



# **First Year Curriculum**

**Admission Year 2026-27**

**First Year Curriculum for the Admission Year 2026-27 Batch**

**B. Tech  
Food Technology**

**Faculty of Engineering & Technology**

**Parul University**

**Vadodara, Gujarat, India**

## Detailed Syllabus

### Semester 01

**Course Name:** Fundamentals of Food Processing

**Course Code:** 20105111

**Prerequisite:** Knowledge of Physics & Mathematics up to 12<sup>th</sup> science level

**Rationale:** Electrical Engineering subject is crucial for equipping students with the foundational knowledge and skills to comprehend, design, and implement electrical systems vital for the automation, control, and efficient functioning of equipment in food processing, ensuring safety, reliability, and technological advancements in the food industry.

#### Course Learning Objective:

<b>CLOBJ 1</b>	Gain an understanding of the perishability of food and causes for food spoilage
<b>CLOBJ 2</b>	Have an idea of the basic methods of preservation of food
<b>CLOBJ 3</b>	Knowledge about non thermal processing of food

#### Course Learning Outcomes:

<b>CLO 1</b>	Understand the concept of food perishability and identify factors affecting the shelf life of food products.
<b>CLO 2</b>	Explain the major causes of food spoilage, including microbial, chemical, and physical factors.
<b>CLO 3</b>	Describe and compare various basic methods of food preservation such as drying, refrigeration, and heat processing.
<b>CLO 4</b>	Analyze the principles and applications of different non-thermal food processing techniques.

#### Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
2	-	1	3	50	-	30	-	20	100

**Lect** - Lecture, **Tut** - Tutorial, **Lab** - Lab, **T** - Theory, **P** - Practical, **CE** - CE, **T** - Theory, **P** - Practical

**Course Content:**

<b>Sr. No.</b>	<b>Content</b>	<b>Weightage</b>	<b>Teaching Hours</b>
1	Food: Definition and Functions, Classification of foods, sources, types and perishability of foods; Causes and types of food spoilage; Scope and benefits of food preservation.	15%	5
2	Food processing: Introduction, levels and techniques; Methods of food preservation; Preservation by salt and sugar: Principle, method and effect on food quality.	14%	6
3	Preservation by heat treatment: Principle, process and equipment for blanching, canning, pasteurization, sterilization.	10%	3
4	Preservation by use of low temperature: Principle, methods, equipment.	10%	2
5	Preservation by drying, dehydration and concentration: Principle, methods, equipment.	10%	2
6	Preservation by irradiation: Principle, methods, equipment.	4%	2
7	Preservation by chemicals- antioxidants, mould inhibitors, antibodies, acidulants, Hurdle technology etc.	10%	2
8	Preservation by fermentation: Principles, methods, equipment.	8%	2
9	Non-thermal preservation processes: Principles, equipment – Pulsed electric field and pulsed intense light, ultrasound, dielectric heating, ohmic and infrared heating, high pressure processing, microwave processing, Cold Plasma technology, etc.	15%	6
10	Quality tests and shelf-life of preserved foods	4%	2
11	<b>*Continuous Evaluation:</b> It consists of Assignments/Seminars/Presentations/Quizzes/Surprise Tests (Summative/MCQ) etc.		

**List of Practical:**

1. Demonstration of various perishable food items and degree of spoilage
2. Blanching of selected food items
3. Preservation of food by heat treatment- pasteurization
4. Preservation of food by high concentration of sugar: Jam
5. Preservation of food by using salt: Pickle
6. Preservation of food by using acidulants i.e. pickling by acid, vinegar or acetic acid
7. Preservation of food by using chemical preservatives
8. Preservation of bread, cake using mold inhibitors
9. Drying of fruit slices pineapple slices, apple slices in cabinet drier

10. Drying of green leafy vegetables; Drying of mango/ other pulp by foam-mat drying
11. Drying of semisolid foods using roller dryers; Drying of foods using freeze drying process
12. Demonstration of preserving foods under cold vs. freezing process
13. Processing of foods using fermentation technique, i.e. preparation of sauerkraut

