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.

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):

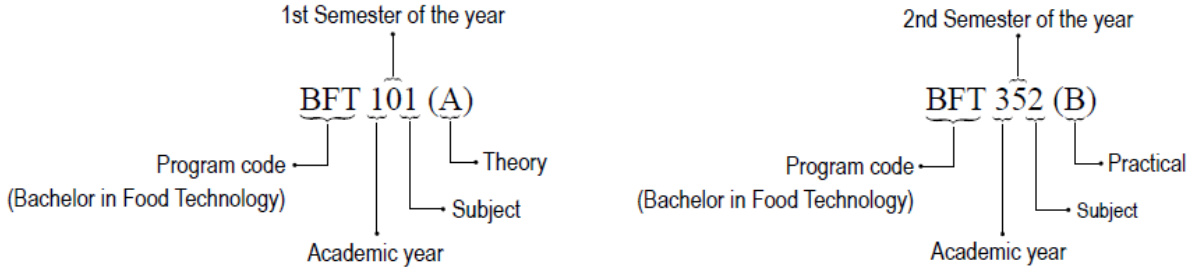
Program Code: Each subject code starts with a program code that is specific to the course of study. In this case, **BFT** denotes **Bachelor in Food Technology**.

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	58+34 = 92	66
	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		
	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 given in credit hour (or credit) as follows:

- 1 credit equals 25 marks.

- 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 i**nternal 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.

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

		Marks distribution		
Credit hour	**Full marks**	**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:
  - **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**)

		Marks distribution		
Credit	**Full marks**	**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.
- 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

		Marks distribution	
Credit	**Full marks**	**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 REQUIREMENT

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

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.

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 Semester I	1. Applied Physics *	BFT 101 (A) BFT 101 (B)	3 1
	2. Engineering Mathematics*	BFT 102 (A)	3
	3. Industrial Chemistry*	BFT 103 (A) BFT 103 (B)	3 1
	4. Applied Statistics*	BFT 104 (A) BFT 104 (B)	3 1
	5. General Biochemistry*	BFT 105 (A) BFT 105 (B)	3 1
	6. General Microbiology*	BFT 106 (A) BFT 106 (B)	2 1
		Sub-Total	**22**

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

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

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

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

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

Year/Semester	Subject	Subject code and Nature	Credit
Year IV Semester I	37. Food Packaging	BFT 401 (A) BFT 401 (B)	2 1
	38. Operations Research *	BFT 402 (A) BFT 402 (B)	2 1
	39. Food Storage	BFT 403 (A) BFT 403 (B)	2 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 Semester II	42. Research Methodology and Statistical Methods *	BFT 451 (A) BFT 451 (B)	2 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**

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] 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. • Surface tension: [4 h] 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. • Viscosity: [3 h] 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] 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. • Refrigeration: [3 h] Production of low temperature; Freezing mixtures; Cooling by evaporation; Vapor compression refrigeration and vapor absorption refrigeration; Refrigeration cycles. • Thermal radiation: [4 h] 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] Sound; Speed of sound; Reverberation and echo; Loudness and volume; Noise; Ultrasonic sound; Applications. • Optical properties: [5 h] 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 Ultraviolet (UV) – Basics; Measuring techniques and applications.	**8**

4	**Electromagnetic Radiation**	• Electromagnetic waves: [3 h] 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. • High energy radiations and health physics: [4 h] 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:** **Geometric and Rheological Properties**	• Mass and Density: [2 h] 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. • Geometric properties: [4.5 h] 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. • Rheological properties: [5.5 h] 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

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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%

Course: Engineering Mathematics	**Course Code: BFT 102A**	**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] • Indeterminate forms, types and their real-life examples, L- Hospital's Rule. [2 h] • Higher order derivatives, Leibnitz theorem. [2 h] • Power series of single valued functions: Taylor's series, Maclaurin's series. [3 h] • Asymptotes to Cartesian and Polar curves. [2 h]	**10**
2	**Antiderivatives and their Applications**	• Review of definite and indefinite integrals. [1 h] • Differentiation under integral sign. [2 h] • Improper integrals. [1 h] • Beta and Gamma functions and their applications. [2 h] • Area and arc length in plane for cartesian curves. [3 h] • 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] • Linear differential equation and equations reducible to linear differential equation: Bernoulli's equation. [1 h] • First order and higher degree differential equations; Clairaut's form. [2 h] • Application in physical sciences and engineering: [3 h] 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. • 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] • Equation of conic in Cartesian and polar form: Identification of conics. [2 h]	**4**
5	**Three-dimensional Geometry**	• Review of planes. [1 h] • The straight line: Symmetrical and general form. [2 h] • Coplanar lines. [2 h]	**5**

