. | 3 |

| | | | |
|---|---|---|---|
| 4 | Selection and Training of Panelists | • Panel development: personnel, facilities, data collection and handling, and cost.<br>• Selection and training:<br>- Selection from different tests, e.g., matching, detection, rating / ranking test; descriptive testing – flavor profile and texture profile.<br>- Selection from questionnaire, personal interview.<br>- Training.<br>• Panelist performance and motivation. | 4 |
| 5 | General Procedure for Conducting Sensory Tests | • General steps:<br>- Food sample preparation.<br>- Presentation of samples.<br>- Taste threshold.<br>- Use of reference samples.<br>- Preparation of mastersheet.<br>- Evaluation and data analysis. | 2 |
| 6 | Measuring Responses and Judging Quality | • Introduction, classification, grading, ranking, scaling-category, line and magnitude estimation.<br>• Conditions, requirements, preparing evaluation cards. | 2 |
| 7 | Sensory Evaluation Methods | • Introduction, objective, principles, examples of conducting test and statistical analysis applicable for each test.<br>- Overall difference test: (i) paired comparison test, (ii) duo-trio test, (iii) triangle test, (iv) other tests (introduction and application only): two out of five, same/difference test, A / not A test, difference from control test, sequential test. [2 h]<br>- Attribute/quantitative difference tests: (i) paired comparison design, (ii) pairwise ranking test, (iii) multi-sample difference test (ranking, rating, completely randomized block design (CRBD), balanced incomplete block design (BIBD). [2 h]<br>- Sensitivity test: (i) threshold (ii) dilution. [1 h]<br>- Descriptive analysis (definition, field of application, components): (i) flavor profile method, (ii) texture profile method, (iii) quantitative descriptive analysis (QDA) method, (iv) time-intensity descriptive analysis (DA), (v) free-choice profiling. [2 h]<br>- Affective test: consumer test and in-house panel acceptance test (applications, consumers/subjects, test location, design and examples) (i) qualitative tests (ii) quantitative: (a) preference test (b) acceptance test. [2 h]<br>- Guidelines for choice of techniques/methods; general instructions for conducting different tests. [1 h]<br>- Sensory lexicon development for indigenous foods. [1 h] | 11 |
| 8 | Planning | - Planning a sensory experiment or project. | 1 |
| 9 | Data Analysis and Reporting | - Methods for analysis of sensory evaluation data:<br>- Basic and advanced statistical methods (Ref. BFT 104).<br>- Chemometric technique for sensory data analysis (objective, applications and benefits); appropriate techniques (principal component analysis (PCA), partial least square (PLS) regression, cluster analysis).<br>- Purpose and guidelines for writing sensory evaluation reports | 3 |
| | | Total | 32 |

Reference materials


1. Burgård, D.R. and Kuznicki, J.T. (1990). "Chemometrics: Chemical and Sensory Data". Boca Raton: CRC Press. [ISBN 978-0849348648]
2. Clark, S., Costello, M., Drake, M.A. and Bodyfelt, F. (2009). "The Sensory Evaluation of Dairy Products" (2nd ed.), New York: Springer. [ISBN 978-1489998422]
3. Heintz, C.M. and Kader, A.A. (1983). Procedure for sensory evaluation of horticultural crops. *In:* "Sensory Evaluation Procedures". UC Davis, California. [ISBN not available]
4. Kemp, S.E., Hollowood, T. and Hort, J. (2009). "Sensory Evaluation. A Practical Handbook". Oxford, Wiley-Blackwell. [ISBN 978-1405162104]
5. Larmond, E. (1977). "Laboratory Methods for Sensory Evaluation of Food". Ottawa: Minister of Supply and Services, Canadian Government Publishing Centre. [ISBN 978-0662012719]
6. Lawless, H.T. (2013). "Laboratory Exercises for Sensory Evaluation". New York: Springer Science+Business Media. [ISBN 978-1461456827]
7. Mabesa, L.B. (1986). "Sensory Evaluation of Foods: Principles and Methods". University of the Philippines at Los Baños. [ISBN not available]
8. Marsili, R. (2007). "Sensory-Directed Flavor Analysis". New York: CRC Press, Taylor and Francis. [ISBN 978-0367390396]
9. Mason, R. and Nottingham, S. (2002). "Sensory Evaluation Manual". Workshop manual used in FOOD 3007 and FOOD 7012 courses. University of Queensland and Naresuan University. Available at: https://www.researchgate.net/file.PostFileLoader.html?id=576e6a5d48954cbc5d621e46&assetKey=AS%3A376827064406016%401466853981385.
10. Meilgaard, M.C., Civille, G.V. and Carr, B.T. (2015). "Sensory Evaluation Techniques" (5th ed.), Boca Raton, CRC Press. [ISBN 978-1482216905].
11. Stone, H. and Sidel, J.L. (2004). "Sensory Evaluation Practices" (3rd ed.), San Diego, Elsevier Academic Press. [ISBN 978-0126726909].
12. Watts, B.M., Ylimaki, G.L., Jeffery, L.E. and Elias, L.G. (1989). "Basic Sensory Methods for Food Evaluation". Ottawa, International Development Research Centre. [ISBN 978-0889365636].

| | | |
|---|---|---|
| Course: Sensory Assessment | Course Code: BFT 304 (B) | Credit Hour: 1 |
| Semester: V | Teaching hours: 64 | Full Marks: 25 |
| Nature of Course: Practical | (Lab; 4 h per session) | |

List of practical for laboratory session

1. Introduction, objectives and scope of practical work; and general instruction for students: guide for participation, option for individual or partner work; Report format- lab, industry and R & D; and Instruction to instructor-teacher or teaching assistant.
2. Screening panelists using simple sensory test: (1) odor identification and (2) ranking test
3. Comparison of discrimination test methods: triangle test, paired comparison, etc., using different food products.
4. Forced-choice threshold using an ascending method of limit.
5. Signal detection theory and the effect of criterion on response.
6. Determining sweetness of fructose and sucrose by different scaling methods.
7. Carrying descriptive analysis of given fruit juice.
8. Using reference standard in panel training with different options
9. Carrying preference and acceptance test of different food products – hedonic test and like or dislike.
10. Group exercise in descriptive analysis.
11. Planning for sensory evaluation of a product or panel training.
12. Developing a procedure for discrimination test of new product.
13. Calculating (i) mean, standard deviation and standard error of sensory data, (ii) binomial based statistic for discrimination test, (iii) t-test, (iv) simple correlation, (v) one-way and two-way ANOVA, (vi) rank order test using sample problem set for statistic given.

**Unit wise marks distribution for the final exam**

| Unit | Title | Total (%) |
|---|---|---|
| 1 | Introduction | 5 |
| 2 | Sensory attributes and human senses in sensory evaluation | 15 |
| 3 | Laboratory setup and facilities | 10 |
| 4 | Selection and training of panelists | 10 |
| 5 | General procedure for conducting sensory tests | 5 |
| 6 | Measuring responses and judging quality | 5 |
| 7 | Sensory evaluation methods | 35 |
| 8 | Planning | 5 |
| 9 | Data analysis and reporting | 10 |
| | **Total** | **100%** |

Institute of Science & Technology
Dean's Office
Kirtipur 2045

| Course: Dairy Technology - I | Course Code: BFT 305 (A) | Credit Hour: 2 |
|---|---|---|
| Semester: V | Teaching hours: 32 | Full Marks: 50 |
| Nature of Course: Theory | (2 lecture hours per week) | |

Course description and objectives

Dairy Technology-I provides a comprehensive introduction to the fundamental aspects of milk and dairy science. The course explores milk secretion and synthesis, focusing on the physiological processes involved in milk production. Students will study the chemistry and physicochemical properties of milk, its composition, nutritional value, and factors influencing milk yield. Additionally, the course covers the scope and field of dairy technology, highlighting its importance in food science and industry applications.

Course detail

| Unit | Content | Details of content | Teaching hours |
|---|---|---|---|
| 1 | General Aspects of Milk | • General introduction; history of dairy industry in Nepal.<br>• Proximate composition of milk; major and minor constituents; differences between milk produced from different herds.<br>• Biosynthesis and secretion of milk; factors affecting the composition of milk; factors influencing the milk yield. | 3 |
| 2 | Physico-chemical Properties of Milk | • Color, flavor, density and specific gravity, specific heat capacity, freezing point, boiling point, acidity and pH, surface tension, viscosity, redox-potential, refractive index, adhesiveness, action of milk on metals.<br>• Processing implications; changes during processing. | 2 |
| 3 | Milk Components | • Water: free, bound and crystallized water<br>• Carbohydrates: chemical properties of lactose, physicochemical aspects of lactose, lactic acid fermentation.<br>• Milk fat: composition, properties, autooxidation, crystallization; fat globules: emulsion stability, interaction with air bubbles, creaming, lipolysis.<br>• Milk protein: chemistry, structure, casein and its precipitation; casein micelles: description, models, colloidal stability; whey proteins: composition, characteristics, differences between casein and whey proteins.<br>• Milk enzymes: activity and inactivation.<br>• Milk salts: composition and distribution among the phase, properties of salt solution, colloidal calcium phosphate, changes in salts.<br>• Other components: natural components, contaminants, radionuclides, flavor components, pigments (carotenoids, riboflavin). | 10 |
| 4 | Microbiology of Milk | • General aspects, milk as a substrate for bacteria.<br>• Undesirable microorganisms: spoilage and pathogenic microorganisms.<br>• Sources of contamination (microorganisms present in the udder, contamination during and after milking).<br>• Measures against contamination. | 2 |

Continued ....

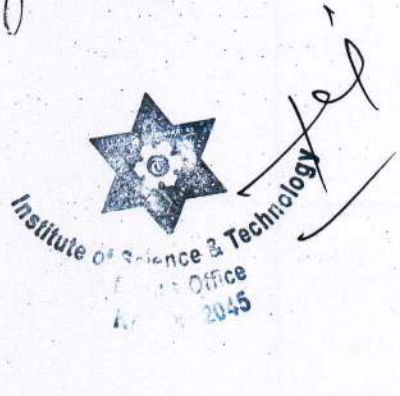
Institute of Science & Technology
Dean's Office
Kirtipur 2045

कीर्तिपुर

| | | | |
|---|---|---|---|
| 5 | Milk Processing Operations | • Milk collection and reception, platform and quality tests (including adulteration test), storage and transport of milk in dairy.<br>• Filtration and clarification: centrifugal clarifier and membrane filtration process.<br>• Standardization: batch and continuous.<br>• Homogenization: theory, type, and operation of homogenizer, effects of homogenization, stability, creaming.<br>• Heat treatment: objectives, changes caused by heating; pasteurization: types, batch and continuous process, HTST, UHT; sterilization: types, batch and continuous process.<br>• Cooling, filling operation, packaging. | 15 |
| | | Total | 32 |

Reference materials


1. Britz, T. J. and Robinson, R. K. (2008). "Advanced Dairy Science and Technology" (1st ed.). Wiley-Blackwell. UK. [ISBN 978-1405136181].
2. Bylund, G. (2003). "Dairy Processing Handbook" (2nd ed.). Tetra Pak Processing Systems AB. Sweden.
3. De, S. K. (1991). "Outlines of Dairy Technology". Oxford University Press. India. [ISBN 978-0-19-561194-6].
4. Fox, P. F., Uniacke-Lowe, T., McSweeney, P. L. H. and O'Mahony, J. A. (2015). "Dairy Chemistry and Biochemistry" (2nd ed.). Springer. Switzerland. [ISBN 978-3-319-14892-2].
5. Huppertz, T. (2025). "Dairy Science and Technology" (3rd ed.). CRC Press. Boca Raton. [ISBN 9781003271765].
6. McSweeney, P. L. H and McNamara, J. P (2022). "Encyclopedia of Dairy Sciences" (3rd ed.). Elsevier. USA. [ISBN978-0-12-818766-1].
7. Kessler, H.G. (2002). "Food and Bioprocess Engineering: Dairy Technology" (5th ed.). Verlag A. Kessler. Germany, [ISBN 9783980237857].
8. Ozer, B. and Akdemir-Evrendilek, G. (2014). "Dairy Microbiology and Biochemistry: Recent Developments" (1st ed.). CRC Press. Boca Raton. [ISBN 9781482235029].
9. Papademas, P. (2020). "Dairy Microbiology: A Practical Approach" (1st ed.). CRS Press. Boca Raton. [ISBN 978-0367738693].
10. Truong, T., Lopez, C., Bhandari, B., Prakash, S. (2020). "Dairy Fat Products and Functionality". Springer. Switzerland. [ISBN 978-3-030-41661-4].
11. Varnam, A. H. and Sutherland, J. P. (2001). "Milk and Milk Products: Technology, Chemistry and Microbiology". Aspen Publishers. Gaithersburg. [ISBN 0-8342-1955-7].
12. Walstra, P., Wouters, J. T. M. and Geurts, T. J. (2006). "Dairy Science and Technology" (2nd ed.). CRC Press. BocaRaton. [ISBN 0-8247-2763-0]


| | | |
|---|---|---|
| Course: Dairy Technology - I<br>Semester: V<br>Nature of Course: Practical | Course Code: BFT 305 (B)<br>Teaching hours: 64<br>(Lab: 4 h per session) | Credit Hour: 1<br>Full Marks: 25 |

List of practical for laboratory session

1. Study of milk processing equipment in nearby milk industries.
2. Study of milk sampling techniques.
3. Platform testing of milk: Physical test: sediment, organoleptic, lactometer, COB, alcohol test, specific gravity, freezing point, SNF/TS, Chemical test: acidity, water, fat, protein, lactose, Microbiological test.
4. Quality testing of raw and processed milk.
5. Detection of adulteration of milk.
6. Adequacy of milk pasteurization by phosphatase test.
7. Cream separation and estimate the efficiency of cream separator.

Unit wise marks distribution for the final exam

| Unit | Title | Total (%) |
|---|---|---|
| 1 | General aspects of milk | 15 |
| 2 | Physico-chemical properties of milk | 10 |
| 3 | Milk components | 25 |
| 4 | Microbiology of milk | 10 |
| 5 | Milk processing operations | 40 |
| | **Total** | **100%** |

Institute of Science & Technology
Dean's Office
Kirtipur 2045

नगर कार्यपालिकाको कार्यालय
कीर्तिपुर

| | | |
|---|---|---|
| Course: Meat Technology - I | Course Code: BFT 306 (A) | Credit Hour: 2 |
| Semester: V | Teaching hours: 32 | Full Marks: 50 |
| Nature of Course: Theory | (2 lecture hours per week) | |

Course description and objectives

Meat Technology-I introduce students to the fundamental aspects of meat, fish, and poultry science. The course covers global and Nepalese perspectives on livestock, fish, and poultry production, along with the role of livestock-based industries in Nepal. Students will explore national regulations governing meat production and food safety. Additionally, the course delves into the general principles of meat animal slaughter and inspection, muscle structure, chemical composition, nutritional value, and grading standards. Egg quality assessment, structure, spoilage factors, meat quality evaluation, and various preservation techniques are also included.

Course detail

| Unit | Content | Details of content | Teaching hours |
|---|---|---|---|
| 1 | Introduction to Meat, Fish, and Poultry Industry | • Definitions of meat, fish, and poultry.<br>• Overview of Nepalese and global meat, fish, and poultry production.<br>• Economic and social significance of livestock-based industries in Nepal. | 2 |
| 2 | Regulations and Quality Control of Meat | • Slaughterhouse specification and Meat Inspection Regulation (Nepal). [1 h]<br>• Meat inspection systems and role of regulatory agencies (e.g., USDA, FDA). [1 h] | 2 |
| 3 | Slaughtering and Inspection | • General principles and steps of slaughter. [5 h]<br>• Zoonotic disease [1 h]<br>• Ante- and post-mortem inspection of meat. [2 h]<br>• USDA grades of livestock and meat animals. [2 h] | 10 |
| 4 | Structure, Composition and Nutritive Value of Meat | • Structure and types of muscles. [1 h]<br>• Major muscle systems and muscle contractions. [1 h]<br>• Chemical composition and nutritive value of meat. [2 h] | 4 |
| 5 | Post-slaughter Changes in Meat | • Normal and abnormal changes in meat. [3 h] | 3 |
| 6 | Egg Structure and Quality Assessment | • Egg formation, structure and composition. [2.5 h]<br>• Visual and instrumental grading of eggs. [1.5 h] | 4 |
| 7 | Meat and Egg Spoilage and Preservation | • Spoilage mechanisms (microbial, biochemical, physical). [2 h]<br>• Preservation methods: chilling, freezing, drying, curing, smoking, irradiation, vacuum packaging. [4 h]<br>• Storage and shelf-life enhancement. [1 h] | 7 |
| | | Total | 32 |

Reference materials


1. Hui, Y.H. (2012). "Handbook of Meat and Meat Processing". CRC Press, Boca Raton, Florida, USA. [ISBN 978-1-4398-3683-5].
2. Kerry, J.P., Kerry, J.F. and Ledward, D. (2002). "Meat Processing: Improving Quality". Elsevier, Cambridge, UK. [ISBN 1-85573-583-0].
3. Ninios, T., Lundén, J., Korkeala, H. and Fredriksson-Ahomaa, M. (2014). "Meat Inspection and Control in the Slaughterhouse". John Wiley and Sons, Hoboken, New Jersey, USA. [ISBN 978-1-118-52586-9].
4. Nollet, L.M.L. (2008). "Handbook of Meat, Poultry and Seafood Quality". John Wiley and Sons, Hoboken, New Jersey, USA. [ISBN 978-0-470-27782-9].
5. Stadelman, W.J., Newkirk, D. and Newby, L. (2017). "Egg Science and Technology". CRC Press, Boca Raton, Florida, USA. [ISBN 1-56022-855-5].
6. Toldrá, F. (2022). "Lawrie's Meat Science". Woodhead Publishing, Cambridge, UK. [ISBN 978-0-323-85408-5].
7. Warriss, P.D. (2010). "Meat Science: An Introductory Text". CABI, Wallingford, Oxfordshire, UK. [ISBN 978-1-84593-593-...].

| | | |
|---|---|---|
| Course: Meat Technology - I | Course Code: BFT 306 (B) | Credit Hour: 1 |
| Semester: V | Teaching hours: 64 | Full Marks: 25 |
| Nature of Course: Practical | (Lab: 4 h per session) | |

List of practical for laboratory session

1. Introduction to laboratory safety and hygiene practices in meat laboratory.
2. Observation of slaughtering process of major meat animals (pig and buffalo) and poultry.
3. Identification of different meat cuts from major meat animals (pig and buffalo) and poultry.
4. Determination of pH and water holding capacity of meat.
5. Estimation of moisture, protein, fat, and ash content in meat
6. Determination of egg quality (candling test, Haugh unit and yolk index).
7. Demonstration of meat preservation methods (chilling, freezing, curing, etc.)
8. Packaging and labeling of meat and meat products.
9. Evaluation of sensory attributes of meat products.
10. Visit to the nearby slaughterhouse or meat processing facilities.

**Unit wise marks distribution for the final exam**

| Unit | Title | Total (%) |
|---|---|---|
| 1 | Introduction to meat, fish, and poultry industry | 5 |
| 2 | Regulations and quality control of meat | 5 |
| 3 | Slaughtering and inspection | 30 |
| 4 | Structure, composition and nutritive value of meat | 15 |
| 5 | Post-slaughter changes in meat | 10 |
| 6 | Egg structure and quality assessment | 15 |
| 7 | Meat and egg spoilage and preservation | 20 |
| | Total | 100% |

Institute of Science & Technology
Dean's Office
Kirtipur 2045

| Course: Fruits and Vegetables, Tea, Coffee and Spices | Course Code: BFT 351 (A) | Credit Hour: 3 |
|---|---|---|
| Semester: VI | Teaching hours: 48 | Full Marks: 75 |
| Nature of Course: Theory | (3 lecture hours per week) | |

Course description and objectives

This course explores postharvest handling, processing technologies, and value addition in fruits, vegetables, tea, coffee, and spices. Students will learn about fruit ripening physiology, storage methods, and preservation techniques. Processing topics include fruit juice and concentrate production, preserves and crystallized fruits, pectin manufacture, and vinegar utilization. The course also covers tomato-based products, chutneys, sauces, pickles, and sustainability through byproduct utilization. Emphasis is placed on nutritional aspects and advanced packaging methods, including aseptic processing for fruit beverages. Hands-on lab sessions complement theoretical learning.