### Suggested Readings

1. Fellows, P.J. 2017. *Food Processing Technology: Principles and Practice*, 4th edn. Woodhead Publishing, Cambridge, UK.
2. Toledo, R.T. 2007. *Fundamentals of Food Process Engineering*, 3rd edn. Springer Science+Business Media, LLC, New York, USA.
3. Potter, N.N. and Hotchkiss, J.H. 1998. *Food Science*, 5th edn. Springer Science+Business Media, LLC, New York, USA.
4. Singh, R.P. and Heldman, D.R. 2009. *Introduction to Food Engineering*, 4th edn. Academic Press, Elsevier, Amsterdam, Netherlands.
5. Brennan, J.G., Butters, J.R., Cowell, N.D. and Lilly, A.E.V. 1990. *Food Engineering Operations*, 3rd edn. Elsevier Applied Science, London, UK.

## SEMESTER 01

**Course Name:** Workshop Technology

**Course Code:** 20105112

**Prerequisite:** Students should have basic knowledge of science, mathematics, and engineering graphics. They must be familiar with simple tools, units of measurement, and general safety practices in laboratories or workshops.

**Rationale :** This course provides fundamental knowledge of manufacturing processes, tools, machines, and safety. It builds practical skills in operations like fitting, welding, carpentry, forging, and machining, forming a foundation for advanced manufacturing and industrial training.

### Course Learning Objective:

<b>CLOBJ 1</b>	Gain an understanding about different type of material and their measurement
<b>CLOBJ 2</b>	Have an idea of the basic methods involved in repair and maintenance of equipment
<b>CLOBJ 3</b>	Knowledge about skills related to welding, blacksmith, carpentry, sheet metal, machining etc.

### Course Learning Outcomes:

<b>CLO 1</b>	Understand different types of engineering materials and their properties along with standard measurement techniques.
<b>CLO 2</b>	Explain the basic methods and tools used for repair and maintenance of equipment.
<b>CLO 3</b>	Demonstrate fundamental skills in welding and blacksmith operations.
<b>CLO 4</b>	Apply practical knowledge of carpentry and sheet metal work in basic fabrication tasks.

### Teaching and Examination Scheme

Teaching Scheme					Examination Scheme					Total
Lecture Hrs/W week	Tutorial Hrs/W week	Lab Hrs/W week	Seminar Hrs/W week	Credit	Internal Marks			External Marks		
					T	CE	P	T	P	
1	-	4	-	3	40	-	20	40	-	100

SEE - Semester End Examination, T - Theory, P - Practical

### Course Content

W - Weightage (%), T - Teaching hours

Sr.	Topics	W	T
1	Introduction to basic materials: Ferrous and non-ferrous materials; Engineering materials like timber, abrasive materials, silica, ceramics, glasses, graphite, diamond, plastics, polymers, composites – properties and applications	10	2
2	Safety measures in workshop; Indian Factory Acts on safety	5	1
3	Measuring and Gauging: Basic measuring instruments and gauges	5	1
4	Heat treatment processes – Introduction and overview	5	1
5	Hardening and Tempering processes	5	1
6	Annealing and Normalizing processes	5	1
7	Welding: Introduction, types of welding, types of electrodes	10	1
8	Welding: Types of flames, types of welding joints, edge preparation, welding techniques and equipment	10	1
9	Gas welding and cutting; Arc welding	5	1
10	Soldering and brazing – introduction, uses, and cost estimation	5	1
11	Smithy and forging: Introduction, tools, uses, and forging operations	5	1
12	Carpentry: Tools, materials, types of wood, characteristics, band saw, circular saw, wood planner	5	1
13	Machinery: Introduction to lathe, power hacksaw, shaper, and planner	10	1
14	Machinery: Drilling, grinder, CNC machines; Length of cut, feed, RPM, cutting speed, time, allowances	10	1
15	Estimation of machining time for lathe, shaping, slotting, and planning operations; Work holding and tool holding devices	5	1
<b>Total</b>		<b>100</b>	<b>16</b>

### Reference Books

1.	<b>Workshop Technology ( Part I and II). (TextBook)</b> By Chapman W A J   Arnold Publishers (India) Pvt. Ltd., AB/9 Safdarjung Enclave, New Delhi., Pub. Year 1989
2.	<b>Elements of Workshop Technology (Vol I &amp; Vol II)</b> By Hajra Choudhary   Media Promoters and Publishers Pvt Ltd
3.	<b>A Course in Workshop Technology (TextBook)</b> By Raghuwamsi B S   Dhanpat Rai and Sons, 1682 Nai Darak, New Delhi., Pub. Year 1982