6	**Matrices**	• Rank of matrices and its application in system of linear equations. [2 h] • Vector space, linear dependence and independence. [1 h] • Eigen values, Cayley Hamilton theorem and its applications. [1 h] • Eigen vectors, diagonalization of matrices. [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.
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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%

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] • Quality control, safety and environmental concerns, pollution control technologies, sustainable industrial chemistry, green chemistry. [1 h] • Industrially important chemical reactions, excess and limiting reactants, fractional conversion, selectivity, yield, extent of reaction, stoichiometry, catalysts. [2 h] • Chemical kinetics, rates of reaction, first order and second order reactions, collision theory. [2 h] • 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] • 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] • Fluid flow: momentum balances, fluid properties, pump types, centrifugal pump, positive displacement pump, piping and valves, flow measurement devices. [2 h] • 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] • Equilibrium-based separations: crystallization, evaporation, condensation, distillation, batch distillation, flash distillation, continuous multistage distillation, packed towers, absorption, adsorption. [3 h] • Water treatment: hardness of water, softening of water, zeolite process, ion-exchange, chemical analysis of water. [1 h] • Pollution control technologies: air pollution control, cyclones, electrostatic precipitator, filters, scrubbers. [1 h] • Water pollution control: industrial waste treatment, aerobic and anaerobic oxidation, Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), anaerobic digestion. [1 h]	**7**

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] • 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] • Chlor-alkali industries, sulfuric acid, sodium hydroxide. [1 h] • Industrial gases: Ammonia, Nitrogen, Oxygen, Hydrogen, Carbon dioxide, Acetylene. [2 h] • Fertilizer, cement, lubricants, pulp and paper, glass, ceramics, paints, refractories. [2 h • 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] • Fuels: Classification, calorific value calculations, coal classification, coal analysis, coking. [1 h] • Plastics and Polymers: Nomenclature, functionality, classification, polymerization processes, molding, thermoplastics, thermosetting plastics, polymer additives. [2 h] • Fermentation process, ethanol, pharmaceuticals, soaps, detergents, sugar. [2 h]	**8**
7	**Introduction to Chemical Analysis**	• Volumetric and gravimetric analysis, Karl Fischer titration. [1 h] • Chromatography, gas chromatography, liquid chromatography. [1 h] • Atomic spectroscopy: Beer-Lambert's Law, UV-visible absorption spectroscopy, atomic emission spectrometer (AAS), inductively coupled plasma emission spectrometer (ICP-AES). [2 h] • Fourier transform infrared (FTIR) spectroscopy, mass spectrometry. [1 h] • 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].

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.	**2**
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.	**10**
6	**Design of Experiments**	• Basic concepts of design of experiment: - Completely randomized design (CRD): Layout, and analysis with equal and unequal number of observations, and their applications. - Randomized block design (RBD): Layout, analysis, and its applications. - Latin square design (LSD): Layout, analysis, and its applications. - Concept of Response surface methodology (RSM).	**8**

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.	**5**
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-σ control limits, tools for Statistical Quality Control (SQC), control charts for variables: $\overline{X}$ and R chats, control limits for chart and R-chart, construction of control chart for $\overline{X}$ and R, criterion for detecting lack of controls in $\overline{X}$ and R charts, interpretation of $\overline{X}$ 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 persession)**	