Course detail

| Unit | Content | Details of content | Teaching hours |
|---|---|---|---|
| 1 | Introduction to Fruits and Vegetables and their Postharvest Physiology | • **Definition, types and difference between fruits and vegetables.**<br>• **Physicochemical and structural properties of fruits and vegetables.**<br>• **Importance of fruits and vegetables in human.**<br>• **Postharvest physiological processes:**<br>- Ontogeny.<br>- Respiration.<br>- Transpiration and water stress.<br>- Ripening and senescence.<br>- Phytochrome effects<br>• **Factors affecting quality:**<br>- Preharvest factors.<br>- Harvesting factors.<br>- Postharvest factors. | 4 |
| 2 | **Maturity, Harvesting, Postharvest Handling and Treatments of Fruits and Vegetables; Fresh Produce Storage and Fruit Ripening** | • **Definition, types and desirable characteristics of maturity indices.**<br>• **Methods of predicting maturity:** computational, physical, chemical and physiological.<br>• **Methods of harvesting.**<br>• **Post-harvest handling operations:** sorting and grading, packaging, transportation, precooling (definition, objectives, and methods).<br>• **Postharvest treatments:** a brief introduction to physical (heat, edible coating, irradiation), chemical (antimicrobial and anti-browning agents, nitric oxide, sulfur dioxide) and gaseous treatments (ozone, ethylene, 1-methylcyclopropene)<br>• **Storage systems:** room temperature, low temperature and gas storage.<br>• **Fruit ripening by ethylene and calcium carbide treatments.**<br>• **Water loss:** basic principles. affecting factors and water loss control. | 5 |

Continued ....

| | | | |
|---|---|---|---|
| 3 | Fruit Juice Production | • Steps involved in fruit juice production: extraction methods; juice clarification (physical, chemical and enzymatic methods); preservation of fruit juices (pasteurization, chemical treatments, freezing, carbonation); production of apple and orange juices.<br>• Juice concentrates and powders: definition, methods of concentration and drying.<br>• Definitions and methods of preparation of dilutables and ready-to-serve (RTS) drinks: cordials, squash, nectar.<br>• Aseptic processing. | 3 |
| 4 | Novel Packaging Systems for Fruits and Vegetables | • General introduction and systems for active and intelligent packaging: oxygen scavenging, moisture regulating, carbon dioxide generating and scavenging, ethylene scavenging and blocking, antimicrobial packaging, integrity indicator, ripeness indicator, time temperature indicator. | 2 |
| 5 | Preserves, Candied and Crystallized Fruits | • Preserves: definition, preliminary processing, syrup treatments, cooling, and packaging; improvement in preserve manufacturing.<br>• Candied and crystallized fruits: definition and method of preparation.<br>• Fruit leather: definition and method of preparation. | 2 |
| 6 | Pectin Manufacture | • Pectin production process from apple and citrus fruits; uses of pectin.<br>• Standardization and characterization of pectin. | 2 |
| 7 | Tomato Products | • Requirements for high-quality tomato juice production<br>• Definition and production processes of tomato juice, pulp, paste and ketchup. | 2 |
| 8 | Chutneys, Sauces and Pickles | • Chutneys: definition and general method of preparation; process flow chart for apple and mango chutneys production.<br>• Sauces: definition, general method of preparation of thin and thick sauces, process flow chart for apple sauce production.<br>• Pickles: definition, raw materials and their roles, pickling process, process flow chart for mango pickle production. | 2 |
| 9 | Vinegar | • Definition, types, raw material preparation, fermentation, clarification and storage.<br>• Current industrial methods of vinegar production, post-production processes.<br>• Process flow chart for the production of malt and apple cider vinegars. | 2 |
| 10 | Fruits and Vegetables By-Products | • Utilization of various waste materials from different sources, viz., apple, grape, jack fruit, mango, pineapple, tomato, citrus fruits, banana, papaya, etc. | 1 |

Continued ..

| | | | |
|---|---|---|---|
| 11 | Coffee Technology | • Definition and classification, cultivation and production in Nepal.<br>• Green coffee production methods: dry and wet processing, coffee beans grading, terminologies used in coffee processing, green coffee beans defects.<br>• Packaging and storage of green and roasted coffee beans.<br>• Quality evaluation of coffee: green coffee, roasted coffee and cup.<br>• Chemical composition of green and roasted coffee beans.<br>• Coffee roasting: introduction, industrial roasters (traditional, fluidized bed and packed bed), coffee roasting stages and characteristics of coffee beans during roasting, changes during coffee roasting.<br>• Decaffeinated and instant coffee: definition, production methods. | 8 |
| 12 | Tea Technology | • Definition and classification of tea, tea cultivation and production in Nepal.<br>• Tea manufacturing process.<br>• Black tea manufacturing:<br>- Tea leaf plucking: methods, standard, chemical composition of tea leaf.<br>- Withering: definition, objectives, methods, changes during withering, requirements for optimum withering, assessment of withering, affecting factors.<br>- Maceration / rolling of tea leaves: definition, objectives, methods of rolling.<br>- Fermentation (oxidation): introduction, objectives, methods, formation of TF and TR, biochemical changes, affecting factors, assessment of fermentation.<br>- Drying / firing: objectives, methods.<br>- Cleaning and grading of made tea.<br>- Chemical composition and compounds responsible for flavor, color and taste of black tea.<br>- Packaging and storage requirements.<br>• Green and semi-fermented teas: introduction, manufacturing process (process flow chart only), health benefits.<br>• Instant and decaffeinated teas: introduction, production process (process flow diagram only).<br>• Quality evaluation of tea. | 9 |
| 13 | Spices Technology | • Definition of spices and condiments, classification and uses of spices.<br>• Ginger, large cardamom, turmeric, black pepper, and chilli: introduction, chemical composition (raw and dried), maturity indices, harvesting, post-harvest technology, quality factors, packaging and storage, uses, adulteration.<br>• Pungency measurement in spices (subjective and objectives methods).<br>• Volatile oil and oleoresin: definition, production methods, chemical composition. | 6 |
| | | Total | 48 |

Reference materials


1. Bekatorou, A. (2020). "Advances in Vinegar Production". CRC Press Taylor and Francis Group, USA. [ISBN 978-0-8153-6599-0].
2. Clarke, R.J. and Macrae, R. (1985). "Coffee (Vol. 1): Chemistry" (1st ed.). Elsevier Science Publishers Ltd. USA. [ISBN 978-94-010-8693-6].


Institute of Science & Technology
Dean's Office
Kirtipur 2045

3. Gaikwad, K.K. and Singh, S. (2025). "Novel Packaging Systems for Fruits and Vegetables" (1st ed.), Apple Academic Press Inc., USA. [ISBN 978-1003415701].
4. Gould, W.A. (1992). "Tomato Production, Processing and Technology" (3rd ed.), CTI Publications Inc., USA. [ISBN 0-930027-18-3].
5. Hara, Y. (2001). "Green Tea: Health Benefits and Applications", Marcel Dekker, Inc., New York, USA. [ISBN 0-8247-0470-3].
6. Harbowy, M.E. and Lipton, D.A.B. (1997). "Tea Chemistry: Critical Review". Plant Sciences, 16(5): 415–480. [doi: 10.1080/07352689709701956].
7. Hui, Y.H. and Evranuz, E.O. (2016). "Handbook of Vegetable Preservation and Processing" (2nd ed.), CRC Press, USA. [ISBN 978-1-4822-1229-7].
8. Lal, G., Siddappa, G.S. and Tandon, G.L. (1960). "Preservation of Fruits and Vegetables". Indian Council of Agricultural Research, India. [ISBN 978-81-7164-090-4].
9. Nelson, P. and Tressler, D.K. (1980). "Fruit and Vegetable Juice Processing Technology" (3rd ed.), The AVI Publishing Company Inc., USA. [ISBN 978-0-87055-362-2].
10. Nsanzabera, F., Nduwayezu, B., Irakoze, E., Mwiseneza, A., Mubashankwaya, I., Manishimwe, A., Nsengiyumva, J.B. and Nkurikiyimana, F. (2024). "Biochemistry of Tea Leaves and Tea Processing Technology". *Univ. J. Agric. Res.* 12(5): 615–628. [doi: 10.13189/ujar.2024.12050].
11. Parthasarathy, V.A., Chempakam, B. and Zachariah, T.J. (2008). "Chemistry of Spices". CAB International, UK. [ISBN 978-1-84593-405-7].
12. Paudel, S. and Sherma, G. (2023). "Technology of Food Products – II: Fruits and Vegetables, Tea, Coffee and Spices, Confectionery" (1st ed.), Samudayik Prakashan Pvt. Ltd., Itahari, Sunsari, Nepal. [ISBN 987-9937-1-3924-3].
13. Rahman, M.S. (2007). "Handbook of Food Preservation" (2nd ed.), CRC Press Taylor and Francis Group, USA. [ISBN 1-57444-606-1].
14. Ranganna, S. (1986). "Handbook of Analysis and Quality Control for Fruit and Vegetables Products" (2nd ed.), Tata McGraw-Hill Publishing, India. [ISBN 978-0-07-451851-9].
15. Salunkhe, D.K. (1974). "Storage, Processing, and Nutritional Quality of Fruits and Vegetables". CRC Press, Inc., Ohio, USA. [ISBN 0-87819-125-9].
16. Verma, L.R. and Joshi, V.K. (2000). "Postharvest Technology of Fruits and Vegetables (Vol. 1)". Indus Publishing Company, New Delhi, India. [ISBN 978-81-7387-108-5].
17. Walter, R.H. (1991). "The Chemistry and Technology of Pectin". Academic Press Limited, London, UK. [ISBN 0-12-733870-5].
18. Wills, R.B.H., Lee, T.H., Gram, D., McGlasson, W.B. and Hall, E.G. (1982). "Postharvest: An Introduction to the Physiology and Handling of Fruit and Vegetables" (2nd ed.), The AVI Publishing Company Inc., USA. [ISBN 0-87055-402-6].

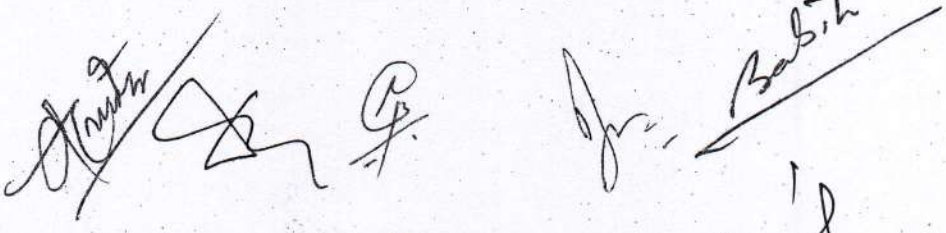
| | | |
|---|---|---|
| Course: Fruits and Vegetables, Tea, Coffee and Spices<br>Semester: VI<br>Nature of Course: Practical | Course Code: BFT 351 (B)<br>Teaching hours: 64<br>(Lab: 4 h per session) | Credit Hour: 1<br>Full Marks: 25 |

List of practical for laboratory session

1. Extraction, estimation, characterization and grading of pectin from citrus fruits and apple.
2. Determination of lycopene, chlorophyll (total, chl *a* and chl *b*) in fruits and vegetables.
3. Preparation of fruit juice concentrates and measurement of non-enzymatic browning.
4. Clarification of juices using enzymes and chemicals (bentonite and tannin-gelatin).
5. Preparation of squash, nectar, cordials and RTS.
6. Preparation of tomato ketchup, preserves and candied fruit.
7. Preparation, preservation and quality analyses of fruit and vegetable juices.
8. Determination of volatile oil, oleoresin and pungency of spices.
9. Preparation and quality evaluation of tea and coffee.
10. Determination of theaflavin (TF) and thearubigin (TR), tannins, caffein, total phenolics, total flavonoids, antioxidant activity in tea, coffee and spices.

**Unit wise marks distribution for the final exam**

| Unit | Title | Total (%) |
|---|---|---|
| 1 | Introduction to fruits and vegetables and their postharvest physiology | 5 |
| 2 | Maturity, harvesting, postharvest handling and treatments of fruits and vegetables, fresh produce storage and fruit ripening | 15 |
| 3 | Fruit juice production | 10 |
| 4 | Novel packaging systems for fruits and vegetables | 10 |
| 5 | Preserves, candied and crystallized fruits | 5 |
| 6 | Pectin manufacture | 5 |
| 7 | Tomato products | 5 |
| 8 | Chutneys, sauces and pickles | 5 |
| 9 | Vinegar | 5 |
| 10 | Fruits and vegetables by-products | 15 |
| 11 | Coffee technology | 20 |
| 12 | Tea technology | |
| 13 | Spices technology | 20 |
| | **Total** | **100%** |



| Course: Biochemical Engineering - II | Course Code: BFT 352 (A) | Credit Hour: 2 |
|---|---|---|
| Semester: VI | Teaching hours: 32 | Full Marks: 50 |
| Nature of Course: Theory | (2 lecture hours per week) | |

Course description and objectives

Biochemical Engineering - II is an advanced course that builds upon the foundational knowledge gained in Biochemical Engineering – I. this course focuses on detailed fermenter design and scale-up, Instrumentation and process control, Media formulation and sterilization, downstream processing for cells, metabolites, and enzymes, basics of enzyme engineering, as well as essentials of water and effluent engineering.

Course detail

| Unit | Content | Details of content | Teaching hours |
|---|---|---|---|
| 1 | Scale-up of Fermenter | • Physical and biological concept of scale-up.<br>• Scale-up on various bases (on equal power per unit volume of liquid, volumetric oxygen transfer coefficient, liquid mixing time, impeller tip speed). | 3 |
| 2 | Effluent Treatment and Management | • Type of wastes.<br>• Factors and parameters measuring the strength of water pollution (DO, BOD, COD, TOC, etc.).<br>• Factors affecting the Dissolved oxygen concentration in water body.<br>• Wastewater characteristics (physical, chemical and biological), disposal of wastes and effluents (steps and process).<br>• Fundamentals of biological waste treatment processes (aerobic, anaerobic), unit operations of each treatment process.<br>• Activated sludge process, trickling filter process, lagoon, rotating disc (conventional and modification).<br>• Factors affecting the efficiency of biological treatment process.<br>• Sludge volume index and its importance.<br>• Nitrification and denitrification process.<br>• Sludge treatment process and steps. | 9 |
| 3 | Microbial Cultivation System | • Growth curve in batch and continuous culture.<br>• Kinetics of batch cultivation system.<br>• Kinetics of continuous cultivation system (chemostat).<br>• Kinetics of feedback cultivation system.<br>• Kinetics of fed-batch cultivation system.<br>• Comparison of each system based on the productivity.<br>• Effect of dilution rate on steady state biomass and residual limiting substrate concentration.<br>• Effect of initial limiting substrate concentration on wash-out point. | 6 |
| 4 | Instrumentation and Process Control in Fermentation | • Introduction.<br>• Instrumentation of bio-processes or fermentation – process variables and sensors.<br>• Control of bioprocesses, including pH, temperature, dissolved oxygen (DO), respiratory quotient (RQ), pH Stat, DO Stat.<br>• Advanced control of bioprocesses or fermentation including application of artificial intelligence (AI) technology. | 4 |

Continued ....

| | | | |
|---|---|---|---|
| 5 | Production, Recovery and Purification of Microbial Products | • Introduction.<br>• Solid state and submerged stated fermentation.<br>• Steps in downstream processing.<br>• Stages in the recovery of product from a harvested broth.<br>• Recovery of particulates (cells and solid particles): foam separation, filtration, centrifugation, sedimentation, emerging technologies.<br>• Cell disruption: physical, mechanical, chemical and biological methods.<br>• Primary isolation: extraction (liquid-liquid, two phase aqueous and SCF extraction) and sorption.<br>• Precipitation (kinetics of precipitate formation), membrane separation.<br>• Sophisticated techniques (chromatography, fixed-bed adsorption).<br>• Enzyme production, isolation and purification techniques. | 4 |
| 6 | Enzyme Immobilization and Enzyme Engineering | • Definition, principles, techniques and importance.<br>• Carrier material (types and characteristics) and its presentment before immobilization.<br>• Kinetics of immobilized enzyme system, configuration of immobilized enzyme system.<br>• Application of immobilized systems.<br>• Enzyme engineering: definition, advantages, techniques and steps. | 3 |
| 7 | Genetic Engineering | • Fundamentals of genetic engineering.<br>• Genetic modification techniques.<br>• Genetic editing, genome sequencing, and bio-informatics.<br>• Agricultural biotechnology: developing GMOs and improving agriculture practices.<br>• Environmental biotechnology: utilizing genetic engineering for waste management and pollution control.<br>• Application of genetic engineering for the production of enzymes, biofuels and other industrial products. | 3 |
| | | Total | 32 |

**Reference materials**


1. Aiba, S., Humphrey, A.E. and Millis, N.F. (1973). "Biochemical Engineering" (2nd ed.), Academic Press Inc., USA. [ISBN 978-0-12-044250-6].
2. Bailey, J.E. and Ollis, D.F. (2010). "Biochemical Engineering Fundamentals" (2nd ed.), Tata McGraw-Hill Publishing Company Limited, India. [ISBN 978-0-07-070123-7].
3. Geankoplis, C.J. (2003). "Transport Processes and Separation Process Principles (Includes Unit Operations)" (4th ed.), Prentice Hall, USA. [ISBN 978-0-13-101367-4].
4. Katoh, S., Horiuchi, J. and Yoshida, F. (2005). "Biochemical Engineering: A Textbook for Engineers, Chemists and Biologists". (2nd Completely Revised and Enlarged ed.), Wiley-VCH Verlag GmbH & Co. KGaA, Germany. [ISBN 978-3-527-31318-7].
5. Shuler, M.L. and Kargi, F. (2008). "Bioprocess Engineering: Basic Concepts" (2nd ed.), Eastern Economy Edition, Prentice-Hall of India Pvt. Ltd., India. [ISBN 978-81-203-3547-0].
6. Stanbury, P.F., Whitaker, A. and Hall, S.J. (2003). "Principles of Fermentation Technology" (2nd ed.), Elsevier, a division of Reed Elsevier India Private Limited, India. [ISBN 978-0-08-056501-6].


Institute of Science & Technology
Dean's Office
Kirtipur 2045

| | | |
|---|---|---|
| Course: Biochemical Engineering - II<br>Semester: VI<br>Nature of Course: Practical | Course Code: BFT 352 (B)<br>Teaching hours: 64<br>(Lab: 4 h per session) | Credit Hour: 1<br>Full Marks: 25 |

List of practical for laboratory session

1. Measurement of dissolved oxygen concentration (DO) by azide modification method.
2. Measurement and comparison of dissolved oxygen concentration (do) by Winkler's iodometric and azide modification method.
3. Measurement of chemical oxygen demand (COD) of an effluent.
4. Measurement of 5-day biological oxygen demand ($BOD_5$) of an effluent
5. Preparation of immobilized enzyme/cell beads using yeast sodium alginate and calcium chloride.
6. Preparation of immobilized enzyme/cell in gel lattice.
7. Study on the kinetic of immobilized enzyme.
8. Study on the effect of the dilution rate on the steady state residual limiting substrate concentration and biomass concentration
9. Scale-up of a fermenter from lab scale to pilot scale or pilot scale to industrial scale – data calculations (on various basis)
10. Extraction of DNA from microbial cells.
11. Study on the disintegration of cell.
12. Measurement of volumetric oxygen transfer coefficient ($K_La$).

**Unit wise marks distribution for the final exam**

| Unit | Title | Total (%) |
|---|---|---|
| 1 | Scale-up in fermentation | 10 |
| 2 | Effluent treatment and management | 30 |
| 3 | Microbial cultivation system | 20 |
| 4 | Instrumentation and process control in fermentation | 10 |
| 5 | Production, recovery and purification of microbial products | 10 |
| 6 | Enzyme immobilization and enzyme engineering | 10 |
| 7 | Genetic engineering | 10 |
| | Total | 100% |

| Course: Food Safety and Security | Course Code: BFT 353 (A) | Credit Hour: 2 |
|---|---|---|
| Semester: VI | Teaching hours: 32 | Full Marks: 50 |
| Nature of Course: Theory | (2 lecture hours per week) | |

Course description and objectives

This course explores key principles of food safety and security, focusing on risk assessment, hazard control, foodborne illnesses, regulatory frameworks, and sustainability in food systems. Students will examine food contamination sources, microbiological risks, and emerging challenges in ensuring safe and secure food supply chains. Special attention will be given to antimicrobial resistance (AMR), studying its impact on food production, public health, and global food security. The course integrates scientific, technological, and policy aspects of food safety while emphasizing preventive strategies, sustainable solutions, and international food regulations.

Course detail

| Unit | Content | Details of content | Teaching hours |
|---|---|---|---|
| 1 | Introduction | • Introduction to food safety in agri-food chain.<br>• Farm to fork food safety governance. | 2 |
| 2 | Physical Hazards Related to Food Safety | • Nature and source of physical hazards.<br>• Detection and elimination system of physical hazards. | 2 |
| 3 | Chemical Aspects of Food Safety | • Basic principles about human toxicology.<br>• Food sensitivities (including allergens).<br>• Food intoxications.<br>• Food additives.<br>• Residues (veterinary drug, crop protection agents (e.g. pesticides), disinfectants, migration from food contact surface, etc.). | 8 |
| 4 | Microbiological Aspects of Food Safety | • Zoonosis, zoonotic agents and food borne outbreaks.<br>• Food borne pathogens (bacteria causing food infections and bacteria causing intoxication).<br>• Food borne viruses and parasites.<br>• Natural toxins (marine histamine, biogenic amines).<br>• Antimicrobial resistance (AMR): definition and significance of AMR, MDR, XDR and PDR; Drivers, trends, and mechanism of AMR; Pathways of AMR bacteria in food chain; Detection of food-borne AMR. | 8 |
| 5 | Risk Analysis in Relation to Food Safety Hazards | • Definition.<br>• Risk analysis framework.<br>• Chemical risk assessment in foods with exercise/examples:<br>- Hazard identification, hazard characterization, exposure assessment, risk characterization (comparison with guidance value, margin of exposure approach, virtual safe dose approach).<br>• Microbial risk assessment (qualitative, semi-quantitative and quantitative) in foods with exercise/ examples:<br>- Hazard identification, hazard characterization (dose response relationship), exposure assessment (modelling production-to-consumption pathway), risk characterization.<br>• Food safety objective and its practical consideration. | 8.5 |
| 6 | Risk Management and Communication | • Risk communication.<br>• Risk management and mitigation strategies. | 1.5 |
| 7 | Food Security | • Introduction and pillars of food security.<br>• Interrelationship between food safety and food security, role of food safety in food security. | 2 |
| | | | Total 32 |

Reference materials


1. FAO and WHO (2021). "Microbiological Risk Assessment- Guidance for Food". Microbiological Risk Assessment Series No. 36. Rome. [doi: 10.4060/cb5006en].
2. Ijabadeniyi, O. A. and Olagunju, O. F. (2023). "Food Safety and Toxicology: Present and Future Perspectives". Walter de Gruyter GmbH & Co KG. Berlin. [ISBN 978-3- 11-074834-5].
3. Kuddus, M., Ashraf, S. A., Rahman, P. (2024). "Food Safety: Contaminants and Risk Assessment". CRC Press. [ISBN 9781032368092]
4. Schmidt, R.H. and Rodrick, G.E. (2003). "Food Safety Handbook". John Wiley & Sons. Inc., New Jersey. [ISBN 0-471-21064-1]
5. Tennant, D. R. (1997). "Food Chemical Risk Analysis. Blackie Academic & Professional". London. [ISBN 0412723107].
6. WHO (2021). "WHO Human Health Risk Assessment Toolkit: Chemical Hazards" (2nd ed.), IPCS Harmonization Project Document No. 8. [ISBN 978-92-4-003573-7].


Further suggested reading materials


1. Bemrah, N., Sanaa, M., Cassin, M.H., Griffith, M.W. and Cerf, O. (1998). Quantitative risk assessment of human listeriosis from consumption of soft cheese made from raw milk. *Prev. Vet. Med.*, 37, 129–145.
2. Buchanan, R.L., Smith, J.L. and Long, W. (2000). Microbial risk assessment: dose-response relation and risk characterization. *Int. J. Food Microbiol.*, 58, 159–172.
3. Zwietering, M. (2005). Practical considerations on food safety objectives. *Food Control*, 16, 817–823.
4. Adams, M.A. and Moss, M.O. (2008). "Food Microbiology" (3rd ed.). Cambridge, UK: Royal Society of Chemistry.
5. Peng, W. and Berry, E.M. (2019). The concept of food security. *In:* "Encyclopedia of Food Security and Sustainability" (P. Ferranti, E.M. Berry and J.R. Anderson, Eds.), Vol. 2, pp. 1–7. Elsevier. [doi:10.1016/B978-0-08-100596-5.22314-7]
6. Unnevehr, L. (Ed.). (2003). "Food Safety in Food Security and Food Trade" (Vol. 10, p. 38). Washington, DC: International Food Policy Research Institute. Available at https://core.ac.uk/download/pdf/6288817.pdf.


Unit wise marks distribution for the final exam

| Unit | Title | Total (%) |
|---|---|---|
| 1 | Introduction | 5 |
| 2 | Physical Hazards Related to Food Safety | 5 |
| 3 | Chemical Aspects of Food Safety | 25 |
| 4 | Microbiological Aspects of Food Safety | 25 |
| 5 | Risk Analysis in Relation to Food Safety Hazards | 30 |
| 6 | Risk Management and Communication | 5 |
| 7 | Food Security | 5 |
| | **Total** | **100%** |

| Course: Confectionery and Snack Foods | Course Code: BFT 354 (A) | Credit Hour: 2 |
|---|---|---|
| Semester: VI | Teaching hours: 32 | Full Marks: 50 |
| Nature of Course: Theory | (2 lecture hours per week) | |

Course description and objectives

This course explores the science, technology, and innovation behind confectionery and snack food production. It covers the processing techniques, ingredient functionality, and quality attributes essential for creating successful products. Students will delve into the fundamentals of formulation, texture profiling, sensory evaluation, and packaging designs for a diverse array of confectionery items and snack foods, including chocolates, candies, baked goods, chips (crisps), biscuits, noodles, pasta (e.g., spaghetti, macaroni), and extruded snacks. The course also emphasizes sustainability in ingredient selection, waste valorization, and the role of emerging technologies in product development.