## List of Practical

1.	Study of materials and measuring instruments: Identification of different engineering materials and demonstration of measurement techniques.
2.	Study of tools: Identification of hand tools and demonstration of various power tools and basic machine tools.
3.	Fitting and bench work: Exercises in filing, fitting, chipping, hacksawing, chiseling, and tapping.
4.	Introduction to welding: Study of welding machines, processes, tools, and safety precautions.
5.	Arc and gas welding exercises: Practice on arc welding and gas welding operations.
6.	Casting and moulding: Demonstration of casting processes and mould making using one- piece and two-piece patterns.
7.	Advanced mould making: Demonstration of mould making using sweep pattern and match plate pattern.
8.	Lathe operations: Simple exercises on step turning, taper turning, and drilling.
9.	Shaper, planner, and drilling machines: Demonstration and preparation of jobs using shaper, planner, and drilling machines.
10.	Comprehensive job work: Demonstration of other important operations and preparation of additional practical jobs.

## SEMESTER 01

**Course Name:** Basic Electrical Engineering

**Course Code:** 20105113

**Prerequisite:** Knowledge of Physics & Mathematics up to 12th science level

**Rationale:** Electrical Engineering subject is crucial for equipping students with the foundational knowledge and skills to comprehend, design, and implement electrical systems vital for the automation, control, and efficient functioning of equipment in food processing, ensuring safety, reliability, and technological advancements in the food industry. Teaching and Examination Scheme:

### Course Learning Objective:

<b>CLOBJ 1</b>	Differentiate between single and three phase connection
<b>CLOBJ 2</b>	Have an idea of the basic measuring electrical current and its quality
<b>CLOBJ 3</b>	Knowledge about application of wiring and connections

### Course Learning Outcomes:

<b>CLO 1</b>	Differentiate between single-phase and three-phase electrical systems and their applications.
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<b>CLO 2</b>	Understand the basic principles of electrical current, voltage, and power in circuits.
<b>CLO 3</b>	Explain methods and instruments used for measuring electrical current and assessing power quality.
<b>CLO 4</b>	Demonstrate knowledge of electrical wiring systems, components, and standard connections.

### Teaching and Examination Scheme:

Teaching Scheme			Credit	Examination Scheme					Total
Lect Hrs/ Week	Tut Hrs/ Week	Lab Hrs/ Week		External		Internal			
				T	P	T	CE	P	
2	-	1	3	30	20	50	-	-	100

**Lect** - Lecture, **Tut** - Tutorial, **Lab** - Lab, **T** - Theory, **P** - Practical, **CE** - CE, **T** - Theory, **P** - Practical

### Contents:

Sr. No	Topic	Weightage	eaching Hrs.
1	<b>AC Fundamentals:</b> Definitions of cycle, frequency, time period, amplitude, Peak value, RMS value, Average value, Electromotive force, Magnetic circuits, composite magnetic circuits, magnetic leakage, hysteresis and eddy currents, phase relations and vector representation, AC through resistance, inductance and capacitance, AC series and parallel circuits, Simple R-L, R-C and R-L-C circuits.	19%	9
2	<b>Engineering Circuit Analysis:</b> Current, Voltage, Power, Circuit elements, Ohm's law.	10%	5
3	<b>Three-Phase Systems:</b> Star and Delta connections, Relationship between line and phase voltages and currents in Star and Delta connections, various methods of single and three-phase power measurement.	10%	5
4	<b>Transformer:</b> Principle of working, construction of single-phase transformer, core type, shell type transformer, emf equation, Phasor diagrams, Ideal transformer, transformer on no load, Transformer under load, Equivalent circuits, Transformer losses, efficiency, Regulation, Open and short circuit test.	15%	8
5	<b>Induction Motors:</b> Single-phase induction motor: Double field revolving theory, characteristics, phase split, shaded pole motors. Poly-phase induction motor: Construction, operation, equivalent circuit, production of rotating field, effect of rotor resistance, torque equation, starting and speed control methods.	15%	8
6	<b>DC Machines:</b> DC Generator & Motor: Types, Construction and Operation, EMF equation, armature reaction, commutation of DC generator and their characteristics. DC Motors, their starting, speed controls and characteristics.	10%	5