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

4	**Cell Signaling**	• Hormones: Classification, mechanism of action, regulations • Neurotransmitters: Classification, mechanism of action, regulations. • Immunoglobulins: Structure, function, antibody diversity, class, switching, • Autoimmunity and hypersensitive reactions, clinical and industrial applications of antibodies.	**4**
5	**Genetic information**	• DNA organization and function. • DNA replication. • DNA damage and repair. • Transcription and RNA processing. • Mutation, genetic code, translation and post-translational modification. • Regulation of gene expression, operon concept. • Non-coding RNAs, siRNA, miRNA. • Molecular techniques: PCR, DNA fingerprinting, • Recombinant DNA technology: vectors, restriction endonuclease, gene cloning, genomic library. • CRISPR gene editing, blotting techniques.	**10**
6	**Biochemical Techniques**	• Definition, classification and applications of different separating techniques: Centrifugation, filtration, dialysis, etc. • Colorimetry, spectrophotometry, spectrofluorometry. • Turbidimetry, nephelometry. • Mass spectrometry. • Chromatography: Paper, thin layer, gel filtration, ion-exchange, affinity chromatography, chromatofocusing. • HPLC, gas chromatography. • Electrophoresis: SDS-PAGE, agarose gel electrophoresis, isoelectric focusing. • Tracer techniques, radioisotope, radioimmunoassay (RIA), autoradiography. • Immunodiffusion, immuno-electrophoresis, Enzyme Linked Immunosorbent assay (ELISA) and Chemiluminescence Immunoassay (CLIA). • Densitometry and hydrometry. • Ion selective electrode and polarimetry. • 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 9789350254844].

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].

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%

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 λ_{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%

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] • Theories of spontaneous generation and germ theory of disease (Louis Pasteur, Robert Koch). [1 h] • Basic understanding of classification of bacteria, viruses, fungi and parasites. [1 h] • 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] • Fine structure of cell organelles and their functions; differences between Gram-negative and Gram-positive bacteria. [1 h] • General structure of virus. [1 h] • Morphology of parasites and fungi. [1 h] • 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] • 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] • Pure culture, ATCC; different types of culture media for bacteria; common ingredients of culture media and their role; biochemical tests. [2 h] • Virus culture; fungi culture media. [1 h] • 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] • Methods of culture of aerobic and anaerobic bacteria; culture preservation methods. [1 h] • 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**

5	**Growth and Nutrition of Microorganisms**	• Nutritional types of bacteria (photolithotrophic, chemolithotrophic, photoorganotrophic, chemoorganotrophic). [1 h] • Bacterial growth; growth curve; factors affecting growth (pH, temperature, osmotic pressure, light, essential elements). [2 h] • 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] • Introduction, functions, classification, structure, important properties of: carbohydrates, amino acids, proteins, enzymes, lipids, and nucleic acids. [3 h]	**4**
		Total	**32**

Reference materials

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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%

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

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. • Common instrumental methods of analysis and applications of their principles. • 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] - Interaction between EMR and matter - Energy Levels: Atomic and Molecular - Spectra: Atomic, Molecular, Absorption and Emission - Absorption Laws (derivation of Beer's Law), adsorption and adsorptivity. - Classification of molecular spectra: Electronic, vibrational and rotational - Spectroscopic technique and instrument nomenclature (spectroscopy, spectrometry, spectrophotometry, photometer, and spectrograph) • Atomic Spectroscopy: [5h] - Atomic Absorption Spectrometry (AAS): Principle, basic instrumentation, interferences, and analytical applications of AAS - 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). • Molecular Spectroscopy: [4 h] - Ultraviolet-visible (UV-Vis) Molecular Spectroscopy: Principle, instrumentation, UV spectra and the structure of organic molecules, and analytical applications. - 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). • Magnetic Resonance Spectroscopy: [3 h] - Introduction to Resonance Spectroscopy - Principle of Nuclear Magnetic Resonance (1H-NMR) - Instrumentation - Chemical shift (shielding, deshielding, upfield, and downfield) and spin-spin coupling - Analytical applications of NMR: Qualitative analyses (molecular structure determination), ^{1}H spectra of some compounds.	15