Course detail

| Unit | Content | Details of content | Teaching hours |
|---|---|---|---|
| 1 | Introduction to Confectionery Technology | • Definition, classification, and scope of confectionery industry.<br>• Overview of sugar and sugar substitutes. | 1 |
| 2 | Ingredients in Confectionery | • Sugar, glucose syrup, invert sugar, milk solids, fats, emulsifiers, cocoa products, etc.<br>• Hydrocolloids, flavoring agents, and colorants. | 2 |
| 3 | Sugar Confectionery | • Processing of hard-boiled candies, toffees, fudges, and jellies.<br>• Batch vs. continuous processing. | 3 |
| 4 | Chocolate Technology | • Cocoa processing, chocolate manufacture (milk, white, and dark chocolates).<br>• Tempering, molding, and enrobing techniques.<br>• Compound coatings and filled chocolates.<br>• Defects in chocolates. | 3 |
| 5 | Specialty and Novel Confections | • Chewing gum, aerated confections, lozenges, nutraceutical candies.<br>• Sugar-free and fortified confectionery. | 2 |
| 6 | Engineering Aspects of Confectionery Technology | • Overview:<br>- Raw material handling and preparation.<br>- Heat and mass transfer operations.<br>- Mixing and homogenization.<br>- Molding and forming technologies.<br>- Crystallization control.<br>- Coating and enrobing.<br>- Packaging engineering.<br>- Process control and automation. | 3 |
| 7 | Quality Control and Packaging | • Physical, chemical, microbiological, and sensory evaluation.<br>• Packaging materials and methods for confectionery.<br>• Shelf-life assessment. | 2 |
| 8 | Hygiene and Regulatory Aspects, Standards for Confectionery Products | • GMP, GHP, HACCP in confectionery.<br>• FSSAI regulations and labeling.<br>• Standards for confectionery products. | 1 |
| 9 | Introduction Snacks | • Definition and classification of snacks: traditional *vs.* modern.<br>• Nutritional considerations.<br>• Market trends and consumer preferences. | 1 |
| 10 | Raw Materials in Snacks | • Cereal-based: rice, wheat, corn, millets.<br>• Legumes and pulses.<br>• Oil and fat types.<br>• Additives: spices, flavors, emulsifiers, leavening agents. | 2 |

| | | | |
|---|---|---|---|
| 11 | Key Unit Operations Processing Technologies | • Mixing and blending:<br>- Dry and wet mixing of flours, starches, oils, and seasonings.<br>- Use of ribbon blenders, paddle mixers, and planetary mixers.<br>• Extrusion:<br>- Thermoplastic extrusion for puffed snacks and pellets.<br>- Twin-screw and single-screw extruders: temperature profile, screw configuration, die design.<br>- Cold vs. hot extrusion.<br>- Expanded snacks.<br>- Mechanical energy to thermal energy conversion.<br>• Frying:<br>- Deep fat frying: heat and mass transfer during frying.<br>- Fryer design: batch *vs* continuous, oil turnover rate, energy efficiency.<br>- Control of moisture content, oil uptake, and acrylamide formation.<br>- Deep frying, vacuum frying, hot-air frying; Oil uptake and control.<br>• Baking and roasting:<br>- Principles of baking; use in crackers, biscuits, protein bars.<br>- Convection and radiation heating methods.<br>- Oven design parameters: airflow, belt type, temperature control.<br>- Energy optimization in baking operations.<br>• Drying:<br>- Hot air drying, microwave-assisted drying for moisture reduction.<br>- Dryer types: tray, conveyor, rotary, and fluidized bed.<br>- Moisture diffusion kinetics and shrinkage behavior.<br>• Coating and seasoning:<br>- Drum seasoning, spray coating methods.<br>- Uniform distribution of flavors and reduction of fines.<br>- Adhesion mechanisms and liquid-solid mixing.<br>- Roasting and puffing (traditional and mechanical). | 8 |
| 12 | Traditional Snacks | • Preparation methods for: namkeen, sev, bhujia, cheese balls, papad, banana chips. | 1 |
| 13 | Modern Snack Development | • Ready-to-eat (RTE) and Ready-to-cook (RTC) snacks.<br>• Fortified and functional snacks.<br>• Gluten-free and high-protein snacks. | 1 |
| 14 | Quality Control and Packaging | • Physical, chemical, and sensory analysis.<br>• Shelf-life evaluation.<br>• Packaging materials and technologies.<br>• Labeling requirements. | 1 |
| 15 | Equipment Design and Selection | • Design considerations based on product rheology, particle size, and throughput. | 1 |
| | | Total | 32 |

Reference materials


*Confectionery Technology*

1. Bashir, K., Jan, K., Jan, S. and Habib, M. (2023). "Bakery and Confectionery Technology". NIPA Publications, India. [ISBN 978-93-94490-51-2].
2. Hartel, R.W., von Elbe, J.H. and Hofberger, R. (2018). "Confectionery Science and Technology". Springer, Switzerland. [ISBN 978-3-319-61742-8].
3. NIIR Board. (2010). "Modern Technology of Food Processing and Agro Based Industries". National Institute of Industrial Research, New Delhi, India. [ISBN 978-81-7833-073-0].

*Snack Food Processing*

4. Matz, S.A. (2012). "Snack Food Technology" (2nd ed.). Springer Science & Business Media, Netherlands. [ISBN 978-94-010-9778-9].


Institute of Science & Technology
Dean's Office
Kirtipur 2045

5. Serna-Saldivar, S.O. (Ed.) (2022). "Snack Foods: Processing, Innovation, and Nutritional Aspects". CRC Press, Boca Raton, USA. [ISBN 978-0-367-65351-4].

*Food Engineering and Unit Operations*

6. Rizvi, S.S.H. (2024). "Food Engineering Principles and Practices: A One-Semester Course". Springer, Switzerland. [ISBN 978-3-031-34123-6].
7. Sepúlveda Torre, L., Kannan, P. and Haghi, A.K. (2024). "Engineering Principles for Food Processing Technology and Product Realization". CRC Press, Boca Raton, USA. [ISBN 978-1-032-46360-2].

*Quality Control and Safety*

8. Vasconcellos, J. and Silva, M. (2021). "Food Quality Assurance and Safety". Springer, Switzerland. [ISBN 978-3-030-65843-4].

Institute of Science & Technology
Dean's Office
Kirtipur 2045

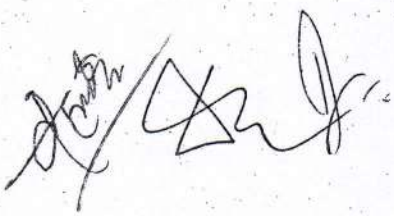
| | | |
|---|---|---|
| Course: Confectionery and Snack Foods | Course Code: BFT 354 (B) | Credit Hour: 1 |
| Semester: VI | Teaching hours: 64 | Full Marks: 25 |
| Nature of Course: Practical | (Lab: 4 h per session) | |

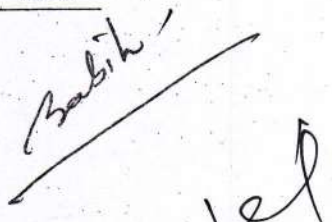
List of practical for laboratory session

1. Preparation of sugar-based candies (boiled, toffee, caramel).
2. Chocolate tempering and molding.
3. Preparation of jelly, fondant, marshmallows.
4. Use of sugar substitutes in confectionery.
5. Product formulation and sensory analysis.
6. Packaging and shelf-life study.
7. Preparation of traditional snacks.
8. Oil uptake studies in fried snacks and extruded snacks.
9. Extrusion of puffed snacks using lab extruder.
10. Shelf-life and packaging trials.

**Unit wise marks distribution for the final exam**

| Unit | Title | Total (%) |
|---|---|---|
| 1 | Introduction to confectionery technology | 0 |
| 2 | Ingredients in confectionery | 5 |
| 3 | Sugar confectionery | 10 |
| 4 | Chocolate technology | 10 |
| 5 | Specialty and novel confections | 5 |
| 6 | Engineering aspects of confectionery technology | 10 |
| 7 | Quality control and packaging | 5 |
| 8 | Hygiene and regulatory aspects, standards for confectionery products | 5 |
| 9 | Introduction snacks | 5 |
| 10 | Raw materials in snacks | 5 |
| 11 | Key unit operations processing technologies | 20 |
| 12 | Traditional snacks | 5 |
| 13 | Modern snack development | 5 |
| 14 | Quality control and packaging | 5 |
| 15 | Equipment design and selection | 5 |
| | Total | 100% |






| | | |
|---|---|---|
| Course: Dairy Technology - II | Course Code: BFT 355 (A) | Credit Hour: 2 |
| Semester: VI | Teaching hours: 32 | Full Marks: 50 |
| Nature of Course: Theory | (2 lecture hours per week) | |

Course description and objectives

Dairy Technology-II delves into the engineering and technological aspects of dairy processing, focusing on milk product technology, plant organization, sanitation, hygiene, and plant layouts. Students will explore the design and arrangement of dairy processing plants, optimizing workflow and efficiency in production. The course covers processing techniques for various dairy products, including cheese, yogurt, butter, and fermented dairy products. Additionally, students will study dairy plant management, sanitation and hygiene regulations, and quality control methods to ensure safe and efficient production.

Course detail

| Unit | Content | Details of content | Teaching hours |
|---|---|---|---|
| 1 | Market Milk | • **Pasteurized, sterilized, ESL and UHT milk:** introduction, manufacture, shelf life, flavor, nutritive value. | 2 |
| 2 | Concentrated Milk | • **Evaporated milk:** description, manufacture, heat stability, creaming, age thickening and gelation.<br>• **Sweetened condensed milk:** description, manufacture, chemical deterioration, lactose crystals, microbial spoilage. | 2 |
| 3 | Milk Powder | • **Introduction, drum- and spray drying, production of different types of milk powders, instant milk powder production, reconstituted products.** | 3 |
| 4 | Cream | • **Introduction, types, manufacturing details, formation and stability.** | 2 |
| 5 | Butter | • **Introduction, classification, theory of churning, manufacture, butterfat crystallization, structure, defects, causes and prevention, quality control and analysis.** | 3 |
| 6 | Ghee | • **Description, manufacture, comparison of different methods, defects and prevention.** | 2 |
| 7 | Fermented Milk | • **Introduction, classification, production of yoghurt and dahi, starter technology, kefir, koumiss, probiotic and prebiotic, nutritional aspects.** | 2 |
| 8 | Cheese | • **Principle of cheesemaking, classification, composition, varieties found in Nepal, manufacturing process of hard and soft varieties, cheese milk, additives to cheese milk, curd treatment, cheese ripening, cheese faults and prevention, processed cheese.** | 3 |
| 9 | Ice cream | • **Introduction, classification, composition, role of various components, formulation and mix calculation, manufacture, physical structure, overrun, defects and control.** | 3 |
| 10 | Dairy By-product Utilization | • Introduction, byproduct recovery and utilization (buttermilk, whey). | 2 |
| 11 | Dairy Plant Sanitation | • Sanitation of dairy plants and handling equipment, common washing detergents and sanitizers, cleaning and sanitizing procedures, COP- and CIP system. | 3 |
| 12 | Dairy Plant Management and Effluent Treatment | • Elements, process selection, product design, plant layout, plant organization, dairy effluent treatment methods. | 4 |
| | | Total | 32 |

Reference materials


1. Atherton, H. V., Newlander, J. A. (2021). "Chemistry and Testing of Dairy Product". CBS Publishers. [ISBN 978-9390158553].
2. Bylund, G. (2003). "Dairy Processing Handbook" (2nd ed.). Tetra Pak Processing Systems AB. Sweden.
3. De, S. K. (1991). "Outlines of Dairy Technology". Oxford University Press. India. [ISBN 978-0-19-561194-6].
4. Fox, P. F., Guinee, T. P., Cogan, T. M., McSweeney, P. L. H. (2015). "Fundaments of Cheese Science" (2nd ed.). Springer. [ISBN 978-1489976819].
5. Goff, H. D., Hartel, R. W. (2013). "Ice Cream" (7th ed.). Springer. [ISBN 978-1461460954]. Shukla, P.M. and Goyal, B.C. (2012). "Dairy Science and Technology". Kalyani Publishers, Ludhiana, India. [ISBN 978-93-272-2567-5].
6. Harper, W. J., Hall, C. W. (1976). "Dairy Technology and Engineering". Avi Publishing Co Inc. [ISBN 978-0870551987].
7. Huppertz, T. (2025). "Dairy Science and Technology" (3rd ed.). CRC Press. Boca Raton. [ISBN 9781003271765].
8. Sangwan, K. P. S. (2008). "Technology of Dairy Plant Operations". Agrobios. India. [ISBN 978-8177543315].
9. Spreer, E. (2018). "Milk and Dairy Product Technology". Taylor & Francis. [ISBN 978-1138385931]
10. Tamime, A. Y., Robindon, R. K. (2007). "Yoghurt: Science and Technology" (3rd ed.), Woodhead Publishing. [ISBN 978-1845692131].
11. Walstra, P., Wouters, J.T.M. and Geurts, T.J. (2005). "Dairy Science and Technology". (2nd ed.), CRC Press, Boca Raton, Florida, USA. [ISBN 978-0-8247-2763-5].


Institute of Science & Technology
Dean's Office
Kirtipur 2045

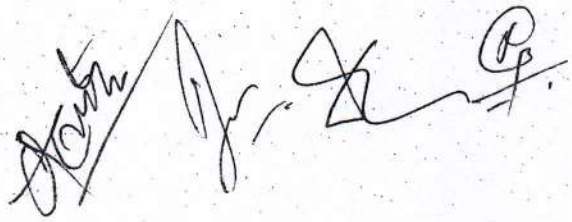
| | | |
|---|---|---|
| Course: Dairy Technology - II | Course Code: BFT 355 (B) | Credit Hour: 1 |
| Semester: VI | Teaching hours: 64 | Full Marks: 25 |
| Nature of Course: Practical | (Lab: 4 h per session) | |

**List of practical for laboratory session**

1. Preparation of ice cream and evaluation of its quality.
2. Preparation of butter from sweet and ripened cream.
3. Preparation of ghee.
4. Preparation of yoghurt.
5. Preparation of sweets such as *rasbari, lalmohan,* and *kalakand.*
6. Preparation of condensed milk using vacuum evaporator.
7. Preparation of *paneer.*
8. Preparation of cheese and evaluation of its quality.
9. Field visit to nearby cheese factory.

**Unit wise marks distribution for the final exam**

| Unit | Title | Total (%) |
|---|---|---|
| 1 | Market milk | 10 |
| 2 | Concentrated milk | 5 |
| 3 | Milk powder | 10 |
| 4 | Cream | 5 |
| 5 | Butter | 10 |
| 6 | Ghee | 5 |
| 7 | Fermented milk | 10 |
| 8 | Cheese | 10 |
| 9 | Ice cream | 10 |
| 10 | Dairy by-product utilization | 5 |
| 11 | Dairy plant sanitation | 10 |
| 12 | Dairy plant management and effluent treatment | 10 |
| | Total | 100% |




| Course: Meat Technology - II | Course Code: BFT 356 (A) | Credit Hour: 2 |
|---|---|---|
| Semester: VI | Teaching hours: 32 | Full Marks: 50 |
| Nature of Course: Theory | (2 lecture hours per week) | |

Course description and objectives

Meat Technology-II focuses on advanced processing and manufacturing techniques used in meat and poultry industries. The course covers the production of value-added meat products, including sausages, cured meats, canned meats, and dried meats. Additionally, students will study egg production technologies and various egg-based products. The course further explores fish processing, fish-based products, packaging methodologies, and distribution strategies essential for maintaining product quality and safety in the food supply chain.

Course detail

| Unit | Content | Details of content | Teaching hours |
|---|---|---|---|
| 1 | Meat Products and their Processing | • Raw meats suitable for preparing processed meats. [1 h]<br>• Curing and cured meats: [6 h]<br>- Considerations in curing meat products.<br>- Ingredients in meat curing.<br>- Safety aspects of nitrite.<br>- Cured meat color.<br>- Curing methods.<br>• Meat extracts [1 h] | 8 |
| 2 | Smoking, Smoked, and Dry Meat Products | • Purpose and methods of smoking. [1 h]<br>• Composition and production of smoke. [1 h]<br>• Deposition of smoke and safety concerns of smoke. [1 h]<br>• Smoked and dry whole meat products, bacon and animal fats. [2 h]<br>• Dried meats and intermediate moisture meats. [2 h] | 7 |
| 3 | Canned Meat and Fish Products | • Raw material preparation, pre-canning treatments, packing methods, thermal processing, packaging, and quality control. | 2 |
| 4 | Sausages | • Sausage classification. [0.5]<br>• Non-meat ingredients (additives, spices, hydrocolloids) for meat processing. [0.5 h]<br>• Mincing, emulsifying, mixing, and filling, methods and equipment. [1 h]<br>• Technology of emulsion-type cooked sausage (theory of emulsion development). [2 h]<br>• Technology of ground and formed meat, shelf-stable meat products. [2 h]<br>• Casings for meat products. [1 h] | 7 |
| 5 | Egg and Fish Processing and Preservation | • Principles involved in preparation of egg powder and other egg-products. [1 h]<br>• Packing of egg and egg products. [1 h]<br>• Fishery resources, marine and freshwater fishes, processing, preservation, grading, standards and quality control, meat product certification and labeling. [2 h] | 4 |
| 6 | By-products Utilization | • Production, classification, nutritive value, processing and utilization [2 h] | 2 |
| 7 | Meat Processing Facilities Design | • Quality criteria, meat processing operations and hygiene of meat production and processing (GHP, GMP and CCP). [2 h] | 2 |
| | | Total | 32 |

Reference materials


1. Feiner, G. (2006). "Meat Products Handbook: Practical Science and Technology". CRC Press, Boca Raton, USA. [ISBN 978-1-84569-050-2].
2. Kerry, J.P., Kerry, J.F. and Ledward, D. (Eds.) (2002). "Meat Processing: Improving Quality". Woodhead Publishing, UK. [ISBN 978-1-85573-583-5].
3. Lawrie, R.A. (1991). "Meat Science". Pergamon Press, UK. [ISBN 978-0-08-040824-8].
4. Ockerman, H.W. and Hansen, C.L. (2000). "Animal By-Product Processing and Utilization". Technomic Publishing Company, USA. [ISBN 978-1-56676-777-3].
5. Pearson, A.M. and Tauber, F.W. (1984). "Processed Meats". AVI Publishing Company, USA. [ISBN 978-0-87055-461-2].
6. Stadelman, W.J., Newkirk, D. and Newby, L. (2017). "Egg Science and Technology". CRC Press, Boca Raton, USA. [ISBN 978-1-56022-854-7].
7. Subba, D. (2001). "Practical Book of Meat, Poultry and Fish Technology". RONAST, Lalitpur, Nepal.
8. Subba, D. (2001). "Textbook of Meat Technology". RONAST, Lalitpur, Nepal.
9. Tarte, R. (Ed.) (2009). "Ingredients in Meat Products: Properties, Functionality and Applications". Springer, USA. [ISBN 978-0-387-71326-7].
10. Toldrá, F. (2022). "Lawrie's Meat Science". Woodhead Publishing, UK. [ISBN 978-0-323-85408-5].


Institute of Science & Technology
Dean's Office
Kirtipur 2045

गाउँपालिका परिषद्को कार्यालय
कीर्तिपुर

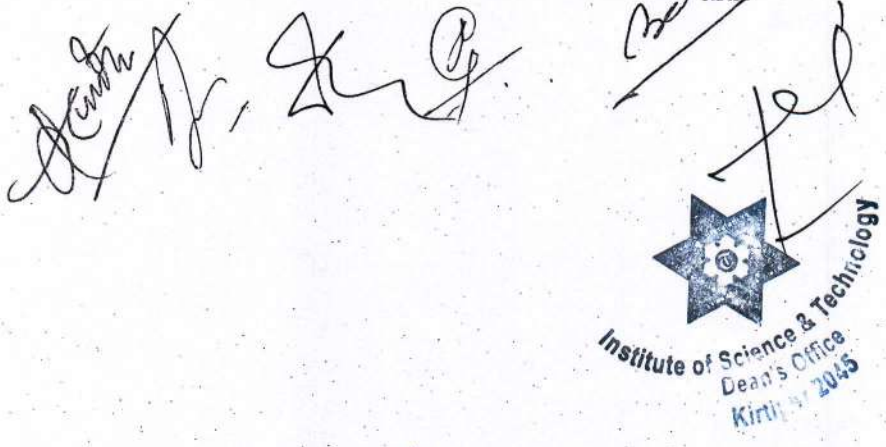
| | | |
|---|---|---|
| Course: Meat Technology - II | Course Code: BFT 356 (B) | Credit Hour: 1 |
| Semester: VI | Teaching hours: 64 | Full Marks: 25 |
| Nature of Course: Practical | (Lab: 4 h per session) | |

List of practical for laboratory session

1. Preparation of Sausage (cooked emulsion type sausage, fresh ground, dry sausage).
2. Preparation of cured meats: ham and bacon.
3. Determination of freshness of fish by subjective method and lab tests.
4. Fish preservation by salting, smoking and drying.
5. Preparation of fish, meat and egg pickle.
6. Preparation of dehydrated and convenient egg products.
7. Preparation of sausage casing-bone meal and meat meal.

**Unit wise marks distribution for the final exam**

| Unit | Title | Total (%) |
|---|---|---|
| 1 | Meat products and their processing | 25 |
| 2 | Smoking, smoked, and dry meat products | 20 |
| 3 | Canned meat and fish products | 10 |
| 4 | Sausages | 20 |
| 5 | Egg and fish processing and preservation | 15 |
| 6 | By-products utilization | 5 |
| 7 | Meat processing facilities design | 5 |
| | **Total** | **100%** |




(6)

| | | |
|---|---|---|
| Course: Food Packaging | Course Code: BFT 401 (A) | Credit Hour: 2 |
| Semester: VII | Teaching hours: 32 | Full Marks: 50 |
| Nature of Course: Theory | (2 lecture hours per week) | |

Course description and objectives

Food Packaging provides a comprehensive understanding of food packaging technology, covering materials, design principles, life cycle assessment, circular economy strategies, and regulatory compliance. Students will explore traditional and modern packaging solutions, including flexible, metal, glass, biodegradable packaging, closure designs, and sustainability considerations. Advanced technologies such as smart packaging, intelligent systems, edible coatings, additive migration studies, nanotechnology, and active packaging will be understood. Additionally, the course will cover packaging hierarchy, focusing on primary, secondary, tertiary, quaternary, and transport packaging, highlighting their role in food preservation, distribution, and supply chain efficiency.