7	<b>Electric Power Economics:</b> Maximum demand charge, Load factor, Power factor and power factor improvement.	5%	2
8	<b>Measuring Equipment:</b> Classification, Characteristics of different electrical measuring systems and equipment.	5%	2
9	<b>Electrical Wiring &amp; Protection Devices:</b> System of wiring, domestic wiring installation, industrial electrification, Earthing, Circuit protection devices, fuses, ELCB and relays.	10%	4
<b>*Continuous Evaluation:</b> It consists of Assignments/Seminars/Presentations/Quizzes/Surprise Tests (Summative/MCQ) etc.			

### List of Practicals

1. Study of voltage resonance in L.C.R. circuits at constant frequency: (a) Star connection study of voltage and current relation. (b) Delta connection study of voltage and current relation.
2. Measurement of Power in 3-phase circuit by wattmeter and energy meter: (a) for balanced loads, (b) for unbalanced loads.
3. Polarity test, no-load test, efficiency and regulation test of a single-phase transformer.
4. Starting of induction motors by; (a) D.O.L. (b) Manual star delta (c) Automatic star delta starters.
5. Starting of slip ring induction motors by normal and automatic rotor resistance starters.
6. Test on 3-phase induction motor: determination of efficiency, line current, speed slip, and power factor at various outputs.
7. Determination of relation between the induced armature voltage and speed of a separately excited DC generator.
8. Magnetization characteristics of a DC generator.
9. Study of starter connection, starting, reversing, and adjusting speed of a DC motor.
10. Problems on Industrial Electrification.
11. Study of various circuit protection devices.
12. Study of various measuring instruments.

### Suggested Readings

1. Theraja, B.L. and Theraja, A.K. 2005. *A Textbook of Electrical Technology, Vol. II*. S. Chand and Company Ltd., New Delhi.
2. Toro, V.D. 2000. *Electrical Engineering Fundamentals*. Prentice-Hall India Private Ltd., New Delhi.

## SEMESTER 01

**Course Name:** General Microbiology

**Course Code:** 20105114

**Prerequisite:** Basic knowledge of general microbiology including classification and identification of microorganism, microscopy, structures of cell wall, as well as understanding of bacterial metabolism and growth and bacterial genetics.

**Rationale :** This course provides a foundational understanding of microbiology, focusing on the

principles and concepts that govern the biology of microorganisms. Students will learn about the structure, function, and diversity of microorganisms. The course covers various aspects of microbial biology, including microbial growth, metabolism, genetics.

**Course Learning Objective:**

<b>CLOBJ 1</b>	Identify the micro-organisms, their structure and growth characteristics
<b>CLOBJ 2</b>	Techniques for cultivation and preservation and control

**Course Learning Outcomes:**

<b>CLO 1</b>	Identify different types of microorganisms and classify them based on their characteristics.
<b>CLO 2</b>	Understand the basic principles of electrical current, voltage, and power in circuits.
<b>CLO 3</b>	Explain the growth characteristics and factors affecting microbial growth.
<b>CLO 4</b>	Demonstrate techniques for cultivation and preservation of microorganisms

**Teaching and Examination Scheme**

Teaching Scheme					Examination Scheme					Total
Lecture	Tutorial	Lab	Seminar	Credit	Internal Marks			External Marks		
					T	CE	P	T	P	
2	-	2	-	3	40	-	20	40	-	100

SEE - Semester End Examination, T - Theory, P – Practical W - Weightage (%), T - Teaching hours