3	**Chromatographic Techniques**	• Principles of chromatography: [3 h] - Introduction: Definition, general principle, and basic terminologies. - Chromatographic process and classification of chromatography. - Qualitative chromatography: Analyte identification. - Quantitative measurements in chromatography: Peak area and peak height. • Paper Chromatography, Thin Layer Chromatography (TLC), and Column Chromatography: [3 h] - General principle, basic instrumentation and applications • High-Performance Liquid Chromatography (HPLC): [3 h] - Principle, instrumentation, and applications of HPLC. • Gas Chromatography (GC): [3 h] - Principles, derivatization, instrumentation, GC instrument operation, and applications in food analysis. • Electrophoresis: [2 h] - Capillary Zone Electrophoresis (CZE), sample injection, detection and modes of CE.	**14**
4	**Electroanalytical Methods: (pH and conductometric, potentiometry, voltammetry (polarography), coulometry)**	• Introduction to electroanalytical chemistry: [3 h] - Electrochemical cells, Potentials in electroanalytical cells, electrode potentials, calculation of cell potentials from electrode potentials, currents in electrochemical cells, and types of electroanalytical methods. • Potentiometry: [3 h] - Introduction to electrodes (standard hydrogen, reference, and glass membrane), general principles, instruments for measuring cell potentials, and potentiometric titration of redox reactions. • Voltammetry (Polarography): [2 h] - Excitation signals, Dropping Mercury Electrode (DMF), general principle, instrumentation, applications of voltammetry. • pH titrations: [2 h] - Introduction to pH and pH scale, buffer solutions, general principle, basic instrumentation, applications in acid/base titrations. • Conductometric titrations: [2 h] - 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] • Introduction to polarimetry, optical activity and specific rotation, basic principle of polarimeter, instrumentation of polarimeter and applications. [2 h]	**4**
		Total	**48**

Reference materials

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2. Bahl, A., Bahl, B. S. and Tuli, G. D. (2022). "Essentials of Physical Chemistry" (28th ed.). S Chand and Company Ltd. [ISBN 9355010605, 978-9355010605].
3. Shrestha, S., Yadav, P. N. and Shakya, B. (2021). "Basic Analytical Chemistry". Garuda Publication Pvt. Ltd. Nepal. [ISBN 978-9937-0-9579-2].

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].
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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].

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 λ_{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%

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

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 • Types of materials: - Metal, ceramics, glass, synthetic polymers, cementing materials, insulating materials, etc. • Properties of material: - Physical, mechanical, thermal, electrical and other properties of material • Material selection and use: - Based on composition and engineering properties of material – steel, stainless steel, cast iron, galvanized iron, HDP/CPVC pipe, ceramics, etc. • 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. • Introduction to the graphic language, principles of the projection of points, straight lines, planes, solid, isometric projection and intersection. • Unit of measurements and their conversion with special emphasis on SI system • Use of scales, measurement units and dimensioning system • Plane geometrical construction: - Proportional division of lines, arc and line tangents; Introduction to orthographic projection, principal planes, four quadrants or angles - First and third angle projection, orthographic drawings: Making an orthographic drawing, visualizing objects (pictorial view) from the given views • Standard symbols for civil, agricultural, mechanical and industrial components, electronics, communication and computer components, topographical symbols, standard piping symbols and piping drawing. • 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. • 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

		• Introduction to single phase and three phase system • Electrical Machines: - Instrument Transformers - Potential Transformer (PT) and Current Transformer (CT). • Introduction to auto transformer: - Construction, working principle and Cu saving; Three phase transformers. • 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. • Measurement of fluid flow: - Obstruction meters for incompressible and compressible fluids, variable area flow meter, measurement of fluid velocities, pressure probes. • Experiment on fluid flow and temperature measurement • 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 • Fluid flow: - 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, • Thermodynamic properties: - Intensive, extensive and specific properties; Thermodynamic equilibrium • Common properties: - Pressure, specific volume, temperature; Energy and its meaning. • Refrigeration: - Principles of refrigeration, basic refrigeration cycles and concept of vapor compression cycle. • Refrigerants: - Ammonia, freon brines and their properties and comparison • Introduction to humidity, relative humidity, water activity, dew point; Importance of humidity in food. • Psychometry: - Psychometric properties. - Psychometric process. - Psychometric chart and its use. • Sensible heating and cooling, cooling and dehumidification, heating and humidification, mixing of two streams of air, humidification and dehumidification. • Evaporative cooling/adiabatic humidification. • Temperature/pressure measuring devices and their application • Properties of common substances: - 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**

		• Definitions: - 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. • Cold storage: - Introduction, functional requirements, condition of storage for perishable products.	
6	**Mechanical Power Transmission System**	• Mechanical power transmission: - Methods and principles; Gear system and hydraulic transformation; Bearings, coupling, crank, shaft, etc. • Pumps: - 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. • Common mechanical measurement system and transducers: - Temperature measurement: Use of bi-materials, pressure thermometer, thermoelectric thermometry, thermo-resistive elements, thermocouples and circuitry, linear quartz thermometer, pyrometer. • Pressure Measurement: - Static and dynamic pressure measurement systems, pressure transducers types, measurement of low pressure, measurement of high pressure, acoustical measurement. • Pneumatic system: - 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. • Types and characteristics of fuels used in thermal power generation. • Properties of steam, T-Q diagram, heat recovery system. • Steam Nozzles and Types; Flow of steam through nozzles. • 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 9789352606429].
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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].