Course detail

| Unit | Content | Details of content | Teaching hours |
|---|---|---|---|
| 1 | Introduction to Food Packaging and Packaging Hazards | • Development of food package; packaging as a science and technology; objectives, principle and functions of packaging. [1 h]<br>• Mechanical, physical, chemical, biological and microbiological hazard. [1 h] | 2 |
| 2 | Food Packaging Materials (Fabrication Process and Properties) | • Paper-based materials: paper, paper board, regenerated cellulose. [2 h]<br>• Plastics (conventional and novel materials).<br>• Metal (aluminum and tinplate).<br>• Wood and textiles. [3 h]<br>• Bio-polymer and protective edible film (technology, principles and applications).<br>• Glass (types, primary ingredients, manufacturing, and properties relevant to food packaging) [2 h] | 7 |
| 3 | Food Package design (Retail and Export Packaging) | • Function-environment grid analysis. [1 h]<br>• Flexible packaging systems: [2 h]<br>- Plastic films<br>- Bags, pouches, wraps.<br>- Foil packaging.<br>- Textile and paper sacks<br>• Rigid and semi-rigid packaging systems: [2 h]<br>- Rigid containers (glass jars, PET bottles HDPE tubs).<br>- Molded plastic containers.<br>- Corrugated and solid fiberboard containers.<br>- Folding cartons.<br>- Set-up boxes.<br>- Liquid-tight paperboard containers.<br>• Composite and multi-layer packaging systems. [2 h]<br>- Laminates and multi-layer packaging<br>- Tin and composite cans<br>- Collapsible metal and squeezable plastic tubes. | 7 |
| 4 | Closures and Lids | • Material, types, styles, closing technology. | 1 |

Continued ...

| | | | |
|---|---|---|---|
| 5 | Special Packaging Methods | • Shrinkable and stretchable packaging.<br>• Vacuum and gas packaging.<br>• Retortable packaging (introduction, principles, properties and technology only). | 2 |
| 6 | Packaging Technology (Technological Principles and Applications) | • Innovation in food packaging and packaging technology; aseptic packaging technology; active packaging technology. [2 h]<br>• Modified and Controlled Atmospheric packaging (technology only). [2 h] | 4 |
| 7 | Packaging Material and Technology Requirements | • Criteria for the selection of packaging material and technology for:<br>- Fresh fruits and vegetable.<br>- Minimally processed foods.<br>- Confectionery and bakery products.<br>- Meat, fish and poultry products.<br>- Fats and oils.<br>- Milk and milk products.<br>- Aerated and extruded snacks.<br>- Cereals and pulses.<br>- Tea, coffee and spices.<br>- Oily fried and dehydrated products.<br>- Carbonated beverages. | 5 |
| 8 | **Food Package Labelling** | • **Core labeling requirements, nutritional information, safety and allergen information, claims and certifications, special labeling contexts (e.g., infant and medical foods).** | 1 |
| 9 | **Product-package Compatibility** | • **Migration; corrosion; scalping; toxicity; tainting.** | 1 |
| 10 | **Packaging Standards and Regulations** | • **Packaging specification and quality control; packaging waste management; evaluation of packaging performance.** | 2 |
| | | **Total** | 32 |

Reference materials


1. Ahvenaninen, R. (2003). "Novel Food Packaging Techniques". Woodhead Publishing Ltd., UK. [ISBN 978-1-85573-675-7].
2. Arhalye, A.S. (1992). "Plastics in Packaging". Tata McGraw-Hill Publishing Company Ltd., India. [ISBN 978-0-07-460014-6].
3. Biswas, D., Chakraborty, D. and Manna, A. (2025). "Food Marketing and Labelling: A Practical Guide". CRC Press. [ISBN: 9781003473305].
4. Chiellini, E. (2008). "Environmentally Compatible Food Packaging". Woodhead Publishing Ltd., UK. [ISBN 978-1-84569-194-3].
5. Hotchkiss, J.H. (1998). "Food and Packaging Interactions". American Chemical Society, USA. [ISBN 978-0-8412-2122-2].
6. Mathlouthi, M. (1994). "Food Packaging and Preservation". Elsevier Applied Science Publishers, UK. [ISBN 978-1-4615-3112-8].
7. Paine, F.A. and Paine, H.Y. (1983). "A Handbook of Food Packaging". Leonard Hill, UK. [ISBN 978-0-216-93210-4].
8. Rijk, R. and Veraart, R. (2010). "Global Legislation for Food Packaging Materials". Wiley-VCH Verlag GmbH Germany. [ISBN 978-3-527-31912-1].
9. Risch, S.J. (2000). "Food Packaging: Testing Methods and Applications". American Chemical Society, Washington D.C., USA. [ISBN 978-0-8412-3617-2].
10. Robertson, G.L. (2016). "Food Packaging: Principles and Practice" (3rd ed.). CRC Press, Boca Raton, USA. [ISBN 978-1-4398-6241-4].
11. U.S. Food and Drug Administration. (2013). "A Food Labeling Guide: Guidance for Industry." Center for Food Safety and Applied Nutrition, U.S. Department of Health and Human S... https://www.fda.gov/media/81606/download.
12. Willhoft, E.M.A. (1993). "Aseptic Processing and ...ging of Particulate Foods". Blackie Academic & Professional, UK. [ISBN 978-0-7514-0010-6].

| | | |
|---|---|---|
| Course: Food Packaging<br>Semester: VII<br>Nature of Course: Practical | Course Code: BFT 401 (B)<br>Teaching hours: 64<br>(Lab: 4 h per session) | Credit Hour: 1<br>Full Marks: 25 |

List of practical for laboratory session

1. Determination of physical chemical properties of plastic packaging material.
2. Determination of physical chemical properties of tin plate packaging.
3. Determination of physical chemical properties of paper and paper board packaging.
4. Determination of 'dimension' and 'thermal shock resistance' of glass bottles.
5. Study on the identification of plastic packaging.
6. Study on the performance evaluation of transport packages.
7. Study on the water vapor transmission rate through plastic packages.
8. Shelf-life study of packaging materials and the packaged food.
9. Exercise on the packaging design to meet the products needs for protection and preservation.
10. Determination of the 'crush strength' of the paperboard packaging.
11. Determine the 'tensile strength' of the plastics packaging films.
12. Market analysis of product on the basis of packaging material and packaging technology used.
13. Determination of the 'impact strength' of the plastic packaging in packaged item.
14. Visit to food industry to study on the modern packaging technology in process line.

**Unit wise marks distribution for the final exam**

| Unit | Title | Total (%) |
|---|---|---|
| 1 | Introduction to food packaging and packaging hazards | 5 |
| 2 | Food packaging materials (fabrication process and properties) | 20 |
| 3 | Food package design (retail and export packaging) | 20 |
| 4 | Closures and lids | 5 |
| 5 | Special packaging methods | 5 |
| 6 | Packaging technology (technological principles and applications only) | 15 |
| 7 | Packaging material and technology requirements | 15 |
| 8 | Food package labelling | 5 |
| 9 | Product-package compatibility | 5 |
| 10 | Packaging standards and regulations | 5 |
| | Total | 100% |

राजश्री परिषद्को कार्यालय
कीर्तिपुर

Institute of Science & Technology
Dean's Office
Kirtipur 2045

| Course: Operations Research | Course Code: BFT 402 (A) | Credit Hour: 2 |
|---|---|---|
| Semester: VII | Teaching hours: 32 | Full Marks: 50 |
| Nature of Course: Theory | (2 lecture hours per week) | |

Course description and objectives

This course introduces students to the principles of operations research and their applications within food technology industries. It focuses on using quantitative and analytical methods to solve the problems in production, supply chain management, quality control, and resource optimization. Topics include introduction to operation research, linear programming, transportation, decision-making, simulation techniques, inventory management, logistics planning and project scheduling. By integrating case studies and computational tools, the course bridges theoretical concepts with practical applications, enhancing decision-making skills in food technology sectors.

Course detail

| Unit | Content | Details of content | Teaching hours |
|---|---|---|---|
| 1 | Introduction to Operation Research | • The history of operations research.<br>• Definitions of operations research.<br>• Features of operations research approach.<br>• Operations research approach to problem solving.<br>• Scientific method in operation research.<br>• Necessity of operation research in food industry<br>• Scope of operation research (general management and financial management).<br>• Models and modelling in operations research [classification based on structure, function (or purpose), time reference, degree of certainty, method of solution or quantification).<br>• Advantages of model building.<br>• Methodology of operations research.<br>• Applications of operations research.<br>• Computer software for operations research. | 3 |
| 2 | Linear Programming: Application and Model Formulation | • Structure of linear programming model (general structure of an LP model, assumptions of an LP model).<br>• Advantages and limitations of LP.<br>• Application areas of LP.<br>• General mathematical model of LP problem.<br>• Guidelines on LP model formulation.<br>• Examples of LP model formulation (production, marketing, finance, agriculture, transportation, personnel). | 2 |
| 3 | Linear Programming: The Graphical Method | • Introduction and definitions<br>• Graphical solution methods of LP problems (extreme point solution method, examples on maximization LP problem, examples on minimization LP problem, examples on mixed constraints LP problem). | 2 |

Continued ....

| | | | |
|---|---|---|---|
| 4 | Linear Programming: The Simplex Method, Duality and Sensitivity Analysis | • LP model in equation form.<br>• Simplex method (iterative nature of the simplex method, computational details of the simplex algorithm; maximization and minimization case using two-phase method and Big-M method)<br>• Types of LP solutions (alternative or multiple optimal solutions, unbounded solution and infeasible solution)<br>• Duality in LP (introduction, formulation of dual LP problem- symmetrical form, economic interpretation of dual variables, economic interpretation of dual constraints, rules for constructing the dual from primal), advantages and managerial significance of duality.<br>• Sensitivity analysis: change in objective function coefficient (cj), change in the availability of resources (bj), change in the input-out coefficients (aij 's)) | 5 |
| 5 | Transportation Problem | • Introduction, definition and assumption of transportation model.<br>• Types of transportation problem.<br>• Mathematical model of transportation problem.<br>• Methods of finding initial solution of cost minimization (North West Corner method, Least Cost method, Vogel's Approximation method).<br>• Test for optimality [Stepping Stone method or MODI (modified distribution) method]. | 4 |
| 6 | Decision Making Models | • Introduction to decision making environments.<br>• Decision making under uncertainty: criteria of Maximax, Maximin, Minimax Regret, Hurwicz, and Laplace.<br>• Decision making under risk: expected monetary value criterion, expected opportunity loss criterion, expected profit with perfect information, expected value of perfect information, marginal analysis approach. | 4 |
| 7 | Replacement and Maintenance Models | • Introduction, types of failure (gradual failure and sudden failure).<br>• Replacement of items whose efficiency deteriorates with time.<br>• Replacement of items that completely fail (individual Replacement policy, group replacement policy).<br>• Other replacement problems (staffing problem and equipment renewal problem). | 2 |
| 8 | Inventory Management | • Concept and importance of inventory.<br>• Inventory costs.<br>• Inventory control problem.<br>• Inventory models:<br>- Deterministic demand models:<br>Model 1 (a): demand rate uniform, replenishment rate infinite (classical EOQ model).<br>Model 1 (b): demand rate non-uniform, replenishment rate infinite<br>Model 1 (c) demand rate uniform, replenishment or production rate finite.<br>Model 2 (a) demand rate uniform, replenishment rate infinite and storage allowed.<br>Model 2 (b) demand rate uniform, production rate finite, storage allowed.<br>• Probabilistic and inventory model with price breaks.<br>• Forecasting of demand and method.<br>• Selective inventory management technique. | 4 |

| | | | |
|---|---|---|---|
| 9 | Project Management: PERT and CPM | • Introduction.<br>• Basic differences between PERT and CPM.<br>• Significance of using PERT/CPM.<br>• Phases of project management.<br>• PERT/CPM network components and precedence relationships (rules for AOA network construction and errors and dummies in network), time estimates and probability in PERT.<br>• Critical path analysis (forward pass method, backward pass method, float (slack) of an activity and event, critical-path).<br>• Project scheduling with uncertain activity times (estimation of project completion time).<br>• Project time-cost trade-off (project crashing and time-cost trade-off procedure). | 6 |
| | | Total | 32 |

Reference materials


1. Gautam, N. (2014). "A Textbook of Operation Research and Food Plant Management". Nawakala Publication, Nepal. [ISBN 99933-52-00-9].
2. Gupta, P.K. and Hira, D.S. (2007). "Operations Research". S. Chand Publishing, India. [ISBN 9788121902816].
3. Gupta, S.P., Gupta, P.K. and Man Mohan. (2022). "Business Statistics and Operations Research". Sultan Chand & Sons, India. [ISBN 9391820350].
4. Hillier, F.S. and Lieberman, G.J. (2024). "Introduction to Operations Research". McGraw Hill, USA. [ISBN 9781264856961].
5. Kumar, S.A. and Suresh, N. (2009). "Operations Management". New Age International (P) Ltd., Publishers, India. [ISBN 9788122425871].
6. Murthy, P.R. (2007). "Operations Research". New Age International (P) Ltd., Publishers, India. [ISBN 9788122420692].
7. Ravindran, A.R. (Ed.). (2007). "Operations Research and Management Science Handbook". CRC Press, Boca Raton, USA. [ISBN 9780849397219].
8. Sharma, J.K. (2016). "Operations Research: Theory and Applications". Laxmi Publications Pvt. Ltd., India. [ISBN 9789385935145].
9. Sthapit, A.B., Yadav, R.P., Tamang, G., Dhital, S. and Adhikari, P. (2015). "Production and Operation Management". Asmita Books Publishers and Distributors Pvt. Ltd., Nepal. [ISBN 99946-45-36-6].
10. Taha, H.A. (2017). "Operations Research: An Introduction". Pearson Education, London, UK. [ISBN 9781292165561].
11. Verma, R. and Kaur, M. (2022). "Production and Operations Management". Wellwritten Publishing Co., India. [ISBN 9789394764002].


Institute of Science & Technology
Dean's Office
Kirtipur 2045

| | | |
|---|---|---|
| Course: Operations Research<br>Semester: VII<br>Nature of Course: Practical | Course Code: BFT 402 (B)<br>Teaching hours: 64<br>(Lab: 4 h per session) | Credit Hour: 1<br>Full Marks: 25 |

List of practical for laboratory session

1. Write the operation research report related to food related Issues.
2. Formulate and solve the optimization problems using linear programming techniques. (Graphical and Simplex methods).
3. Formulate the dual linear programming problems and solve the problems using Big M and Two-Phase Simplex Method.
4. Apply transportation models to minimize the cost of distributing goods from sources to destinations.
5. Apply decision making criteria under different environments.
6. Apply EOQ models to manage the optimum stock levels and re order point and total inventory cost.
7. Create effective logistic planning process for food related operations.
8. Create project networks, identify critical path and calculate project duration using PERT and the Critical Path Method (CPM).
9. Formulate this problem as a transportation problem by constructing the appropriate parameter table. Display the transportation problem on an Excel spreadsheet. Use Solver to obtain an optimal solution.
10. Indicate the decision taken under the following approach: (i) pessimistic (ii) optimistic (iii) regret and (iv) equal probability
11. Calculation of expected monetary value (EVM) and expected value of perfect information (EVPI)
12. Determine the economic life, optimum period for maintenance and replacement of the machine.

**Unit wise marks distribution for the final exam**

| Unit | Title | Total (%) |
|---|---|---|
| 1 | Introduction to operation research | 10 |
| 2 | Linear programming: application and model formulation | 7 |
| 3 | Linear programming: the graphical method | 7 |
| 4 | Linear programming: simplex method, duality and sensitivity analysis | 15 |
| 5 | Transportation problem | 12 |
| 6 | Decision making models | 12 |
| 7 | Replacement and maintenance models | 7 |
| 8 | Inventory management | 12 |
| 9 | Project management: PERT and CPM | 18 |
| | Total | 100% |

Institute of Science & Technology
Dean's Office
Kirtipur 2045

प्राज्ञिक परिषदको कार्यालय
कीर्तिपुर

| | | |
|---|---|---|
| Course: Food Storage | Course Code: BFT 403 (A) | Credit Hour: 2 |
| Semester: VII | Teaching hours: 32 | Full Marks: 50 |
| Nature of Course: Theory | (2 lecture hours per week) | |

Course description and objectives

This course provides an in-depth understanding of food storage technology, covering principles of storage, transport, handling, and loss prevention for various food materials, including fresh produce, grains, and oilseeds. Students will explore factors affecting food losses, including moisture migration, grain quality deterioration, pest infestations, and rodent control methods. The course also delves into inspection procedures, sampling techniques, and storage structure design, incorporating chemical and non-chemical preservation approaches. Emphasis is placed on good storage practices, warehouse management, and farm-level storage improvements to enhance food security and reduce post-harvest losses.

Course detail

| Unit | Content | Details of content | Teaching hours |
|---|---|---|---|
| 1 | Introduction | • Introduction to the storage of food materials and principle of storage. | 1 |
| 2 | Transport and Handling of Food Materials | • Fresh fruits and vegetables, grains, and oilseeds. | 2 |
| 3 | Storage Structures | • Types of storage, selecting design of storage building, and handling equipment. | 3 |
| 4 | Food Losses and Damage during Storage | • Types of storage losses.<br>• Loss assessment and estimation - an approach to more efficient storage.<br>• Factors responsible for food losses during storage and their prevention (including fresh produce, grains, and oilseeds). | 2 |
| 5 | Physical Factors Affecting Stored Grain | • Definition and measurement.<br>• Mechanical and thermal properties of grain.<br>• Moisture migration in grain. | 3 |
| 6 | Grain Quality and Grain Sampling | • Theoretical basis of grain sampling.<br>• Sampling devices, their applications, analysis of grain sample.<br>• Inspection procedures and handling equipment. | 2 |
| 7 | Entomology of Stored Grains and Processed Foods | • Insect infestation of stored grains, grain stores, handling equipment and milling premises.<br>• Biology of stored product insects, food preference and specificity, infestation quality and quantity.<br>• Stored product insects of processed foods. | 2 |
| 8 | Stored Grain Mycology | • Common fungal species of stored grains.<br>• Factors influencing fungal growth.<br>• Mycotoxin production and risks.<br>• Detection and monitoring of fungal contamination.<br>• Prevention and control strategies. | 3 |
| 9 | Rodents and their Control | • Identification of rodents.<br>• Biology and economic importance.<br>• Physical and chemical control of rodents. | 2 |

Continued ....

| | | | |
|---|---|---|---|
| 10 | Grain Infestation Control | • Non-chemical methods:<br>- Aeration principles.<br>- Grain and seed drying.<br>- Modified atmosphere, hermetic storage, and CA storage.<br>- Refrigerated storage.<br>- Irradiation.<br>• Chemical control methods:<br>- Insects control methods:<br>o Contact insecticides, common Insecticides in use, properties, general principles, application, formulation, methods of using, problems relating to the use of insecticides.<br>o Pesticide residues and their significance, pesticides resistance in stored product insect, methods of detecting pesticide resistance in storage pests.<br>o Type, active principle and application of natural insecticides.<br>- Fumigants:<br>o Permitted fumigants, their properties, principle of fumigation.<br>o Effects of fumigants on stored grains.<br>o Detection and analysis of fumigants.<br>o Fumigant application methods and dosage.<br>o Fumigating devices and their operation. | 9 |
| 11 | **Grain Storage Practices** | • **Good grain storage practices.**<br>• **Warehouse management and maintenance.**<br>• **Rural storage structures of Nepal and possible ways of improvement.** | 3 |
| | | Total | 32 |

Reference materials


1. Bala, B.K. (2016). "Drying and Storage of Cereal Grains". John Wiley & Sons, India. [ISBN 9781119124238].
2. Baur, F.J. (1984). "Insect Management for Food Storage and Processing". The American Association of Cereal Chemists Inc., Minnesota. [ISBN 9780913250389].
3. Chakraverty, A., Mujumdar, A.S. and Ramaswamy, H.S. (2003). "Handbook of Postharvest Technology: Cereals, Fruits, Vegetables, Tea and Spices". CRC Press, USA. [ISBN 9780824705145].
4. Hall, C.W. (1980). "Drying and Storage of Agricultural Crops". AVI Publishing Co. Inc., Connecticut. [ISBN 9780870553215].
5. Hall, D.W. (1970). "Handling and Storage of Food Grains in the Tropical and Subtropical". Food and Agriculture Organization of the United Nations, Italy. [ISBN 9789251000907].
6. Proctor, D.L. (1994). "Grain Storage Techniques: Evolution and Trends in Developing Countries". FAO Agricultural Services Bulletin No. 109, Food and Agriculture Organization of the United Nations, Italy. [ISBN 9251034567].
7. Rosentrater, K.A. (2022). "Storage of Cereal Grains and Their Products". 5th ed., Elsevier, UK. [ISBN 9780128127582].


प्राविधिक परिषदको कार्यालय
कीर्तिपुर

Institute of Science & Technology
Dean's Office
Kirtipur 2045

| | | |
|---|---|---|
| Course: Food Storage<br>Semester: VII<br>Nature of Course: Practical | Course Code: BFT 403 (B)<br>Teaching hours: 64<br>(Lab: 4 h per session) | Credit Hour: 1<br>Full Marks: 25 |

List of practical for laboratory session

1. Assessment of postharvest losses in marketed produce in selected regions of Nepal.
2. Determination of physicochemical properties of grains.
3. Evaluation of infestation: causes, precautionary measures, and control strategies.
4. Grading assessment of rice samples.
5. Identification and characterization of insects present in stored grains.
6. Sanitation practices in grain storage facilities (godowns).
7. Handling and maintenance of grain storage equipment.
8. Fumigation techniques: ballooning method and its applications.
9. Grain grading and inspection: analysis of pesticide residues.
10. Storage stability study of dehydrated food products.
11. Field visit to local warehouses and traditional rural storage structures.

**Unit wise marks distribution for the final exam**

| Unit | Title | Total (%) |
|---|---|---|
| 1 | Introduction | 5 |
| 2 | Transport and handling of food materials | 5 |
| 3 | Storage structures | 10 |
| 4 | Food losses and damage during storage | 5 |
| 5 | Physical factors affecting stored grain | 10 |
| 6 | Grain quality and grain sampling | 5 |
| 7 | Entomology of stored grains and processed foods | 5 |
| 8 | Stored grain mycology | 10 |
| 9 | Rodents and their control | 5 |
| 10 | Grain infestation control | 30 |
| 11 | Grain storage practices | 10 |
| | Total | 100% |

Babita

Institute of Science & Technology
Dean's Office
Kirtipur 2045

| | | |
|---|---|---|
| Course: Industrial Tour | Course Code: BFT 404 (B) | Credit Hour: 1 |
| Semester: VII | Teaching hours: 7 Days | Full Marks: 25 |
| Nature of Course: Practical (visit) | | |

Course description and objectives

This industrial tour provides students with real-world exposure to food, dairy, and beverage industries, as well as grain storage facilities and regulatory bodies overseeing food quality and standards. Over seven days, students will visit manufacturing plants, warehouses, and food safety organizations, gaining insights into production processes, quality assurance, supply chain logistics, and regulatory compliance. The experience fosters practical understanding of industry operations, bridging academic concepts with applied knowledge. Students will engage in interactive sessions, facility inspections, and discussions with industry experts, culminating in a detailed group report analyzing their observations and learnings.

The guideline for the Industrial Tour is given in Annex I of the curriculum.