**Course Content**

Sr.	Topics	W	T
1	Scope and history of microbiology: (notable contributions of Leeuwenhoek, Pasteur, Koch, etc.), Place of Microorganisms in living world; Groups of microorganisms; Applied area of microbiology	8	2
2	Classification and identification of micro- organism; Major Characteristics of Microorganisms, Methods of classification of bacteria	12	6
3	Microscopy: Introduction to microscope; Component of microscope; Types of microscope and Microscopic techniques	10	2
4	Microbial Ultra Structure and Functions: Morphological features; Structures external to cell wall, Cell wall; Structures internal to cell wall	15	4
5	Cultivation and preservation of micro-organisms: Nutritional requirements; Types of media	10	2
6	Physical condition required for the growth; Enumeration methods for micro- organisms	5	2
7	Bacterial Metabolism and Growth: Reproduction of bacteria	10	2
8	Growth of bacteria: growth curve, continuous culture, synchronous culture; Methods of isolation of pure cultures; Maintenance and preservation of pure cultures; Culture collections	15	5
9	Control of microorganisms: Physical and Chemical agents	5	2
10	Bacterial genetics: Structure and functions of DNA and RNA; Overview of replication and regulation	10	5
<b>Total</b>		<b>100</b>	<b>32</b>

### List of Practical

1. Microscopy
2. Cleaning and sterilization of glassware and acquainting with equipment used in microbiology
3. Preparation of nutrient agar media and techniques of inoculation
4. Monochrome staining
5. Gram staining
6. Negative staining
7. Capsule- staining,
8. Flagella staining
9. Endospore staining
10. Pure culture techniques (streak plate/pour plate/spread plate)
11. Identification procedures (morphology and cultural characteristics)
12. Growth characteristics of fungi: Determination of microbial numbers
13. Direct plate count
14. Generation time
15. Factors influencing growth: pH, temperature, growth curves for bacteria.

### Reference Books

1. Prescott's Microbiology. 9th edition. (TextBook)  
By Willey JM, Sherwood LM, and Woolverton CJ. (2013). | McGraw Hill Higher Education
2. Microbiology: An Introduction. 9th edition Pearson Education (TextBook)  
By Tortora GJ, Funke BR, and Case CL. (2008).
3. Prescott's Microbiology (9th Edition) by Christopher J. Woolverton, Joanne Willey, and Linda Sherwood  
By Christopher J. Woolverton, Joanne Willey, and Linda Sherwood

## SEMESTER 01

**Course Name:** Farming Based Livelihood System

**Course Code:** 20105115

**Prerequisite:** Completion of introductory courses in dairy technology and agricultural sciences, Basic knowledge of animal husbandry, farm management, and rural economics, Familiarity with dairy farming practices and supply chain dynamics, Understanding socio-economic aspects of rural livelihoods.

**Rationale :** Explores integration of dairy farming into sustainable livelihood systems for rural economic stability, equips students to design and manage dairy-based farming systems for enhanced productivity and profitability, fosters innovation in small-scale dairy enterprises, prepares students to address challenges in rural dairy farming and promote sustainable development.

**Course Learning Objective:**

<b>CLOBJ 1</b>	To make the students aware about farming based livelihood systems in agriculture
<b>CLOBJ 2</b>	To disseminate the knowledge and skill how farming based systems can be a source of livelihood

**Course Learning Outcomes:**

<b>CLO 1</b>	Apply agricultural practices and strategies to enhance income generation and sustainable livelihoods.
<b>CLO 2</b>	Demonstrate knowledge and skills related to planning and managing farming-based livelihood activities.
<b>CLO 3</b>	Explain the economic and social importance of agriculture-based livelihood opportunities.
<b>CLO 4</b>	Identify different types of farming systems and their role in rural livelihoods.

### Teaching and Examination Scheme

Teaching Scheme					Examination Scheme					Total
Lecture	Tutorial	Lab	Seminar	Credit	Internal Marks			External Marks		
					T	CE	P	T	P	
2	-	2	-	3	40	-	20	40	-	100

SEE - Semester End Examination, T - Theory, P - Practical W - Weightage (%), T - Teaching hours