Course: Basic Principles of Engineering	**Course Code: BFT 152 (B)**	**Credit Hour: 1**
Semester: II	**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. 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:
8. Refrigerator.
9. Water cooler.
10. Deep freezer, compare their cooling coil and internal systems.
11. Measurement of power in 3-phase circuit.
12. For balance load.
13. For unbalanced load by watt meters and power meters.
14. Polarity test, no load test, efficiency and regulation test of single-phase transformer.
15. Study of various measuring instruments.
16. Calculation of refrigeration load.
17. Layout of machines on building plan.
18. Measurement of Fluid viscosity and density.
19. Fluid flow in piping, friction losses in liquid flow.
20. 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%

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. • Food Composition Table and its applications.	2
2	**Moisture in Food**	• Forms of moisture, role of moisture in food. • Determination of moisture in food: Direct/ indirect methods, physical/chemical methods. • Water activity and food stability; Moisture sorption isotherm: Types and applications.	3
3	**Carbohydrates**	• Definition, classification and examples. • Monosaccharides: Isomerism, chemistry and uses. • Oligosaccharides: Glycosidic bond, chemistry of important disaccharides and uses. • Polysaccharides: Classifications, origin and uses. • Manufacture of starch, chemistry of starch, gelatinization and retrogradation of starch, modified, resistant starch, chemistry of cellulose, glycogen, inulin and hemicellulose. • Crude and dietary fiber in food: Sources, functions and harmful effects. • Pectin: sources, chemistry, extraction of pectin. Gel formation chemistry of pectin; Pectic enzymes and their applications.	11
4	**Lipids**	• Classifications and examples. • Fatty acids: Chemistry, classifications, PUFA and their nutritional significance. • Triglycerides: Composition, physical, chemical and functional properties. • Characteristics of cooking, frying, salad, hydrogenated fat/oil. • Characteristics of fat from animal sources. • 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. • Protein and peptides: Peptide bond, structure of protein, properties of protein (precipitation/coagulation, denaturation, gelation, hydrolysis). • Assay of protein by qualitative and quantitative methods. • Peptides and their biological role.	5

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. • Role of minerals in human body. • Important sources, interactions with food components of iron, calcium, phosphorus, iodine and zinc. • 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].
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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	**Course Code: BFT 154 (A)**	**Credit Hour: 2**
Semester: II	**Teaching hours: 32**	**Full Marks: 50**
Nature of Course: Theory	**(3 lecture hours per week)**	

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] • Microorganisms important in food: Major groups of bacteria, yeast and mold. [2 h] • 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] • Poultry products, eggs, fish. [1 h] • Fruits and vegetables, spices. [1 h] • Beverages. [1 h] • Milk and milk products. [1 h] • Meat and meat products. [1 h] • Canned foods. [1 h]	7
	Analytical Techniques in Food Microbiology	• Sampling techniques, Electrical methods, ATP bioluminescence. [1 h] • Microscopy techniques: DEFT Immunological techniques: Immunochromatography, Enzyme linked immunofluorescent assays and agglutination techniques. [2 h] • Genetic techniques: PCR, NASBA, hybridization; Biosensors for microbiological analysis of food. [2 h]	5
3	**Food Poisoning and Disease**	• Food borne disease: Introduction, types, toxins, infectious dose; Indicator organisms; Investigation of food borne disease outbreak. [2 h] • 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] • Gram negative bacteria (*Campylobacter*, *Salmonella*, *Shigella*, *Escherichia coli*, *Vibrio cholerae*). [2 h] • Mycotoxins (aflatoxins, fumonisins). [1 h] • Foodborne viruses (Hepatitis, Norovirus). [1 h] • Parasites (*Giardia lamblia*, *Entamoeba histolytica*). [1h]	9

4	**Food Safety Management**	• Good Hygienic Practice (GHP), Good Manufacturing Practice (GMP), Hazard Analysis Critical Control Points (HACCP), Microbiological criteria for food products	**4**
5	**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].
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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
7	Microbial Sources and Factors Affecting Microorganisms	15
	Total	100%