Institute of Science & Technology
Dean's Office
Kirtipur 2045

प्रांजल परिषदको कार्यालय
कीर्तिपुर

| | | |
|---|---|---|
| Course: In-plant Training | Course Code: BFT 405 (B) | Credit Hour: 2 |
| Semester: VII | Teaching hours: 45 Days (including weekends) | Full Marks: 50 |
| Nature of Course: Practical (internship) | | |

Course description and objectives

This in-plant training provides students with hands-on experience in food industries, as well as relevant government and non-government organizations. Over 45 days, students will engage in real-world operations, gaining exposure to production processes, quality assurance, supply chain management, food safety regulations, and industrial best practices. The training allows students to develop technical skills, problem-solving abilities, and industry-specific competencies while working under the supervision of production managers and immediate supervisors. The pass marks is 60%.

Students will be evaluated based on their performance, adaptability, and technical proficiency, with assessments conducted by industry professionals. A structured individual training report must be submitted in a prescribed format, detailing observations, challenges, and key learnings. This course bridges academic knowledge with practical application, preparing students for professional roles in food technology and industry operations.

The guideline for the Industrial Tour is given in Annex II of the curriculum.

Institute of Science & Technology
Dean's Office
Kirtipur 2065

प्राविधिक परिषदको कार्यालय
कीर्तिपुर

| Course: Research Methodology and Statistical Methods | Course Code: BFT 451 (A) | Credit Hour: 2 |
|---|---|---|
| Semester: VIII | Teaching hours: 32 | Full Marks: 50 |
| Nature of Course: Theory | (2 lecture hours per week) | |

Course description and objectives

This course provides a structured approach to research methodology and its integration with statistical methods in food technology. The research component covers fundamental principles of scientific inquiry, including problem identification, hypothesis formulation, research design, data collection techniques, and ethical considerations. Emphasis is placed on quantitative and qualitative research approaches, literature review strategies, and academic writing practices to equip students with strong research skills.

Course detail

| Unit | Content | Details of content | Teaching hours |
|---|---|---|---|
| 1 | Introduction to Research Methodology | • Meaning, objectives, motivation of research, characteristics of scientific method, Identification of research questions and its formulation, research objectives, statement of the problem.<br>• Variables, concept of dependent variable, independent variable.<br>• Research hypothesis, sources of hypothesis and its utilities, research process, types of researches (quantitative and qualitative). | 6 |
| 2 | Review of Literature | • Concept of review of literature, sources of research literature, search strategies.<br>• Citation and referencing, an overview of different formats of citation and referencing, citation of books, reports, journal articles in American Psychological Association (APA) format.<br>• Use of reference management software such as Zotero / Mendeley / Endnote.<br>• Research integrity, plagiarism, plagiarism detector software. | 7 |
| 3 | Research Design and Research Method | • Concept of research design and its importance, characteristics of a good research design.<br>• Exploratory research design, descriptive research design, experimental research design, case study, survey. | 5 |
| 4 | Methods of Data Collection and Sampling Techniques | • Primary and secondary data, method of collecting primary data, preparation of questionnaire, types of questions, characteristics of good questionnaire, observation method.<br>• Concept of sampling, population, sampling frame, sampling and non-sampling error, probability and non-probability sampling, overview of probability sampling and the practical applications in research problems, sample size estimation for estimating mean and proportion.<br>• Ethical issues in research, informed consent. | 6 |
| 5 | Measurement and Scaling | • Concept of measurement, different levels of measurement, Likert scales, Hedonic scales.<br>• Issues of validity and reliability in research. | 3 |
| 6 | Task of Writing in Research | • Research proposal, structure of research proposals.<br>• Research report, format for academic research report, thesis/ dissertation writing.<br>• Research paper writing, preparation of a small report by reviewing work on some relevant specific topics. | 5 |
| | | Total | 32 |

Reference materials


1. Dubey, U.K.B. and Kothari, D.P. (2022). "Research Methodology: Techniques and Trends." Chapman and Hall/CRC, Boca Raton. [ISBN 9781315167138].
2. Kothari, C.R. (2004). "Research Methodology: Methods and Techniques" (2nd rev. ed.). New Age International, New Delhi. [ISBN 9788122424881].
3. Lawless, H.T. and Heymann, H. (2010). "Sensory Evaluation of Food: Principles and Practices" (2nd ed.). Springer, New York. [ISBN not available].
4. Montgomery, D.C. (2019). "Design and Analysis of Experiments" (10th ed.). John Wiley & Sons, Hoboken, NJ. [ISBN not available].
5. Rotello, C.M., Myers, J.L., Well, A.D. and Lorch, R.F., Jr. (2025). "Research Design and Statistical Analysis" (4th ed.). Routledge, New York. [ISBN 9781032897288].


Institute of Science & Technology
Dean's Office
Kirtipur 2045

पार्षिक परिषद्को कार्यालय
कीर्तिपुर

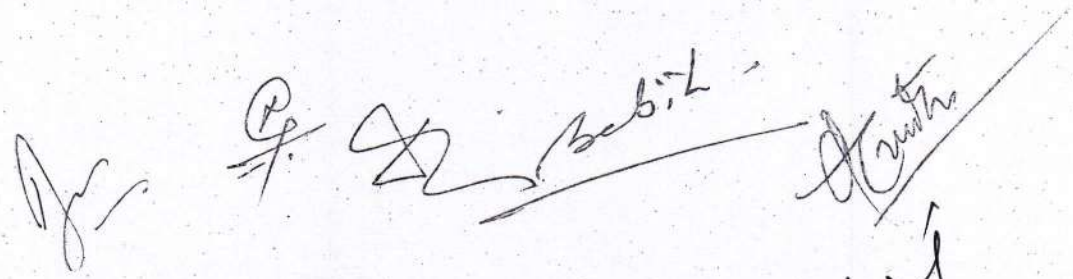
| Course: Research Methodology and Statistical Methods | Course Code: BFT 451 (B) | Credit Hour: 1 |
|---|---|---|
| Semester: VIII | Teaching hours: 64 | Full Marks: 25 |
| Nature of Course: Practical | (Lab: 4 h per session) | |

List of practical for laboratory session

| Unit | Details of content |
|---|---|
| 1 | • Through frequency tables, bar charts, pie charts, percentages, cross tabulations, summary measures.<br>• Activity: Creating charts and tables in Excel/SPSS and others, computing descriptive statistics. |
| 2 | • Hypothesis testing (t-test, chi-square test, correlations, Mann-Whitney etc.), p-value interpretation, Type I/II errors, power of test.<br>• Activity: Running tests in SPSS/Excel and others. Interpretation of output tables and significance. |
| 3 | • Concept of multivariate analysis, applications in food science research.<br>• Activity: Hands-on illustration using SPSS/ or pre-prepared dataset. |
| 4 | • Data entry using statistical software (SPSS, Excel and others), descriptive statistics, hypothesis testing, regression, ANOVA, DOE, control charts. |
| 5 | • Review of experimental designs CRD, RBD, post hoc tests, introduction to factorial designs.<br>• Activity: Practical application of experimental design and data analysis using SPSS/Excel and others, case study from food industry or R & D scenario. |
| 6 | • Introduction to RSM.<br>• Experimental designs for RSM: Central Composite Design (CCD), Box-Behnken Design (BBD).<br>• Rotatability and orthogonality concepts.<br>• Visualization Techniques: 3D surface plots, contour plots, overlay plots for multi-response optimization. |

**Unit wise marks distribution for the final exam**

| Unit | Title | Total (%) |
|---|---|---|
| 1 | Introduction to research methodology | 20 |
| 2 | Review of literature | 20 |
| 3 | Research design and research method | 15 |
| 4 | Methods of data collection and sampling techniques | 20 |
| 5 | Measurement and scaling | 10 |
| 6 | Task of writing in research | 15 |
| | **Total** | **100%** |




| | | |
|---|---|---|
| Course: Food Plant Management and Entrepreneurship Development | Course Code: BFT 452 (A) | Credit Hour: 2 |
| Semester: VIII | Teaching hours: 32 (2 lecture hours per week) | Full Marks: 50 |
| Nature of Course: Theory | | |

Course description and objectives

Food Plant Management and Entrepreneurship Development course provides students with a comprehensive understanding of food plant operations and entrepreneurial strategies, focusing on key aspects such as production systems, quality management, financial control, supply chain logistics, and regulatory compliance. Emphasis is placed on ISO 22000:2018, HACCP, GMP, and Statistical Process Control (SPC) to ensure food safety and operational efficiency. Students will also explore marketing, business development, and innovation in the food sector, along with the formal procedures for establishing a food industry in Nepal, including approval, registration, and licensing requirements. The course will enhance entrepreneurial mindset in students and equip them with the skills required to initiate, develop, and manage food-related business ventures.

Course detail

| Unit | Content | Details of content | Teaching hours |
|---|---|---|---|
| 1 | Food Production Management | • Concept of production and production system.<br>• Classification of production system.<br>• Function of production management.<br>• Objectives of production management.<br>• Important types of systems in use in food production (Just-in-Time, Lean Operation, Quick Response Manufacturing, Agile Manufacturing, etc.).<br>• Challenges in food processing.<br>• Efficient food processing solutions. | 2 |
| 2 | Product and Process Design | • Definitions of product design and development.<br>• Types of product design.<br>• The product design process.<br>• Characteristics of a good product design.<br>• Factors to be considered at product design:<br>- Marketing aspect.<br>- Product characteristics.<br>- Economic analysis.<br>- Break-even analysis.<br>- Effect of management decision on break-even point.<br>- Profit and competitiveness.<br>• Origin of the product idea.<br>• Choosing among alternative products.<br>• Modifying the existing products.<br>• The new product design. | 3 |

Continued ....

Institute of Science & Technology
Dean's Office
Kirtipur 2045

| | | | |
|---|---|---|---|
| 3 | Plant Location and Layout | • Plant Location:<br>- Introduction and meaning.<br>- Need for selecting a suitable location.<br>- Factors influencing plant location:<br>o General locational factors.<br>o Specific locational factors for manufacturing organization.<br>- Location models:<br>o Factor rating method.<br>o Weighted factor rating method.<br>o Load-distance method.<br>o Centre of gravity.<br>o Break even analysis.<br>- Locational economics.<br>• **Plant layout:**<br>- Objectives of plant layout.<br>- Principles of plant layout.<br>- Classification of layout:<br>o Process layout.<br>o Product layout.<br>o Combination layout.<br>o Fixed Position layout.<br>o Group layout (or cellular layout).<br>- Design of product layout.<br>- Design of process layout. | 4 |
| 4 | Food Quality Management | • **Introduction on food quality management.**<br>• **Garvin's nine dimensions of quality.**<br>• **Cost of quality (prevention, inspection and failure).**<br>• **Quality management:**<br>- Quality planning.<br>- Quality control.<br>- Quality assurance.<br>- Continuous improvement.<br>• **Quality improvement tools:**<br>- New tools for quality improvements.<br>- Quality circle (concept, objective and structure).<br>- Total Quality Management (TQM).<br>- Six-sigma (principles and benefits).<br>- Kaizen.<br>- Lean six-sigma.<br>- Shewhart (PDCA) cycle.<br>- Benchmarking (advantages, approaches and types).<br>- Quality function deployment (objectives, advantages, process, tools and technique).<br>• Statistical quality control:<br>- Tools of descriptive statistics.<br>- Tools statistical process control (SPC):<br>o Control charts for variables.<br>o Control charts for attributes.<br>- Tools for acceptance sampling:<br>o Types of sampling plans.<br>o Operating Characteristic Curve. | 5 |

| | | | |
|---|---|---|---|
| 5 | Financial Control | • Risk mitigation.<br>• Revenue management and costing strategies.<br>• Working capital management.<br>• Capital budgeting. | 4 |
| 6 | Food Supply Chain Logistics | • Food supply chain.<br>• Food logistics and their critical role in food supply chain.<br>• Key components of logistics (transportation, storage and distribution).<br>• Challenges faced in the use of logistics; Innovative technologies used to improve logistic efficiency of supply chain. | 2 |
| 7 | Marketing | • Introduction: marketing; principles of marketing; marketing management and its functions.<br>• Concept and elements of marketing mix, advertising, sales promotion, channels of distribution, product packaging, pricing.<br>• Concept of product-mix, product line, product life cycle, consumer behavior.<br>• Salient features of International Marketing.<br>• Composition and direction of Nepal's food. | 4 |
| 8 | Introduction to Entrepreneurship | • Meaning and definition of entrepreneur and entrepreneurship.<br>• Characteristics of entrepreneur.<br>• Functions of entrepreneur.<br>• Types of entrepreneurs.<br>• Importance of entrepreneurship.<br>• Causes of success and failure of business/enterprise: success/ failure symptoms; causes of failure.<br>• Theories of entrepreneurship.<br>• Importance of entrepreneurship for micro enterprise, cottage and small industry in Nepal.<br>• Women entrepreneurship concept and prospects. | 3 |
| 9 | Business Development, Creativity, and Innovation | • Concept of creativity and Innovation.<br>• Phases of creativity.<br>• Barriers to creativity.<br>• Developing creativity.<br>• Types of Innovation and sources of innovation.<br>• Entrepreneurial opportunity and identification.<br>• Basic concepts and elements of food business opportunities and sources of business opportunities.<br>• Innovative food technology trends and importance of food innovations (with examples and breakthroughs). | 2 |
| 10 | Regulatory Compliance, Food Industry Establishment, and Operation Procedures | • Important technical laws and regulations, particularly related consumer protection, weight and measures, standard marks, intellectual property rights.<br>• Brief understanding of relevant business laws, regulations and guidelines for establishing and operation of a food industry in Nepal, including approval, registration, and licensing requirements (aligned with Company Act, Private Firm Act, Industrial Enterprises Act, Foreign Investment and Technology Transfer Act, Consumer Protection Act other relevant acts and regulations of Federal, Provincial and Local Governments)<br>• Export-import code. | 3 |
| | | Total | 32 |

Institute of Science & Technology
Dean's Office
Kirtipur 2045

कीर्तिपुर

Reference materials


1. Chary, S. N. (2017). "Production and Operations Management" (5th ed.), McGraw Hill Education, India. [ISBN 9781259005107].
2. International Finance Corporation. (2020). "Food Safety Handbook: A Practical Guide for Building a Robust Food Safety Management System". World Bank, Washington, DC. [ISBN 9781464815485]. [doi: 10.1596/978-1-4648-1548-5].
3. Mathur, S. B. (2017). "Financial Management: Theory and Practice". Laxmi Publications Pvt Ltd. [ISBN 9789351360665].
4. Khanka, S. S. (2007). "Entrepreneurial Development". S. Chand and Company, India. [ISBN 9788121918015].
5. Kotler, P., Keller, K. L., Koshy, A. and Jha, M. (2022). "Marketing Management: A South Asian Perspective" (16th ed.), Pearson Education. [ISBN 9789356062665].
6. Kumar, S. A. and Suresh, N. (2006). "Production and Operations Management". New Age International. [ISBN 9788122418279].
7. Kuratko, D. F. and Hodgetts, R. M. (2000). "Entrepreneurship: A Contemporary Approach". South-Western College Publishing, USA. [ISBN 9780030196041].
8. Murthy, P. R. (2005). "Production and Operations Management". New Age International, India. [ISBN 9788122415582].
9. Sontakki, C. N., Gupta, N. and Gupta, A. (2016). "Marketing Management". Kalyani Publishers, India. [ISBN 9788127229764].
10. Sudheer, K. P. and Indira, V. (2021). "Entrepreneurship Development in Food Processing". CRC Press, USA. [ISBN 9781003246022]. [doi: 10.1201/9781003246022].
11. Vozikis, G. S., Mescon, T. S., Feldman, H. D. and Liguori, E. W. (2015). "Entrepreneurship - Venture Initiation, Management, and Development" (2nd ed.). Routledge, New York. [ISBN 978-0-7656-3113-8].
12. Following Acts currently prevailing in Nepal and directly related portions of linked with Rules and regulations, Standards, Directives and Procedures set in:
    - कम्पनी ऐन २०६३
    - प्राइभेट फर्म रजिस्ट्रेसन ऐन २०१४
    - साझेदारी ऐन २०२०
    - विदेशी लगानी तथा प्रविधि हस्तान्तरण ऐन २०७५
    - वातावरण संरक्षण ऐन २०७६
    - खाद्य स्वच्छता तथा गुणस्तर ऐन २०८१
    - नेपाल गुणस्तर (प्रमाण-चिन्ह) ऐन २०३७
    - स्टैन्डर्ड नाप र तौल ऐन २०२५
    - पेटेन्ट डिजाइन र ट्रेडमार्क ऐन २०२२
    - प्रतिलिपि अधिकार ऐन २०५९
    - उपभोक्ता संरक्षण ऐन २०७५


**Unit wise marks distribution for the final exam**

| Unit | Title | Total (%) |
|---|---|---|
| 1 | Food production management | 5 |
| 2 | Product and process design | 10 |
| 3 | Plant location and layout | 15 |
| 4 | Food quality management | 15 |
| 5 | Financial control | 10 |
| 6 | Food supply chain logistics | 5 |
| 7 | Marketing | 15 |
| 8 | Introduction to entrepreneurship | 10 |
| 9 | Business development, creativity and innovation | 5 |
| 10 | Regulatory compliance, food industry establishment and operation procedures | 10 |
| | Total | 100% |

Institute of Science & Technology
Dean's Office
Kirtipur 2045

| | | |
|---|---|---|
| Course: Dissertation | Course Code: BFT 453 (B) | Credit Hour: 4 |
| Semester: VIII | Research duration: 6 months | Full Marks: 100 |
| Nature of Course: Research (Practical) | | |

Course description and objectives

In the final semester, students undertake a comprehensive dissertation, developing independent research aligned with prioritized topics approved by the Head of Department (HOD). Each student is assigned a supervisor and an internal examiner, guiding the six-month research process. Successful completion of coursework up to the 7th semester is a prerequisite for defense, which must be conducted within 12 months of completion.

Evaluation is conducted by a dissertation committee comprising the supervisor (40%), internal examiner (20%), external examiner (30%), and HOD (10%), with a minimum passing mark of 60%. The dissertation must adhere to the latest APA style manual, with a similarity index below 20%, as verified by the plagiarism checker specified by IoST. The final version must be submitted within six months post-defense, ensuring academic rigor and professional research competency.

The manual for dissertation writing is given in Annex III.

Institute of Science & Technology
Dean's Office
Kirtipur 2045

प्राज्ञिक परिषद्को कार्यालय
कीर्तिपुर

| | | |
|---|---|---|
| Course: Class Seminar | Course Code: BFT 454 (B) | Credit Hour: 2 |
| Semester: VIII | Presentation: Twice per year | Full Marks: 50 |
| Nature of Course: Review and Presentation | | |

Course description and objectives

In the final semester, students deliver two seminar presentations supported by a research paper and slides formatted to dissertation standards. This course hones scholarly communication and presentation skills, with structured faculty evaluation—Mentor Faculty (50%), Commentator Faculty (25%), and Head of Department (25%) – ensuring rigorous academic assessment. A minimum pass mark of 60% is required, emphasizing clarity, research depth, and adherence to formal academic guidelines.

The manual for dissertation writing is given in Annex IV.

---

---

Institute of Science & Technology
Dean's Office
Kirtipur 2045

# ANNEXES


Institute of Science & Technology
Dean's Office
Kirtipur 2045

---


प्रज्ञान तथा शिक्षण कार्यालय
कीर्तिपुर

# ANNEX - I

## INDUSTRIAL TOUR MANUAL
## (B. Tech. Food Technology, Semester system | 2025)

**Course title: Industrial Tour [BFT 404 (B)], 1 Credit**

**Year and Semester: 3rd Year / 7th Semester**

**Course Description**

This 7-day experiential and field-based industrial tour offers students real-world exposure to food, dairy, and beverage industries, grain storage facilities, and regulatory bodies overseeing food quality and standards in Nepal. Over the course of seven days, students will visit manufacturing plants, warehouses, and food safety organizations, gaining first-hand insights into production processes, quality assurance, supply chain logistics, and regulatory compliance. Through facility inspections, interactive sessions, and discussions with industry experts, students will develop practical knowledge of industry operations and bridge academic concepts with applied learning. The tour fosters critical thinking, observation skills, and teamwork, culminating in group presentations and a detailed report analyzing their observations and learnings.

---

**Course objectives**

Upon successful completion of this industrial tour, students will be able to:

1. Gain hands-on experience in food processing, storage, and quality assurance.
2. Understand regulatory compliance in food production.
3. Observe supply chain logistics from procurement to distribution.
4. Enhance observation and reporting skills through documentation.
5. Engage with industry professionals on careers and challenges.
6. Improve teamwork and communication through discussions and presentations.
7. Prepare a structured industry visit report in academic format.

**1. Official communications for industry visit**

- Drafting formal request letters to industries/organizations by the HOD or the campus for visit approvals.
- Ensuring letters are signed and stamped by relevant authorities before submission.
- Confirming responses and finalizing the itinerary with the institutions.

**2. Submission of itinerary by the HOD and approval process**

- Preparing a detailed itinerary specifying visit locations, time slots, and transport details.
- The itinerary must be submitted for approval to the Campus Chief at least two weeks before departure to allow sufficient time for managing transportation logistics.
- Coordinating with the administration for budget approval and expense calculations.

Institute of Science & Technology
Office

### 3. Expense calculation and budgeting

- Estimating expenses for transportation, meals, accommodations, and miscellaneous costs.
- Seeking financial support (if applicable) and confirming payment procedures.
- Allocating funds effectively while adhering to institutional regulations.
- Writing a request letter to the Campus Chief to request an advance payment.

### 4. Detailed tour itinerary

To maintain clarity and organization, the daily schedule must be well-defined, specifying locations, industry visits, meal breaks, and night stays.

**Sample itinerary**

| Day | Visit Locations | Industry Type | Lunch & Rest Stops | Night Stay |
|---|---|---|---|---|
| Day 1 | Departure and travel | - | Lunch en route | City A |
| Day 2 | Industry A | Dairy | Lunch at site | City B |
| Day 3 | Industry B | Beverage | Lunch at site | City C |
| Day 4 | Industry C | Grain Storage | Lunch en route | City D |
| Day 5 | Organization I | Regulatory Compliance | Lunch at site | City E |
| Day 6 | Industry D | Food Processing | Lunch at site | City F |
| Day 7 | Return | - | Lunch en route | - |

*Key Guidelines:-*

- Clearly communicate the next visit schedule after each industry visit to avoid confusion among students.
- Students must adhere to the strict departure schedule to prevent delays.
- Faculty must ensure everyone is informed about night stay locations in advance.

**5. Pre-tour student orientation**

- Conducting a mandatory orientation session to clarify learning objectives and expectations.
- Briefing students on the code of conduct at industrial sites.
- Highlighting reporting requirements (standard format, group submissions, annexes).
- Distributing a checklist of essential items:
- Notebook and pen (for observations)
- Apron/Lab coat
- Masks and hairnets
- Safety gear (if required by industry standards)

**6. Industry visit guidelines**

- Students must strictly adhere to industry-specific protocols and safety measures.
- Not more than two similar types of industries should be included in the itinerary.
- Punctuality is crucial – delays must be avoided as buses are reserved.
- Guide teachers must carry:
  - ✓ Original, stamped request letter
  - ✓ Signed list of students, guide teachers, and transport staff

**7. Disciplinary guidelines and consequences**

To maintain order and professionalism, students must adhere to the code of conduct during the tour. Any violations will result in disciplinary actions.