### Course Content

Sr.	Topics	W	T
1	Status of agriculture in India and different states, Income of farmers and rural people in India, Livelihood-Definition, concept and livelihood pattern in urban and rural areas, Different indicators to study livelihood systems.	16	5
2	Agricultural livelihood systems (ALS): Meaning, approach, approaches and framework, Definition of farming systems and farming based livelihood systems Prevalent Farming systems in India contributing to livelihood.	13	4
3	Types of traditional and modern farming systems. Components of farming system/ farming-based livelihood systems: Crops and cropping systems, Livestock (dairy, piggery, goatry, poultry, duckry etc.), Horticultural crops, Agroforestry systems, Aquaculture Duck/Poultry cum Fish, Dairy cum Fish, Piggery cum Fish etc., Small-, medium- and large enterprises including value chains and secondary enterprises as livelihood components for farmers	27	10
4	Factors affecting integration of various enterprises of farming for livelihood. Feasibility of different farming systems for different agro-climatic zones, Commercial farming-based livelihood models by NABARD, ICAR and other organizations across the	16	5
5	Case studies on different livelihood enterprises associated with the farming. Risk and success factors in farming-based livelihood systems, Schemes and program by Central and State Government.	12	3
6	Public and Private organizations involved in promotion of farming-based livelihood opportunities. Role of farming-based livelihood enterprises in 21st Century in view of circular economy, green economy, climate change, digitalization and changing lift	16	5
<b>Total</b>		<b>100</b>	<b>32</b>

### List of Practical

1. Survey of farming systems and agriculturally based livelihood enterprises
2. Study of components of important farming-based livelihood models/ systems in different agro-climatic zones
3. Study of production and profitability of crop based, livestock based, processing based and integrated farming-based livelihood models
4. Field visit of innovative farming system models

5. Visit of Agri-based enterprises and their functional aspects for integration of production, processing and distribution sectors and Study of agri-enterprises involved in industry and service sectors (Value Chain Models)
6. Learning about concept of project formulation on farming-based livelihood systems along with cost and profit analysis
7. Case study of Start-Ups in agri-sectors.

### Reference Books

1. Towards Green Villages: A strategy for Environmentally, Sound and Participatory Rural Development, Center for Science and Environment (TextBook)  
By Agarwal, A. and Narain, S., Pub. Year 1989
2. Farming Systems and Poverty: Improving Farmers' Livelihoods in a Changing World.  
By Dixon, J. and Gulliver, A. with Gibbon, D. | FAO & World Bank, Rome, Pub. Year 2001
3. Integrated Farming System models for Agricultural Diversification, Enhanced Income and employment, Indian Council of Agricultural Research  
By Panwar et al., Pub. Year 2020
4. Farming System and Sustainable Agriculture (TextBook)  
By Reddy, S.R | Kalyani Publishers, New Delhi., Pub. Year 2016
5. Farming System and Sustainable Agriculture  
By Walia, S. S. and Walia, U. S. 2020 | Walia, S. S. and Walia, U. S. 2020, Pub. Year 2020

## SEMESTER 01

**Course Name:** Communication Skills

**Course Code:** 20105116

**Prerequisite:** Basic understanding of English language, including reading, writing, and speaking skills.

**Rationale:** To acquire competence in oral, written and non-verbal communication, develop strong personal and professional communication and demonstrate positive group communication skills for academic and industrial success.

### Course Learning Objective:

<b>CLOBJ 1</b>	To acquire competence in oral, written and non-verbal communication, develop strong personal and professional communication and demonstrate positive group communication
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### Course Learning Outcomes:

<b>CLO 1</b>	Apply professional communication strategies to enhance personal and workplace effectiveness.
<b>CLO 2</b>	Exhibit positive group communication skills including teamwork, collaboration, and active listening.
<b>CLO 3</b>	Interpret and apply non-verbal communication techniques in interpersonal interactions.
<b>CLO 4</b>	Develop clear and structured written communication for various purposes.

### Teaching and Examination Scheme:

Teaching Scheme			Credit	Examination Scheme					Total
Lect Hrs/ Week	Tut Hrs/	Lab Hrs/ Week		External		Internal			
				T	P	T	CE	P	
1	-	1	2	40	-	20	20	20	100

**Lect** - Lecture, **Tut** - Tutorial, **Lab** - Lab, **T** - Theory, **P** - Practical, **CE** - CE, **T** - Theory, **P** - Practical