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**	• Definition, history and development of nutrition, historical and geographical perspective; Nutrition and development; Terminologies.	**2**
2	**Nutritional Physiology**	• Human body composition at different levels and measurement; Digestive and circulatory system.	**2**
3	**Food Nutrients and Energy**	• Nutrients and their functions; nutritional classification of food; Digestion absorption and metabolism of carbohydrates, protein and fat and their utilization; Protein quality of food and determination of protein quality, body nitrogen balance, way to improve protein quality of food; 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; 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. • Measurement of nutritional status (direct and indirect method): - Nutritional anthropometry; Anthropometric measurement, I indices and indicators; Classification of nutritional status based on anthropometric measurement. • Biochemical assessment: Limitations and advantage. • Clinical assessment: Limitations and advantages. • Dietary assessment: Methods, data analysis and interpretation; Limitations and advantages. • Classification of nutritional status: - Gomez classification, Howard classification, Waterlow classification. - BMI and classification, measurement, factor influencing and uses.	**5**
5	**Malnutrition and Nutrient Deficiency Disorders and their Prevention**	• Definition, form and types of malnutrition; Protein energy malnutrition (PEM), Vit A deficiency (VAD), Iodine deficiency disorder (IDD), nutritional anemia, rickets, osteomalacia and osteoporosis, beri-beri, pellagra, scurvy; Prevalence, prevention, and management of nutrient deficiency diseases.	**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 standard; Diet therapy: Principles, objectives, and considerations; Planning of diet using food exchange list for diabetics, and for the family; Concept of healthy food, dietary guideline, basic five food group and food pyramid.	**3**
8	**Supplementary Foods**	• Infant and weaning food: Definitions, need, formulation, and preparation.	**2**
9	**Food Habit**	• Introduction, social function of food, factor influencing, dynamic of food habit.	**2**
10	**Food Fortification and Enrichment**	• Principle and purpose of fortification and enrichment; Guideline for food fortification and enrichment; Common food fortification practices in Nepal.	**1**
11	**Applied Nutrition Program**	• Introduction, nutrition education and protective food preparation (in brief); Nutrition program and policy; Current nutrition program at national and international level.	**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.
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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 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. • Electric circuit components: Source, conductor, load, controlling device and protective device. • Electrical sources: Ideal and practical voltage and current sources, symbol and characteristic Source conversion method. • Ohm's law, Limitation and application. • Series and Parallel circuit, current divider rule, voltage divider rule. • Electric power and energy. • Kirchhoff's law and its application.	6
2	**DC Network Analysis**	• Nodal analysis method. • Mesh analysis method. • Star/Delta, Delta/Star transformation. • Superposition theorem. • Thevenin's theorem. • Norton's theorem. • Maximum power transfer theorem. • Reciprocity theorem.	8
3	**AC Fundamentals**	• Introduction of AC quantities. • Generation of alternating sinusoidal voltage. • Different terminologies of AC system. • RMS and average value: definition, derivation, and importance. form factor, peak factor. • Ways of phasor representation of AC quantities. conversion from one form to another, complex algebra (addition, subtraction, multiplication and division). • General concept of Inductance, capacitance, inductive reactance and capacitive reactance. • Single phase AC circuit analysis with R, L, C, RL, RC, RLC series and parallel circuits. • Introduction of three phase AC system. • Advantages of three phase AC system. • Generation of three phase sinusoidal voltage; Wave and phasor diagram; Phase sequence.	12

		• Interconnection of three phase coils; Line and phase quantities in Star and Delta connections and their relationship. • Voltage, current, power and power factor computation in balanced and unbalanced load.	
4	**Electrical Machines**	• DC motor: Introduction, construction and working principle • Back EMF and its significance, types and application of DC motor. • Transformer: Introduction, construction and working principle of transformer. • EMF equation, transformation ratio, types and application of transformer. • 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).
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8. Asadi, F. (2023). “Electric Circuit Laboratory Manual”. Springer Nature, Switzerland. [ISBN 978-3-031-24552-7].

Course: Fundamentals of Electrical Engineering	**Course Code: BFT 156 (B)**	**Credit Hour: 1**
Semester: II	**Teaching hours: 32**	**Full Marks: 25**
Nature of Course: Practical + Tutorial	**(Tutorial: 1 h, Lab: 3 h per session)**	

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%