***Code of Conduct:***

- Respect industry protocols and host organizations.
- Maintain punctuality – strict adherence to the schedule.
- Comply with dress code (apron, masks, hairnets).
- Follow instructions from guide teachers and industry personnel.
- Refrain from unauthorized photography or sharing confidential industry information.

Institute of Science & Technology
Dean's Office
Kirtip[illegible] 2045

**Consequences for offences:**

| Type of Offence | Penalty |
|---|---|
| Minor violations (lateness, dress code issues) | Warning and deduction in participation marks |
| Major violations (disrespectful behavior, failure to submit reports) | Formal disciplinary notice & restriction from future tours |

| | |
|---|---|
| Severe misconduct (violation of industry rules, absenteeism) | Exclusion from the tour and report to HOD |

**8. Daily group presentations**

- At the end of each day, students will present their experiences in groups.
- Presentations should highlight key learnings, observations, and challenges faced.
- Guide teachers should facilitate discussion sessions for reflection and analysis.

**9. Post-tour reporting and submission guidelines**

- Group-based submission – each group will document observations from a similar type of industry.
- The report format must include:
  1. Introduction (Purpose of the tour, industries visited)
  2. Objectives (Key learning goals)
  3. Findings (Detailed observations and insights)
  4. Conclusions (Summary of industry practices)
  5. Suggestions (Improvements, recommendations)
  6. References (If applicable)
  7. Annexes:
     - ✓ Photographs from the visit
     - ✓ Route map of Nepal marking visited locations

---

प्राज्ञिक परिषद्का कार्यालय
कीर्तिपुर

Institute of Science & Technology
Dean's Office
Kirtipur 2045

# ANNEX - II

## 45-day In-plant Training (internship) Guideline for B. Tech. Food Technology (Semester System)

**Course: BFT 405 (B), 2 Credit**

### Introduction

An essential component of the B. Tech. (Food Technology) program is the in-plant training program, which allows students to experience the real world of food industries and associated businesses outside of the classroom. This 45-day internship, which takes place during the seventh semester, gives students a firsthand look at how the food industry functions while assisting them in putting their academic knowledge to use in real-world situations, such as production facilities, quality control labs, or administrative offices.

The production manager (or the chief) at the host organization and the intern's immediate supervisor closely monitor each intern's development. During the training period, a college or campus coordinator also makes at least one site visit to make sure everything goes as planned. The Department of Food Technology formally requests the internship, and campus administration may assist in arranging the placement if necessary. A request letter, joining information, an intern code of conduct, and private performance evaluation forms are sent to the host organization.

Following the internship, students are required to write and submit an internship report using the CDFT-IoST format. Students should submit 2 copies of the in-plant training report (one for department and one for the library) duly signed by the HOD. Students should also submit a soft copy of the report in pdf format to the department library.

The report will later be presented by the students (in groups if they interned at the same company). The marks (out of 50) will be distributed as follows: Production manager (or the chief) at the host organization: 20%, immediate organizational supervisor: 60%, report presentation: 10%, and on-site visit by faculty: 10%. The student's grades will be recorded in the marks file and transmitted in confidence to the central exam section via the concerned food technology department.

Babita

Institute of Science & Technology
Dean's Office
Kirtipur 2045

During the internship period, students must maintain a daily work diary and have it signed weekly by their immediate supervisor. Faculty designated for the on-site visit shall verify the intern's daily work diary, attendance, and punctuality.

Documents to be submitted by the campus/college to the host institution:

1. Student's curriculum vitae (CV) highlighting academic background, technical skills, and relevant coursework.
2. Official request letter for internship placement

Documents to be submitted by the intern to the host institution:

1. Intern's joining letter clearly specifying the exact internship period, code of conduct, reporting relationship, and other relevant details.
2. Confidential evaluation sheets (shown below) to be filled by the immediate supervisor and production manager (organizational chief).
3. Copy of student ID card or institutional enrollment verification.
4. Emergency contact information and any required medical or insurance details (if applicable).

**Instruction:** Use separate colors to differentiate evaluation sheets completed by the immediate supervisor from those completed by the production manager (organizational chief).

Institute of Science & Technology
Dean's Office
Kirtipur 2045

Evaluation sheet sample

Name of the academic institute

**In-plant Training Evaluation Form**

**(Part I: Immediate Supervisor)**

Name of the Industry / Organization: .....

Name of the Intern: .....

Section / Session (if applicable): .....

There are TWO parts of evaluation. PART-I has to be completed by the immediate in-charge of the trainee and PART-II has to be completed by the Plant Chief (General Manager/ Manager). The marks should be filled in the table given below, against corresponding headings.

| *S/N* | *Items to be evaluated* | *Full marks* | *Marks given* |
|---|---|---|---|
| 1 | Overall technical know-how in the subject matter | 5 | |
| 2 | Sincerity in work | 4 | |
| 3 | Ability to solve problems | 4 | |
| 4 | Reliability of work | 4 | |
| 5 | Problem solving attitude | 4 | |
| 6 | Work confidence | 3 | |
| 7 | Learning attitude | 2 | |
| 8 | Cooperative attitude | 2 | |
| 9 | Overall impression | 2 | |
| | Total | 30 | |

.....
Signature
(Immediate Supervisor)

.....
Name

Date: .....

Official Seal

Name of the academic institute

In-plant Training Evaluation Form

(Part II: Production Manager /Organizational Chief)

Name of the Industry / Organization: .....

Name of the Intern: .....

There are TWO parts of evaluation. PART-I has to be completed by the immediate in-charge of the trainee and PART-II has to be completed by the Plant Chief (General Manager/ Manager). The marks should be filled in the table given below, against corresponding headings.

| *S/N* | *Items to be evaluated* | *Full marks* | *Marks given* |
|---|---|---|---|
| 1 | Regularity | 2 | |
| 2 | Attitude towards the assigned job | 2 | |
| 3 | Ability to cope with problems | 2 | |
| 4 | Relationship with the senior and junior staff | 2 | |
| 5 | General impression about the trainee | 2 | |
| | Total | 10 | |

.....
Signature
(Production manager /
Organization Chief)

.....
Name

Date: .....

Official Seal

Institute of Science & Technology
Exams Office
Kathmandu 2045

## Information to be included in the report

Interns are required to include the following information in their report – wherever feasible and subject to the organization's consent for disclosure.

### Management

- Factory / Organization / Institution name:
- Address:
- Established year:
- Nature of ownership (private / public / government, etc.):
- Company structure / Organizational chart:
- Capital investment
  (a) Fixed assets: (b) Operational cost:
- Annual turnover:
- Product range (% contribution of each product per annum) in terms of:
  (a) Volume (b) Sales (retail value)
- Growth or decline (comparison of total production per sales with preceding years):
- Total number of employees: Catchment area:
  No. of direct laborers: No. of indirect laborers:
  Unionized or non-unionized Benefits and facilities:
- Clinic, canteen, and recreational facilities:

### Building

- Total area: Plant area:
- Plant layout:
- Location and surrounding:
- Measures against fire, infestations, and other hazards:
- Security measures:
- Production (take each product separately):
- Raw materials and other ingredients:
- Manufacturing details:
- Packaging materials and types of containers (unit, retail, etc.):
- Material balance shown in flow diagram:
- Production capacity:
  (a) Installed (b) Actual
- Qualification and experience of skilled workers:
- No. of unskilled workers and kind of job:
- No. of shifts of total working hours:
- Peak and lean season (for candy, soft drinks, ice-cream, tea, sugar, etc.):
- Production machinery name, number, capacity and the make:
- Estimated power consumption:

Institute of Science & Technology
Dean's Office
Kirtipur 2045



प्राज्ञिक परिषदको कार्यालय
कीर्तिपुर

- Important features of boiler, generator, and power supply:
- Technical problem with the process and product, if any:
  (a) As stated by the management (b) As observed by the student

## Quality control

- Raw material supplier:
  Time: Season: Duration of supply:
- Regular or occasional supplier:
- Any other methods of procurement used:
- Packaging material supplier:
- Inline QC:
- Lab. QC:
- Critical Control Points in flowcharts:
- Tests on finished product:
- Tests on packaging materials and containers:

## Storage

- Storage conditions of the raw materials:
- Average storage period of raw materials before being processed:
- Storage condition (temperature and RH):
- Measures taken against storage hazards and losses:
- Average storage period of the finished product before dispatch:
- Specific storage problems (if any):

## Marketing

- Markets and retail chain:
- Means of transport:

## Waste and by-product

- By-product process and utilization:
- Type of waste: Value/time:
  pH: BOD: COD:
- Disposal of effluent (how and where):
- Waste water treatment:

## Water

- Source:
- Water treatments for:

Institute of Science & Technology
Dean's Office
Kirtip r 2045



शैक्षिक परिषदका कार्यालय

(a) Ingredient water:
(b) Process water:

- Appliances and chemicals:
- Volume of water used:

## Plant sanitation and hygiene

- Cleaning procedure:
- Frequency:
- Cleaning appliances and chemicals:
-

## Legislation

- Legal requirements on the product and container:
- Standards followed:
- Excise and duty on items:

## Research and Development

- Does the industry carry out R & D work? If yes, what type(s) of R & D?
  (a) Product development:
  (b) Process development:
  (c) Process design:
- Plant automation:

Your overall comment:

Date:

Signature of the student

शैक्षिक परिसदको कार्यालय
कीर्तिपुर

Institute of Science & Technology
Dean's Office
Kirtipur 2045

# ANNEX - III

# CDFT-IoST DISSERTATION STYLE MANUAL

| | |
|---|---|
| Program | : B. Tech. (Food), Semester System |
| Year and Semester | : 4th Year / 8th Semester |
| Course Code | : BFT 453 (B), 4 Credit |

**Developed by Food Technology Subject Committee, Institute of Science & Technology**

**Tribhuvan University**

**Nepal**

**2025**

---

Institute of Science & Technology
Dean's Office
Kirtipur 2045

## Table of contents

## 1. Introduction

Academic writing plays a crucial role in fostering structured knowledge dissemination and advancing research methodologies within specialized fields. The CDFT-IoST style is an innovative dissertation formatting system tailored for students pursuing B. Tech. (Food), M. Tech. (Food), B.Sc. Nutrition and Dietetics (BND), and Master's programs under the Institute of Science and Technology (IoST), Tribhuvan University. Designed to ensure uniformity and professional presentation across academic submissions, the CDFT-IoST style incorporates distinctive structural elements while adhering to globally recognized referencing standards.

The CDFT-IoST format is uniquely crafted to meet the specific needs of food technology, nutrition, and dietetics disciplines by integrating a precise layout for cover pages, front matters, and document page formatting. This approach ensures clarity in research presentation and enhances readability, facilitating effective academic communication. The foundational elements of the format include:

1. **Cover page design:** A standardized title page emphasizing essential details such as the dissertation title, author information, degree program, and institutional affiliation.
2. **Front matter structure:** Organized preliminary pages encompassing the approval, abstract, keywords, acknowledgments, tables of contents, list of tables, list of figures, list of abbreviations, appendices, and other introductory components.
3. **Document page formatting:** A unique style for headings, subheadings, text alignment, and spacing, specifically designed to enhance comprehension and maintain scholarly rigor.
4. **Citation and referencing:** While the document structure is distinct to CDFT, the referencing and citation format strictly follows the latest APA style manual, ensuring consistency in academic integrity and global compatibility.

By integrating the latest APA citation style, the CDFT-IoST format aligns with international academic standards, fostering accessibility and proper attribution of sources. This dual-approach – combining a unique formatting structure with universally accepted referencing—ensures that research publications under IoST uphold precision, credibility, and professionalism.

The introduction of the CDFT-IoST style marks a significant step toward streamlining academic writing conventions within Tribhuvan University's science and technology disciplines. By standardizing dissertation structures, it promotes effective knowledge sharing, improved scholarly communication, and enhanced research impact across food technology and nutritional sciences.

## 2. General information

### *Unit and nomenclature*

Use SI system of unit and IUPAC rule for nomenclature. In special cases, other conventional forms are also acceptable, such as: ppm (for parts per million), mg/L, cfu/g (colony forming units per gram), etc.

### *Spelling convention*

Maintain consistency by adhering to either American or British spelling throughout, avoiding a mix of both.

### *Standard notations*

Use following standard notations for units:

| Full form | Use | Do not use |
|---|---|---|
| centimeter(s) | cm | centimeter |
| cubic centimeter | $cm^3$ | cc |
| Degree Celsius | °C (insert as a single normal text) | °C or $^0$C (not the superscripts of "o" or "0") |
| gram | g | gm or Gm |
| hour(s) | h | hr, hrs or hour(s)* |
| kilogram | kg | KG |
| meter(s) | m | meter |
| microgram | µg | mcg |
| microliter | µL | µl or mcL |
| micrometer | µm or µ | mcm or micron |
| milligram | mg | mG |
| milligram per liter | mg/L | mg/liter |
| milliliter | mL | ml |
| millimeter(s) | mm | mM or MM |
| minute(s) | min | minute or minutes* |
| Pascal | Pa | pa or Pascal or Pas |
| percent | % | percent* |
| second(s) | s | sec or second(s)* |

* Unless it is absolutely necessary for clarity, e.g., "… the solution needs boiling for several *hours*….", "… the *percentage* of defaulter has increased significantly ..", etc.

### *Spacing and font*

Unless specified, use 1.5 line spacing and Times New Roman font 12 pt.

### *Page set up*

Top = 3 cm, Bottom = 2.5 cm, Left = 3 cm and Right = 2.5 cm.

Institute of Science & Tech... Dean's Office ... 2015

*Pagination*

Put the page number at the bottom center of the page. Hide the page number on the first page of each **Part**. The page numbering for the front matter (from *title page* to the *list of abbreviations*) should be in Roman numerals (i, ii, iii, ...). The numbering from **Part I** onward should be in Arabic numerals (1, 2, 3, ...).

***Paper size***

The paper size will be A4. By dimension, it is 210 mm × 297 mm (8.27 in × 11.69 in)

***Bullets/numbering***

Use automatic numbering (with an indent of 0.63 cm or 0.25 inch) and edit the paragraph spacing to 1 line *for items between the top and bottom items*. Use only solid circle bullet (•) for bulleted list and Arabic numerals (1, 2, 3, ...) for numbering. Follow the correct punctuation (no period needed for a list with fragment or partial sentences).

***Paragraph format***

Set 10 pt or 12 pt space either before or after (not both) paragraph.

***Indentation in paragraphs***

No indentation in the first paragraph (under each heading) but an indentation of 5 space bars for all subsequent paragraphs under the same heading.

***Keywords***

Keywords are essential identifiers that highlight the core themes, methodologies, and subjects of a thesis. They enhance discoverability by enabling academic databases, researchers, and search engines to locate relevant studies efficiently. Well-chosen keywords provide a snapshot of the research focus, guiding scholars toward related work in the field.

To select effective keywords, authors should focus on the main concepts of their research, use precise and discipline-specific terms, and incorporate alternative phrases or synonyms commonly used in the field. A balanced mix of broad and specific keywords improves accessibility while ensuring relevance. By carefully curating 5-7 impactful keywords, a thesis gains greater visibility, helping scholars and institutions categorize and retrieve academic work effectively. Standardizing keyword usage in the CDFT-IoST format would further enhance research accessibility within Tribhuvan University's Institute of Science and Technology (IoST).

Place the Keywords after the abstract under a section labeled "**Keywords**".

***Dissertation length requirement***

The dissertation must adhere to the following page limits, including the front matter, main content, and references:

- **Bachelor's Level**: Minimum 50 pages, maximum 80 pages (including references and appendices).
- **Master's Level**: Minimum 80 pages, maximum 120 pages (including references and appendices).

## 3. Contents of the dissertation

The dissertation should consist of the following items:

1. Cover page
2. Title page
3. Approval letter
4. Acknowledgements
5. Abstract
6. Table of contents
7. List of Tables
8. List of Figures
9. List of Plates
10. List of Abbreviations

Roman numerals for pagination

..... i
.....ii
.....iii
.....iv

11. Part I: Introduction
12. Part II: Literature review
13. Part III: Materials and methods
14. Part IV: Results and discussion
15. Part V: Conclusions and recommendations
16. Summary
17. References
18. Appendices

Arabic numerals for pagination

..... 1-4
..... 1
..... 3
..... 6-22

4. Cover page (sample)

**ANALYSIS OF CHROMATOGRAPHIC PROFILES AND SENSORY QUALITY OF TEA AROMA**


by

**Lakshmi Prasad Dhungel**

**Department of Food Technology**
**Central Campus of Technology**
**Institute of Science and Technology**

5. Title page (sample)

**Analysis of Gas Chromatographic Profiles and Sensory Quality of Tea Aroma**

*A dissertation submitted to the Department of Food Technology, Central Campus of Technology, Tribhuvan University, in partial fulfillment of the requirements for the degree of B. Tech. in Food Technology*

by

**Laxmi Prasad Devkota**

**Department of Food Technology**

**Central Campus of Technology, Dharan**

**Institute of Science and Technology**

**Tribhuvan University, Nepal**

**January, 2025**

## 6. Approval letter (sample)

Tribhuvan University
Institute of Science and Technology
Department of Food Technology
Central Campus of Technology, Dharan


**Approval Letter**

**This *dissertation* entitled *Analysis of Gas Chromatographic Profiles and Sensory Quality of Tea Aroma* presented by Laxmi Prasad Devkota has been accepted as the partial fulfillment of the requirement for the B. Tech. degree in Food Technology**

**Dissertation Committee**

1. **Head of the Departme** _____
   **(Mr./Dr.?????/, Prof./Assoc. Prof.)**
2. **External Examiner** _____
   **(Mr./Dr.?????/, Prof./Assoc. Prof.)**
3. **Supervisor** _____
   **(Mr./Dr.????/, Prof./Assoc. Prof.)**
4. **Internal Examiner** _____
   **(Mr./Dr.????/, Prof./Assoc. Prof.)**

Institute of Science & Technology
Dean's Office
Kirtipur/2015

## 7. Acknowledgments (sample)

### Acknowledgments 14 B

I would like to express my sincere .....

.....

.....

.....

.....

.....

.....

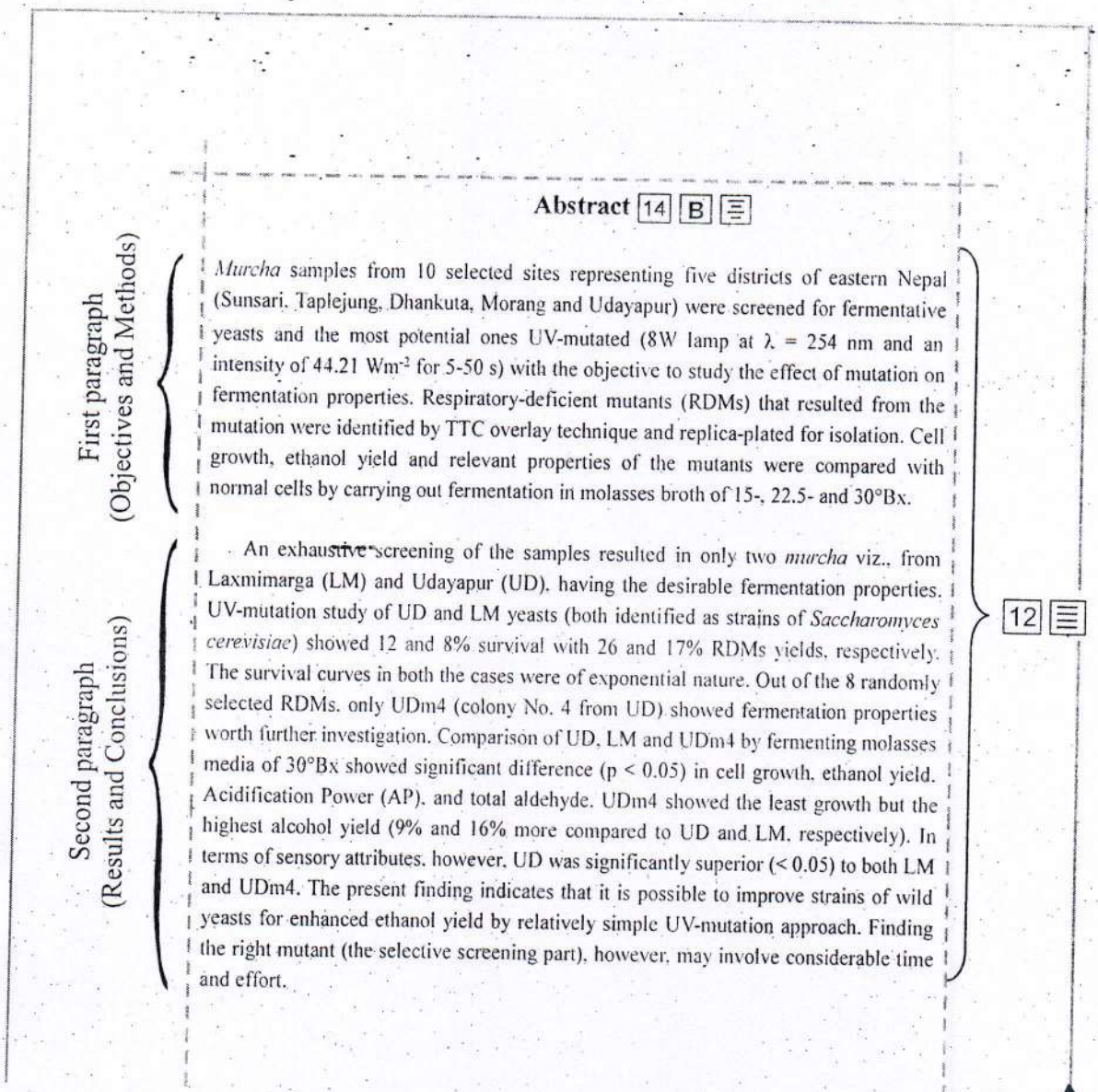
12

Date of submission: January 12, 2012

(Laxmi Prasad Dhungana)

## 8. Abstract (sample)

The abstract should not exceed 250 words and must follow a structured format, including objectives, methods, results, and conclusions—briefly summarizing what was intended, conducted, observed, and concluded. Generally, it should be written in two paragraphs: the first paragraph presenting the objectives and methods, and the second paragraph summarizing the results and conclusions.



**Abstract** 14 B

First paragraph (Objectives and Methods)

*Murcha* samples from 10 selected sites representing five districts of eastern Nepal (Sunsari, Taplejung, Dhankuta, Morang and Udayapur) were screened for fermentative yeasts and the most potential ones UV-mutated (8W lamp at $\lambda$ = 254 nm and an intensity of 44.21 $Wm^{-2}$ for 5-50 s) with the objective to study the effect of mutation on fermentation properties. Respiratory-deficient mutants (RDMs) that resulted from the mutation were identified by TTC overlay technique and replica-plated for isolation. Cell growth, ethanol yield and relevant properties of the mutants were compared with normal cells by carrying out fermentation in molasses broth of 15-, 22.5- and 30°Bx.