### Contents:

Sr. No	Topic	Weightage	Teaching Hrs.
1	<b>Communication Process:</b> The magic of effective communication; Building self-esteem and overcoming fears; Concept, nature and significance of communication process; Meaning, types and models of communication; Verbal and non-verbal communication; Linguistic and non-linguistic barriers to communication and reasons behind communication gap/miscommunication.	35%	11
2	<b>Basic Communication Skills:</b> Listening, Speaking, Reading and Writing Skills; Precis writing/ Abstracting/Summarizing; Style of technical communication Curriculum vitae/resume writing; Innovative methods to enhance vocabulary, analogy questions.	30%	10
3	<b>Structural and Functional Grammar:</b> Sentence structure, modifiers, connecting words and verbals; phrases and clauses; Case: subjective case, possessive case; objective case; Correct usage of nouns, pronouns and antecedents, adjectives, adverbs and articles; Agreement of verb with the subject: tense, mood, voice; Writing effective sentences; Basic sentence faults.	35%	11
	<b>*Continuous Evaluation:</b> It consists of Assignments/Seminars/Presentations/Quizzes/Surprise Tests (Summative/MCQ) etc		

### List of Practical:

1. Listening and note taking
2. Writing skills: precis writing, summarizing and abstracting;
3. Reading and comprehension (written and oral) of general and technical articles;
4. Micro-presentations and Impromptu Presentations;
5. Feedback on presentations;
6. Stage manners: grooming, body language, voice modulation, speed;
7. Group discussions;
8. Public speaking exercises; vocabulary building exercises;
9. Interview Techniques; organization of events.

### Suggested readings

1. Allport, G W, 1937, Personality: A Psychological Interpretation. Holt, New York.
2. Brown Michele and Brandreth, Gyles, 1994, How to Interview and be Interviewed. Sheldon Press, London.
3. Carnegie Dale, 1997, The Quick and Easy Way to Effective Speaking. Pocket Books, New York.
4. Francis Peter S J, 2012, Soft Skills and Professional Communication. Tata McGraw Hill, New Delhi.
5. Kumar S and Pushpa Lata, 2011, Communication Skills. Oxford University Press.
6. Neuliep James W, 2003, Intercultural Communication A Contextual Approach. Houghton Mifflin Co Boston.
7. Pease, Allan, 1998, Body Language. Sudha Publications, Delhi.
8. Raman M and Singh P, 2000, Business Communication. Oxford University Press.
9. Seely J, 2013, Oxford Guide to Effective Writing and Speaking. Oxford University Press.
10. Thomson A J and Martinet A V, 1977, A Practical English Grammar. Oxford University.

### SEMESTER 01

**Course Name:** NCC-I / NSS-I

**Course Code:** 20105117

**Prerequisite:** NSS-I is an initial course syllabus which is open to all students, requiring no anterior knowledge and any kind of experience in leadership or any community service.

**Rationale:** The NSS-I course is designed to support a sense of social responsibility, leadership among students. It introduces them to practical involvement in awareness, health, hygiene, and environmental conservation initiatives. By participating in various youth development programs, students will develop essential life skills and carrying capacity, preparing them to contribute meaningfully to society and nation-building activities.

**Course Learning Objective:**

<b>CLOBJ 1</b>	Drill- aim, general words of command, attention, stands at ease, stand easy and turning.
<b>CLOBJ 2</b>	Sizing, numbering, forming in three ranks, open and close order march, and dressing.
<b>CLOBJ 3</b>	Marching, length of pace, and time of marching in quick/slow time and halt. Side pace, pace forward and to the rear. Turning on the march and wheeling. Saluting on the march.
<b>CLOBJ 4</b>	Nation Building- cultural heritage, religions, traditions, and customs of India. National integration. Values and ethics, perception, communication, motivation, decision making, discipline and duties of good citizens. Leadership traits, types of leadership. Character/ personality development. Civil defense organization, types of emergencies, firefighting, protection. Maintenance of essential services, disaster management, aid during development projects.

**Course Learning Outcomes:**

<b>CLO 1</b>	Aims, objectives, organization of NCC and NCC song. DG's cardinals of discipline.
<b>CLO 2</b>	Drill- aim, general words of command, attention, stands at ease, stand easy and turning.
<b>CLO 3</b>	Sizing, numbering, forming in three ranks, open and close order march, and dressing.
<b>CLO 4</b>	Saluting at the halt, getting on parade, dismissing, and falling out.