Second paragraph (Results and Conclusions)

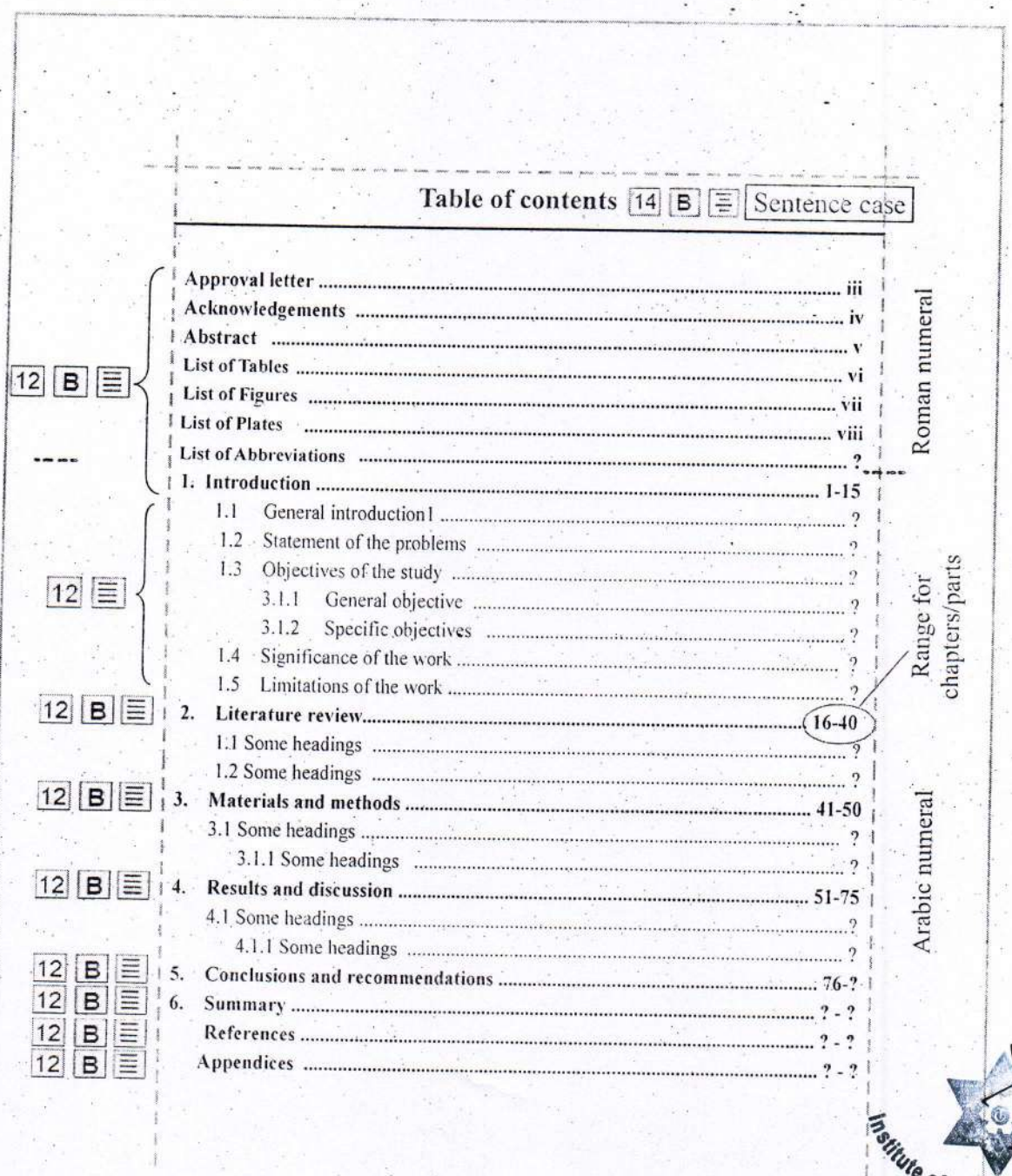
An exhaustive screening of the samples resulted in only two *murcha* viz., from Laxmimarga (LM) and Udayapur (UD), having the desirable fermentation properties. UV-mutation study of UD and LM yeasts (both identified as strains of *Saccharomyces cerevisiae*) showed 12 and 8% survival with 26 and 17% RDMs yields, respectively. The survival curves in both the cases were of exponential nature. Out of the 8 randomly selected RDMs, only UDm4 (colony No. 4 from UD) showed fermentation properties worth further investigation. Comparison of UD, LM and UDm4 by fermenting molasses media of 30°Bx showed significant difference ($p < 0.05$) in cell growth, ethanol yield, Acidification Power (AP), and total aldehyde. UDm4 showed the least growth but the highest alcohol yield (9% and 16% more compared to UD and LM, respectively). In terms of sensory attributes, however, UD was significantly superior (< 0.05) to both LM and UDm4. The present finding indicates that it is possible to improve strains of wild yeasts for enhanced ethanol yield by relatively simple UV-mutation approach. Finding the right mutant (the selective screening part), however, may involve considerable time and effort.

12

## 9. Table of contents

The heading "Table of Contents" should be 14 pt, bold, center-aligned, followed by a solid line. Preliminary sections, ranging from approval to the list of abbreviations, should be 12 pt, bold, left-aligned, with corresponding page numbers in Roman numerals (i, ii, iii, …). Main headings must be 12 pt, bold and include their starting and ending page numbers in Arabic numerals (e.g., 10–20), while sub-headings should be 12 pt, normal, and numbered in Arabic numerals (1, 2, 3, …).

*Note:* Do not include Table of contents in the "Table of contents" itself.



## 10. List of Tables

The List of Tables should be placed on a separate page, with tables numbered using Arabic numerals. The heading "List of Tables" must be in Title Case, 13 pt. Bold, and Center-aligned. In the top row of the table, Table No., Title, and Page No. should be formatted in 12 pt. Bold, while the remaining text should be 12 pt, Normal.

**A specimen of List of Tables**

List of Tables 13 B Title case

| Table No. | Title | Page No. |
|---|---|---|
| 2.1 | Acetaldehyde and ethyl acetate contents of different whiskies | 9 |
| 2.2 | General classification of mutation | 24 |
| 2.3 | Application of mutagenesis to generate novel industrial yeasts | 26 |
| A-I.1 | *t*-Test: Paired Two Sample for means at 15°Bx | 82 |
| A-I.8 | Summary of comparison of physicochemical properties of test yeasts | 84 |

12 Sentence case

## 11. List of Figures

List of Figures 13 B Title case

| Figure No. | Title | Page No. |
|---|---|---|
| 2.1 | Conversion of sugar into ethanol by zymase | 10 |
| 2.2 | Electron micrograph of budding yeast cell | 11 |
| 2.3 | Main features of a typical yeast cell | 12 |
| 2.4 | The electromagnetic spectrum | 27 |
| 2.5 | Formation of thymine dimer under the influence of UV radiation | 28 |
| 2.6 | Survival curve of yeast cells | 29 |

12 Sentence case

## 12. List of Plates

List of Plates should be given on a separate page. Use Arabic numerals for numbering Plates. The heading List of Plates should be in Title case, 13 pt. Bold and Center-aligned. The Plate

No., Title and Page No. in the top row should be 12 pt Bold and the rest should be 12 pt Normal (except in special cases, such as vernacular names, etc.)

**A specimen of list of Plates**

List of Plates 13 B Title case

| Plate No. (12 B) | Title (12 B) | Page No. (12 B) |
|---|---|---|
| P1 | Field study | 85 |
| P2 | Test fermentation of *murcha* samples | 85 |
| P3 | Laboratory analysis | 85 |
| P4 | Beer produced in 30°Bx media using: (a) UDm4, (b) UD and (c) LM | 85 |
| P5 | UV-mutation study | 85 |
| P6 | Healthy and of RDM cells | 85 |
| P1 | Field study | 85 |

12 Sentence case

## 13. List of Abbreviations

List of abbreviations should be given on a separate page. The heading List of Abbreviations should be in Title case, 13 pt Bold and center-aligned. The Abbreviations and the Full form in the top row should be 12 pt Bold and the rest should be 12 pt Normal.

The Table itself should be left-aligned and the list should be alphabetically ordered. Avoid common notations such as °C, kg, mg, etc.

**A specimen of list of abbreviations**

List of Abbreviations 13 B Title case

| Abbreviation (12 B) | Full form (12 B) |
|---|---|
| ρ° | Complete elimination of mitochondrial DNA |
| °Bx | Degree brix (measure of % soluble solids, m/m) |
| abv | Alcohol by volume |
| ANOVA | Analysis of variance |
| AOAC | Association of Official Analytical Chemists |
| DOE | Design of experiment |
| DOG | 2-Deoxyglucose (analog of glucose) |

12 Sentence case

## 14. Part I: Introduction

A clear introductory statement should be provided, citing appropriate references to establish the importance and objectives of the research. It should highlight how the present study emerges from contradictions and inadequacies in past research while stimulating the reader's interest. This section should include:

(a) a general introduction,
(b) a statement of the problem,
(c) the objectives of the study,
(d) the significance of the study, and
(e) the limitations of the study, following the specified format and structure.

As mentioned earlier, the line spacing should be 1.5 pt. In MS Word, use the 'Line and Paragraph Spacing' option to add 10 pt or 12 pt space either before or after each paragraph (not both).

A sample of **Part I** is shown in the following page.

## Part I [14] [B]

### Introduction [13] [B]

**1.1 General introduction** [12] [B] Sentence case (not Title Case)

*Murcha*, an amylolytic starter cake used for traditional alcoholic fermentations, is prepared by incorporating a wide variety of wild plants into cereal flours (KC, 1999). Marcha and similar amylolytic starters contain yeasts, molds, and lactic acid bacteria, which are used to produce various cereal-based alcoholic beverages, including cloudy extract (beer) and clear product (wine) (Lee, 1999). These findings emphasize the essential role of starter cultures in traditional brewing.

[12]

The brewing potential of *murcha* yeasts has been studied by several researchers, including KC (1999) and Rai & Subba (2004). However, there is no reported research on improving the isolated yeast strains to enhance brewing properties. Although various studies outline protocols for yeast strain improvement (Bridges, 1976; Bacila, 1978; Chambers, 2009; Reed & Nagodawithana, 1991; Walker, 1998; Smith & Burke, 2014; Steensels, 2014), they primarily focus on laboratory yeast species, particularly *Saccharomyces*.

Other paragraphs .....

**1.2 Statement of the problem** [12] [B] Sentence case (not Title Case)

Modern commercial yeasts are highly improved aneuploid/polyploid strains (Berry, 1987; Reed & Nagodawithana, 1991), but they all originate from a vast pool of wild strains found in berries, fruits, and traditional starter cultures. In Nepal and neighboring countries, amylolytic starters are extensively used as sources of fermentative yeasts for producing traditional alcoholic beverages (KC, 2004).

[12]

Other paragraphs .....

## 15. Part II: Literature review

Only information relevant to the present study should be included in this section, ensuring precision and clarity. Main headings, subheadings, and text should be formatted as specified in Part I.

All Figures, Tables, Plates, etc., cited in the text must include a reference to their sources, placed on the right-hand side beneath their positions. As previously mentioned, the line spacing should be set to 1.5 pt. Use the 'Line and Paragraph Spacing' option in MS Word to add either 10 pt or 12 pt space before or after paragraphs.

Sample of Part II

Part II [14] [B]

Literature review [13] [B] Sentence case (not Title Case)

2.1 Food fermentation [12] [B] Sentence case (not Title Case)

Food fermentations are known for producing a wide range of aromas, flavors, and textures from a single starting material. This process has been studied extensively, highlighting the significant transformation that occurs during fermentation (Owens, 2015). Additionally, Asia has a rich food heritage, where dietary habits represent those of nearly 60% of the global population. The diversity of traditional foods and fermentation techniques across the region underscores the deep-rooted cultural significance of these practices (Liu et al., 1999).

[12]

Despite Southeast Asia's long history of food fermentations, research in this field has received relatively little attention from indigenous scientific establishments, particularly since 1977 (Owens, 2015). Even when studies have been conducted, there appears to be a preference for presenting findings at conferences or in reports that are not widely disseminated, rather than publishing in peer-reviewed international scientific journals. This limited exposure has contributed to a lack of global recognition and understanding of the complexities of Southeast Asian food fermentations.

Consequently, many of these foods remain artisanal products produced by small-scale backyard producers (Owens, 2015). Without widespread scientific documentation, traditional fermentation techniques risk being lost over time.

2.3 Alcoholic beverages [12] [B] Sentence case (not Title Case)

[12]

Description (first paragraph) .....

Other paragraphs .....

Use only high-quality line diagrams in the review section; screenshots are not permitted. If colored plates are required, they should be placed in the 'Plates' section at the end and cross-referenced appropriately within the review section. Alternatively, a redrawn version may be used, provided the original source is properly acknowledged.

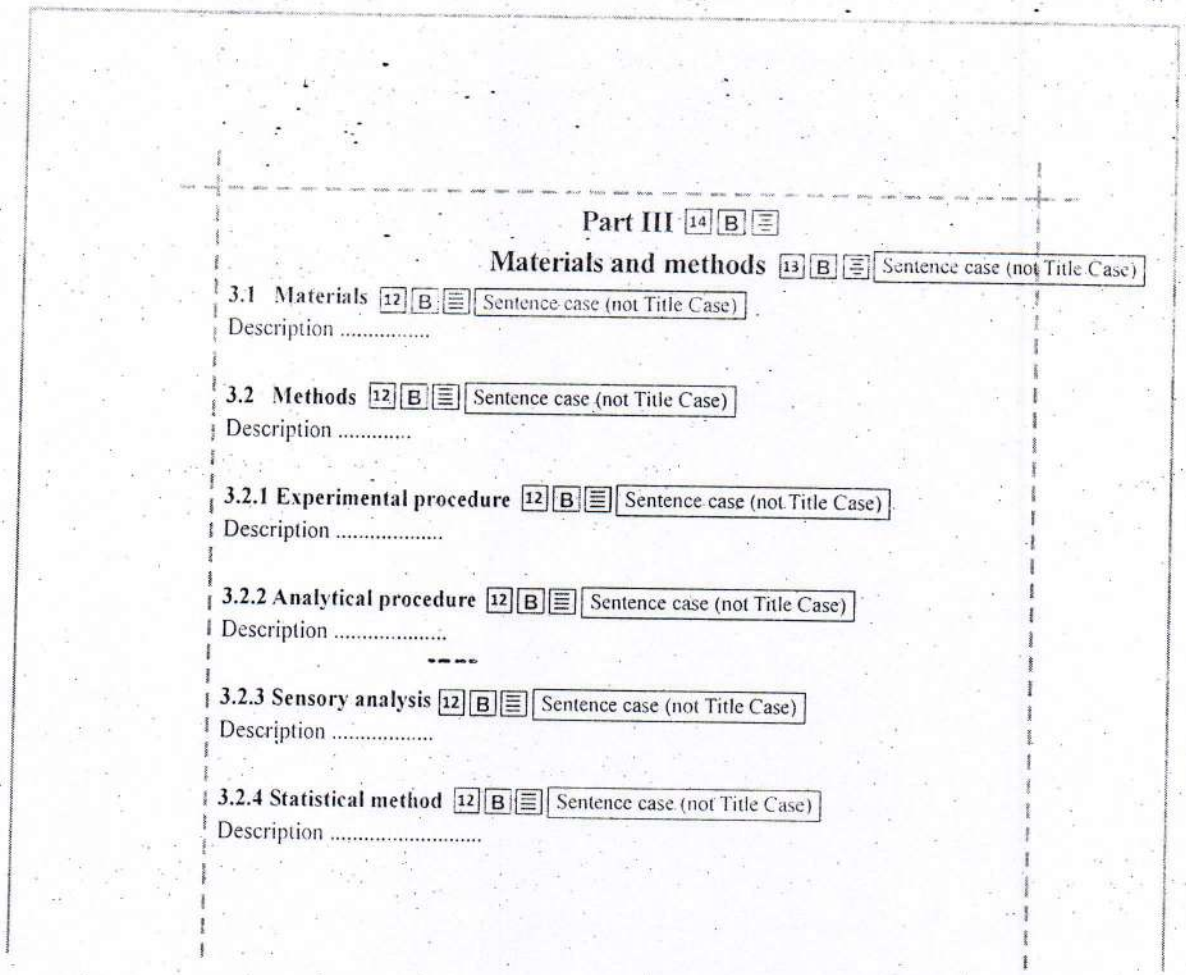
## 16. Part III: Materials and methods

Provide sufficient detail on the materials and methods to ensure the work can be reliably repeated. Well-known operations do not need detailed descriptions. Routine reagents and apparatus/equipment commonly available in the laboratory should not be described. Clearly specify the nomenclature, source of materials, and equipment used, including manufacturer details in parentheses. Additionally, state the statistical tests used and the significance level. If multiple tests are applied, indicate which groups and parameters were subjected to each test.

Main heading, sub-headings and texts must be typed as specified in the previous parts.

As mentioned earlier, the line spacing should be 1.5 pt. Use the 'line and paragraph spacing option' menu in MS-Word to add 10 pt or 12 pt space either before or after paragraph.

**Sample of Part III**




## 17. Part IV: Results and discussion

Before presenting the results and discussion, provide a brief description of the study to establish context. Results should be presented in a logical sequence within the text, with appropriate references to Tables and Figures. Each result should be clear and self-explanatory, ensuring coherence and comprehensibility. Any negative results that might be valuable to other researchers should also be reported.

Data presented in Tables or Figures should not be repeated in the text. Additionally, the same data should not be displayed in both tabular and graphical formats—choose the most effective representation. Simple data can be incorporated directly within the text instead of being presented in Tables or Figures.

Discuss new and significant observations in relation to previous research. When referring to Tables and Figures, avoid generic phrasing such as *"Results of experiment A are given in Table 1"*—instead, write *"Table 1 shows that..."* to enhance readability and engagement.

The discussion should focus on interpreting findings in relation to previously reviewed literature. Avoid introducing new citations in this section, as all relevant sources should already have been discussed in the literature review. Triangulation should be employed to enhance the credibility of findings, ensuring that results are validated by cross-referencing experimental data, previous studies, and complementary perspectives. Assess the validity of your results, comment on their significance, and relate them to existing research. Do not merely rearrange information or repeat results without providing insights. If there are discrepancies between your findings and those of others, acknowledge them and attempt to explain or state any limitations in doing so. While it is acceptable to critique the scientific basis of other studies, avoid personal attacks on authors. Ensure accuracy when describing or quoting previous work and discuss any weaknesses or limitations within your own study.

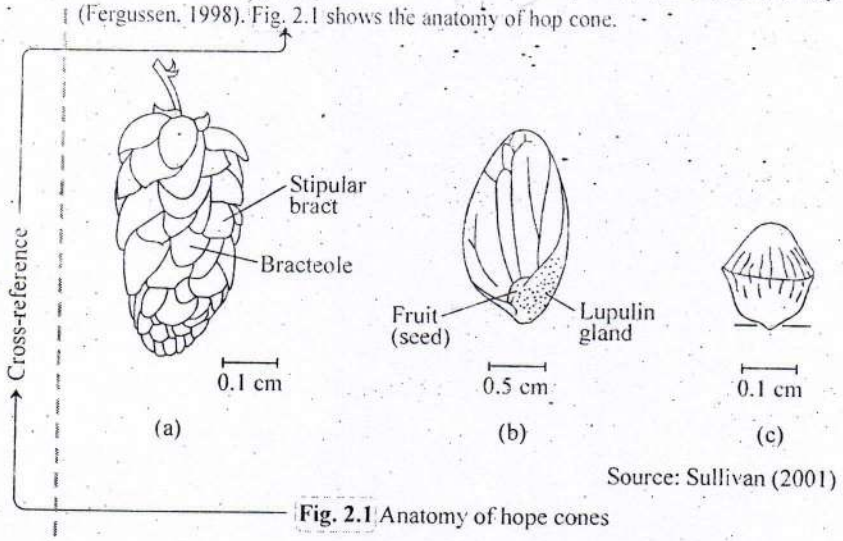
Each Table must be self-explanatory and structured for easy understanding without requiring reference to the main text. Provide a brief description of each Table and Figure before presenting them to ensure clarity. Without such cross-referencing, Tables and Figures become disconnected from the discussion, diminishing their relevance.

Tables and Figures should be numbered sequentially using Arabic numerals. Additionally, specify whether reported values represent the Mean, Median, Mean ± SD, or Mean ± SEM. Any statistical comparisons or differences among values should be indicated using appropriate superscripts.

***Do not put more than two Tables or Figures in a page.***

## Sample of cross-referencing and acknowledgment of sources

Hops as used in brewery are dried cones of female hop plants Humulus lupulus (Fergussen, 1998). Fig. 2.1 shows the anatomy of hop cone.




Source: Sullivan (2001)

**Fig. 2.1** Anatomy of hope cones

## 18. Sample of Part IV

# Part IV [14] [B]

## Results and discussion [13] [B] Sentence case (not Title Case)

Ten different sites (Saangu, Dandaghopa, Panmaara, Belbari, Laxmimarga, Dhankuta, Letang, Kerabari, Bishnupaduka, and Udayapur) representing 5 districts (Sunsari, Dhankuta, Morang, Udayapur and Taplejung) of Eastern Nepal were surveyed and *murcha* samples collected for screening of fermentative yeasts and subsequent UV-mutation study. The findings are described in the sections to follow.

### 4.1 Screening of *murcha* [12] [B] Sentence case (not Title Case)

Rai (2006) mentions that the quality of *murcha* can only be as good as the essential microorganisms it harbors. Therefore the collected *murcha* samples were first tested for suitability by inoculating cooked rice to produce *jand*. This step was also thought necessary to avoid the screening load.

Other paragraphs and sections.....

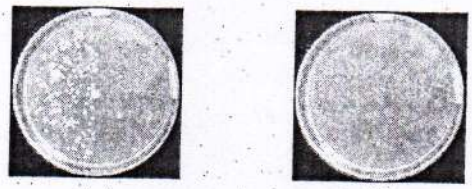
.....

.....

### 4.7 Replica plating and selection of RDMs [12] [B] Sentence case (not Title Case)

The replica plating as described in Part II followed by TTC overlay test for the presence of respiratory-deficient mutant produced plates as shown in Fig. 4.9. Of the survived colonies, an average of 22% colonies were found to be respiratory-deficient.

[12] [B]



(a) (b)

**Fig. 4.9** TTC overlay test for the presence of RDMs. (a) before TTC overlay and (b) after TTC overlay

[12]

## Sample of cross-referencing and triangulation

--- Results and discussion cont'd)

Citation should be present in literature review also

### 4.5 Characterization of the yeast isolates

The yeasts isolated from *murcha* samples from Laxmimarga and Udayapur were identified to be strains of *Saccharomyces cerevisiae*. The KEYS used for the identification (Harrigan and McCance, 1976; Kurtzman *et al.*, 1998) are given in Appendix. The photomicrographs (1000×) of the yeast cells are shown in Fig. 4.4. The result of sugar assimilation and fermentation test is shown in Table 4.3. The result of auxanography is shown in Fig. 4.5.

Cross-referenced elsewhere

Cross-ref. to Table

**Table 4.3** Observation of sugar assimilation and fermentation

| Yeast \ Test sugar | Fermentation | | | | | | | Assimilation | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Glucose | Galactose | Sucrose | Maltose | Lactose | Raffinose | Xylose | Glucose | Galactose | Sucrose | Maltose | Lactose | Raffinose | Xylose |
| *S. cerevisiae* (KEY) | + | v | + | v | - | + | - | + | v | + | + | - | + | - |
| Udayapur yeast | + | v | + | v | - | + | - | + | v | + | + | - | + | - |
| Laxmimarga yeast | + | - | + | v | - | + | - | + | - | + | + | - | + | - |

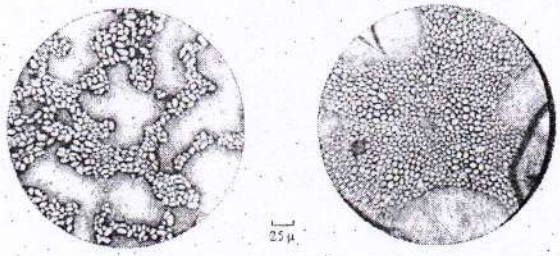
Cross-ref. to Figure

The notations used in Table 4.3 are standard notations used in auxanographic studies. The explanation of the notations is as follows:

+: growth/fermentation observed

-: growth/fermentation not observed

v: variable (growth/fermentation may or may not be observed)




Udayapur yeast Laxmimarga yeast

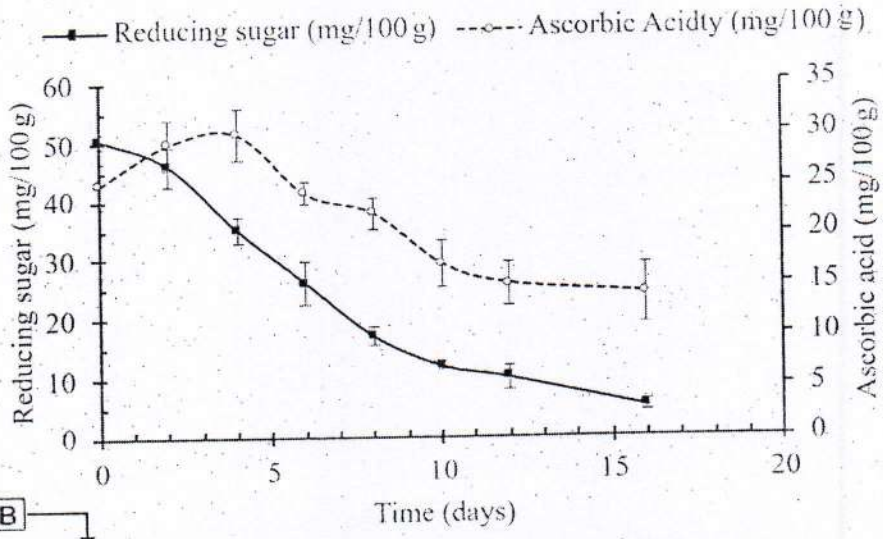
**Fig. 4.4** Yeast isolates (1000×) from *murcha*

## Examples of Table and Figures

Make sure that the font is consistent with the text (Times New Roman, 12 pt). Use following guideline for the construction of graphs:

- *Legend:* Top
- *Marker fill:* Black
- *Marker option:* Built-in, size 3 pt
- *Marker line color:* Solid line, black
- *Marker line width:* 1 pt
- *Line color:* Solid line, black
- *Line width:* 1 pt
- *Line style:* Regular or dash
- *Error bars:* Solid line, back, 0.75 pt
- *Major tick marks:* Outside
- *Minor tick marks:* Inside
- *Height to width ratio:* ~ 3:4
- *Graph/diagram border:* None
- *Axes:* 1 pt, solid line, black
- *Figure alignment* Center-aligned
- *Figure layout option* In Line with Text

**Sample of format for Figure**




12 B

**Fig. 4.4** Reducing sugar and ascorbic acid content of abcdxyz berries as affected by storage time

12

For bar diagrams, histograms, and similar charts, avoid using colored fills. Instead, use black, white, gray, or pattern fills.

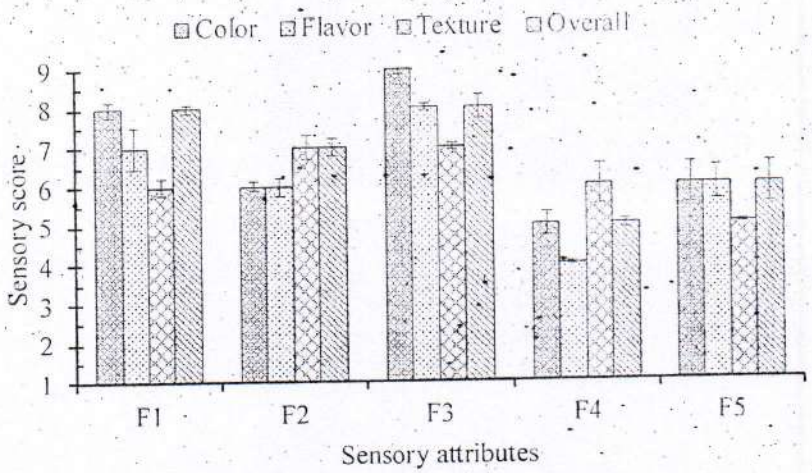



**Fig. 4.5** Mean sensory scores of formulated food

For Response Surface Plots and Contour Plots (isoresponse curves), use wire frame view (as shown elsewhere). Carry out editing with suitable software to produce consistent font and size.

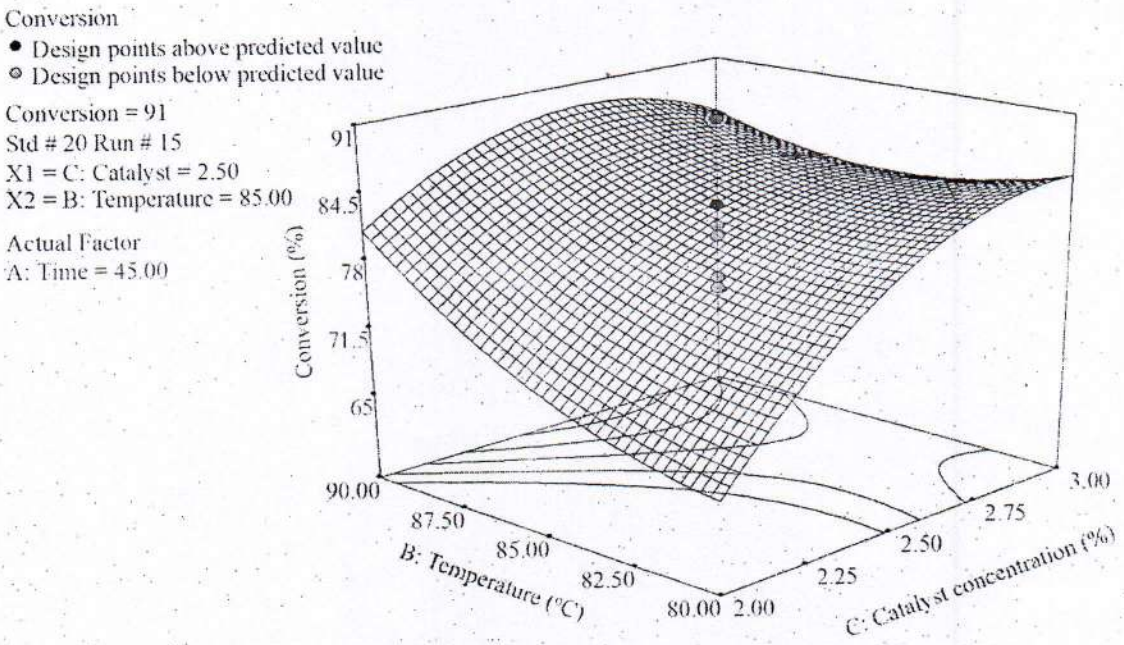



**Fig. 4.5** Response (conversion) surface as a function of concentration and temperature

## Examples of Plates and Photographs

Use following guidelines for Plates:

- Center-aligned
- Appropriate caption (a descriptive title) at the bottom (center-aligned)
- Acknowledgment source (if necessary)

Source: Wikipedia (2010)
**NOT as** "Source: (Wikipedia, 2010)"

**Plate 2** Trained panelists carrying out sensory analysis

## 19. Conclusions and recommendations

The format should match that of the 'Materials and Methods' section. Avoid unqualified statements and conclusions not completely supported by the data. Repetition of information given under *Introduction* and *Results and discussion* should be avoided. Conclusions must be drawn considering the strengths and weaknesses of the study. Make sure that conclusions drawn tally with the objectives stated under *Introduction*.

Recommendation is the application of the results and/or investigator(s) view for further extensive work of the present study. It should not be more than one page.

## 20. Summary

The summary should be a maximum of one page for B. Tech (Food) and B.Sc. Nutrition & Dietetics (BND). However, for M. Tech. (Food) dissertation, it can extend to one and a half pages.

## 21. References

All the ideas and arguments that we use in writing reports, dissertation, essay, etc., need to be supported by reference(s) to other published work. Referencing is therefore an integral part of any publication, research work, or report.

Referencing is a standardized way of acknowledging the sources of information and ideas that you have used in your document. The primary reasons for referencing are to (i) avoid plagiarism, (ii) verify quotations, and (iii) enable readers to follow up what you have written and locate the cited author's work.

Sometimes, students get confused over the terms '*reference list*' and '*bibliography*'. A reference list contains details of only those books, articles, web pages, etc., that are cited in the text of the document. A bibliography includes all sources consulted for background or further reading. Bibliography (or '*Further Reading*') does not require 'in-text citation'. In thesis/dissertation, we use reference, and NOT bibliography.

Students also sometimes mix up the terms 'citation' and 'reference'. They are similar, but not the same. Citations are references that appear in the text (the body of the manuscript). A citation is also called '*in-text citation*' or '*parenthetical citation*'. On the other hand, references are the detailed list of bibliographic information of the cited work. A reference without the corresponding in-text citation does not make much sense. Such a reference simply becomes a bibliography.

Students are also confused over the terms '*reference type*' and '*reference style*'. While writing, we use a number of various types of sources of information. Each of these source types constitutes '*reference type*' (e.g., thesis/dissertation, journal article, newspaper, documentary, etc.). In general, the format for each 'reference type' is unique in some way. A few 'reference types' have a common generic format, though. The collection or set of all the 'reference types' (along with the given format) is called '*reference style*' (also simply called '*styles*' or '*output styles*'). Most 'reference styles' have published guidelines called '*style manual*'.

For B. Tech (Food), BND, and M. Tech (Food) dissertations, we follow the latest APA Style manual for citation and referencing. However, the internal structure of the dissertation should adhere to the CDFT-IoST style outlined in this document.

**Examples of references in the 'CDFT-IoST' style**

A few references have been annotated in the following paragraphs for clarity.

**Book**

Author, A. A. (Year). *Title of book*. Publisher.

*Example:*

Smith, J. (2020). *Understanding Psychology*. Oxford University Press.

**Chapter in an edited book**

Author, A. A. (Year). Title of chapter. In B. B. Editor (Ed.), *Title of book* (pp. xx-xx). Publisher.

*Example:*

Brown, L. (2018). Cognitive development in children. In R. White (Ed.), *Advances in Child Psychology* (pp. 45-67). Cambridge University Press.

**Journal article**

Author, A. A. (Year). Title of article. *Title of Journal, Volume*(Issue), xx-xx. https://doi.org/xxxx

*Example:*

Taylor, M. (2021). The effects of sleep deprivation on memory. *Journal of Neuroscience, 45*(3), 112-125. https://doi.org/10.1234/jns.2021.0087

**Journal article with multiple authors (examples)**

Nguyen, T., Carnevale, J. J., Scholer, A. A., Miele, D. B., & Fujita, K. (2019). Metamotivational knowledge of the role of high-level and low-level construal in goal-relevant task performance. *Journal of Personality and Social Psychology, 117*(5), 879-899.

For works with more than 20 authors, list the first 19 authors, followed by an ellipsis (...), and then the final author's name.

*Example:*

Pegion, K., Kirtman, B. P., Becker, E., Collins, D. C., LaJoie, E., Burgman, R., Bell, R., DelSole, R., Min, D., Zhu, Y., Li, W., Sinsky, E., Guan, H., Gottschalck, J., Metzger, E. J., Barton, N. P., Achuthavarier, D., Marshak, J., Koster, R., ... Kim, H. (2019). The subseasonal experiment (SubX): A multimodel subseasonal prediction experiment. *Bulletin of the American Meteorological Society, 100*(10), 2043-2061.

**Dissertation or thesis**

Author, A. A. (Year). *Title of dissertation or thesis* (Publication No.) [Type of work, Institution]. Database.

*Example:*

Johnson, P. (2019). *Exploring climate change impacts on agriculture* (No. 123456) [Doctoral dissertation, University of California]. ProQuest Dissertations & Theses Global.

**Government document**

Authoring Organization. (Year). *Title of document* (Report No. if available). Publisher. URL

*Example:*

National Institute of Health. (2022). *Annual health report* (NIH Publication No. 22-3456). U.S. Government Printing Office. https://www.nih.gov/reports/2022

**Abstract**

Author, A. A. (Year). Title of abstract [Abstract]. *Title of Journal, Volume*(Issue), xx-xx.

*Example:*

Williams, K. (2020). The role of nutrition in cognitive function [Abstract]. *Nutrition Research, 38*(2), 45-50.

**Journal in a thesis or dissertation**

Author, A. A. (Year). Title of article. *Title of Journal, Volume*(Issue), xx-xx.

*Example:*

Davis, R. (2017). The impact of social media on mental health. *Psychology Today, 32*(4), 78-90.

## 22. Appendices

Appendices (also referred to as "Appendixes") should be numbered using uppercase English letters. No more than two appendix tables or figures should appear on a single page.

# ANNEX - IV

## CDFT-IoST CLASS SEMINAR FORMAT

Program: B. Tech (Food Technology)
Course name and Code: CLASS SEMINAR, BFT 454 (B), 2 Credit
Semester: 8th (Final)
Credits: 2

### Course overview

In the final (8th) semester of B. Tech. (Food Technology) program, students must deliver two seminar presentations, supported by a research paper and slides formatted to dissertation standards. This course is designed to strengthen scholarly communication, research proficiency, and presentation skills, ensuring students are well-prepared for their final dissertation defense. Each student is assigned a mentor faculty, who provides guidance throughout the research process and plays a critical role in the final evaluation. After receiving comments and feedback, students must submit the corrected final seminar paper to the HOD before another seminar is scheduled. Failure to do so will result in ineligibility for the next presentation. Attendance is mandatory, and faculty oversight ensures strict adherence to academic guidelines.

The evaluation follows a structured faculty assessment system: Mentor Faculty (50%), Commentator Faculty (25%), and Head of Department (25%). To successfully complete the course, students must secure a minimum pass mark of 60%, with grading focused on clarity, research depth, and adherence to formal academic standards. The seminar enforces rigorous academic expectations, structured mentorship, and accountability in research documentation, fostering the critical thinking and communication skills necessary for professional and academic success.

### Course objectives

By the end of this course, students will:

1. Conduct extensive literary surveys on relevant food technology topics.
2. Adhere to the CDFT-IoST style manual for academic writing.
3. Develop strong presentation skills through structured, academic discussions.
4. Engage in critical peer review and commentator feedback.
5. Receive mentorship for refining their research and presentation techniques.

### Course structure and guidelines

1. ***Topic selection and literary survey***
   - Each student selects a research topic, preferably linked to their dissertation.
   - Conducts a comprehensive literary survey using peer-reviewed journals, books, and industry reports.

Institute of Science & Technology
Dean's Office
Kirtipur 2045

- Works closely with a mentor faculty for guidance.

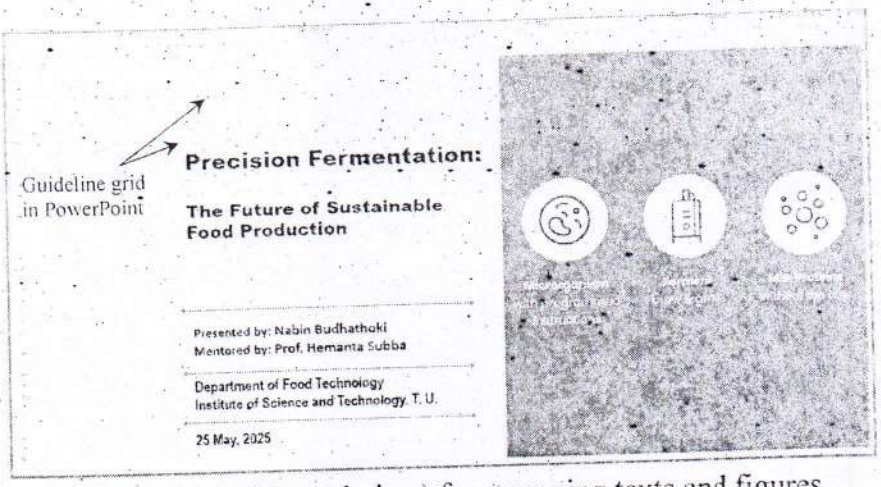
2. *Seminar paper submission*
   - Students submit two copies of their seminar paper draft to the HOD.
   - One copy is forwarded to a commentator for review and constructive feedback.
   - The paper must strictly follow the CDFT-IoST style manual.
   - After receiving comments and feedback, students must submit the corrected final seminar paper to the HOD before another class seminar is scheduled.
   - Failure to submit the revised paper will result in the student not being allowed to present again.
3. *Presentation format*
   - Each student presents twice per semester in a dissertation defense-style setting.
   - Presentation Duration:
     - Presentation: 15 minutes (+5-minute warning).
     - Q&A Session: 30-45 minutes.
   - The seminar is convened by two faculty members in a formal academic setting.
   - Attendance of all students is mandatory and carries marks.

**Presentation guidelines (CDFT-IoST Format):**

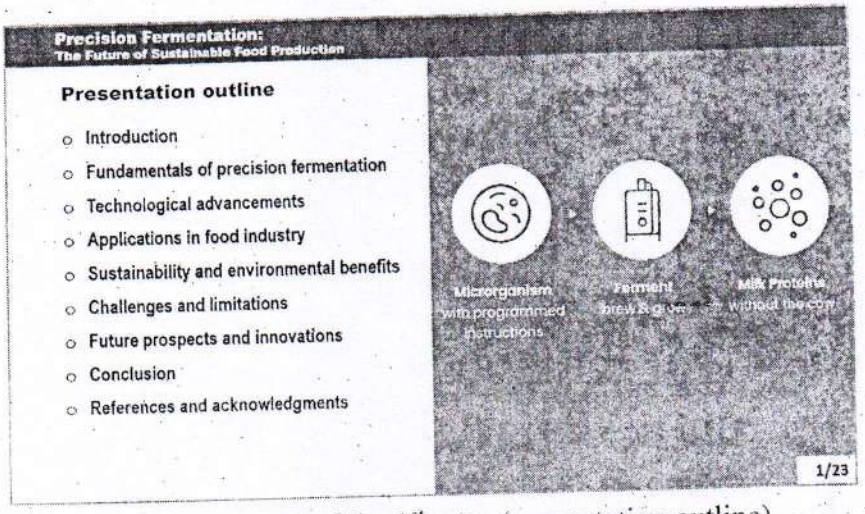
1. Avoid colorful backgrounds, which may distract the audience.
2. Use Sans-serif fonts (Arial, Helvetica, Gill Sans) for clarity and readability.
3. Limit slides to three paragraphs maximum (five lines per paragraph).
4. Use 22 pt (bold) for headings and 20 pt (regular) for text.
5. Prepare slides in widescreen format (16:9).
6. Maintain academic style, avoiding corporate-style infographics.
7. The cover slide must include a meaningful image on one-half of the page.
8. Include a presentation outline slide to structure the content.
9. Limit the total presentation to 25 slides maximum.
10. Use animations, transitions, and morph effects sparingly.
11. Carefully choose font color combinations, considering potential color blindness in the audience.
12. Include running titles and page numbers for clarity on progress.
13. Use dark blue font for in-text citations of key references.
14. Ensure that the running title and main headings remain properly aligned throughout the slideshow. Avoid unintended movement or instability caused by improper manipulation of text and textboxes.
15. The final slides should contain:
    - A partial list of important references.
    - Mention of total references reviewed.
    - Acknowledgments.
    - Relevant color plates.
    - A Thank You slide.

Institute of Science & Technology
Dean's Office
Kirtipur 2045

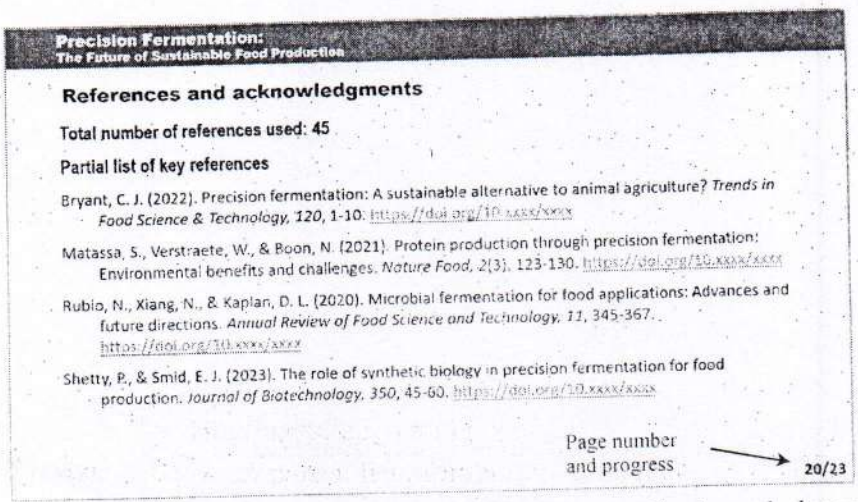
Example of how slides in CDFT-IoST should look like




**Editing view** (Normal view) for arranging texts and figures




**Slideshow view** of the 1st page (presentation outline)




**Slideshow view** of the end matter page (references and acknowledgments)



Institute of Science & Technology
Dean's Office
Kirtipur, 2025
कीर्तिपुर

## Evaluation criteria and grading distribution:

| Component | Marks Allocation | Evaluator Distribution |
|---|---|---|
| Literary survey and paper quality | 30% | Mentor Faculty (50%), Commentator (25%), HOD (25%) |
| Presentation performance | 40% | Mentor Faculty (50%), Commentator (25%), HOD (25%) |
| Engagement in Q & A and peer review | 20% | Mentor Faculty (50%), Commentator (25%), HOD (25%) |
| Attendance and discipline | 10% | Mentor Faculty (50%), Commentator (25%), HOD (25%) |

## Note on writing review-based class seminar paper

Since the seminar paper in the present context is purely a literature review, the focus should be on analyzing and synthesizing existing research rather than presenting original data. In this case, the Methodology section is not required in the traditional sense, but a Literature Search Approach or Source Selection Criteria can be included to explain how the reviewed studies were chosen.

**Main headings for a literature review-based seminar paper**

1. **Title page**
2. **Abstract** – Brief summary of the topic and key findings from literature
3. **Introduction** – Background, research objectives, significance of topic
4. **Literature review** – Categorized discussion of relevant studies
5. **Critical analysis and discussion** – Comparative assessment of reviewed literature, identifying gaps, trends, and contradictions
6. **Conclusion and future directions** – Summary of findings and suggestions for further research
7. **References** – Properly formatted citations in APA 7th edition
8. **Appendices** (if needed) – Supporting materials such as tables, figures, or extended text excerpts

Institute of Science & Tech...
Dean's Office
Kirtip...r 2045