### Teaching and Examination Scheme:

Teaching Scheme			Credit	Examination Scheme					Total
Lect Hrs/ Week	Tut Hrs/week	Lab Hrs/ Week		External		Internal			
				T	P	T	CE	P	
-	-	2	1	-	-	-	-	100	100

**Lect** - Lecture, **Tut** - Tutorial, **Lab** - Lab, **T** - Theory, **P** - Practical, **CE** - CE, **T** - Theory, **P** - Practical

#### Practical NCC-I:

- Aims, objectives, organization of NCC and NCC song. DG's cardinals of discipline.
- Drill- aim, general words of command, attention, stands at ease, stand easy and turning.
- Sizing, numbering, forming in three ranks, open and close order march, and dressing.
- Saluting at the halt, getting on parade, dismissing, and falling out.
- Marching, length of pace, and time of marching in quick/slow time and halt. Side pace, pace forward and to the rear. Turning on the march and wheeling. Saluting on the march.
- Marking time, forward march, and halt. Changing step, formation of squad and squad drill.
- Command and control, organization, badges of rank, honors, and awards
- Nation Building- cultural heritage, religions, traditions, and customs of India. National integration. Values and ethics, perception, communication, motivation, decision making, discipline and duties of good citizens. Leadership traits, types of leadership. Character/ personality development. Civil defense organization, types of emergencies, firefighting, protection. Maintenance of essential services, disaster management, aid during development projects.
- Basics of social service, weaker sections of society and their needs, NGO's and their contribution, contribution of youth towards social welfare and family planning.
- Structure and function of human body, diet and exercise, hygiene and sanitation. Preventable diseases including AIDS, safe blood donation, first aid, physical and mental health. Adventure activities. Basic principles of ecology, environmental conservation, pollution and its control.

#### Practical NSS-I:

- Orientation: history, objectives, principles, symbol, badge; regular programs under NSS
- Organizational structure of NSS, Code of conduct for NSS volunteers, points to be considered by NSS volunteers' awareness about health.
- NSS programme activities. Concept of regular activities, special camping, day camps, basis of adoption of village/slums, conducting survey, analyzing guiding financial patterns of scheme, youth programs/ schemes of GoI, coordination with different agencies and maintenance of diary.

Understanding youth. Definition, profile, categories, issues and challenges of youth; and opportunities for youth who are agents of social change.

- Community mobilization. Mapping of community stakeholders, designing the message as per problems and their culture; identifying methods of mobilization involving youth-adult partnership. Social harmony and national integration

- Indian history and culture, role of youth in nation building, conflict resolution and peacebuilding. Volunteerism and shramdaan. Indian tradition of volunteerism, its need, importance, motivation, and constraints; shaman as part of volunteerism

- Citizenship, constitution, and human rights. Basic features of constitution of India, fundamental rights and duties, human rights, consumer awareness and rights and rights to information. Family and society. Concept of family, community (PRIs and other community based organizations) and society

- **Course Outcomes:**

1. Understand the concept and importance of NSS
2. Participate in community engagement activities
3. Develop teamwork, leadership, and communication skills
4. Demonstrate social awareness and civic responsibility

## SEMESTER 01

**Course Name:** Introduction to Drying Technology and Dryers

**Course Code:** 20105131

**Prerequisite:** Basic knowledge of physics and chemistry, particularly principles of heat and mass transfer, thermodynamics, and fluid dynamics. A foundational understanding of food science, including the behavior of water in food systems, is also recommended.

**Rationale:** This course introduces students to the principles and applications of drying technology, a critical aspect of food preservation and processing. It covers the theoretical and practical aspects of drying, including moisture removal mechanisms, drying kinetics, and the design and operation of various types of dryers. Students will explore how drying affects the quality, texture, and nutritional properties of food products. By understanding these principles, students will be equipped to optimize drying processes in industrial settings, ensuring product quality, energy efficiency, and sustainability in food processing operations.

**Course Learning Objective:**

<b>CLOBJ 1</b>	Drill- aim, general words of command, attention, stands at ease, stand easy and turning.
<b>CLOBJ 2</b>	Sizing, numbering, forming in three ranks, open and close order march, and dressing.

**Course Learning Outcomes:**

<b>CLO 1</b>	Explain the fundamental principles of drying, including moisture content, drying rate, and mechanisms of moisture removal in food and agricultural products.
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<b>CLO 2</b>	Classify different types of dryers and describe their construction, working principles, and applications in the food processing industry.
<b>CLO 3</b>	Analyze the factors affecting the drying process such as temperature, humidity, air velocity, and properties of the material.
<b>CLO 4</b>	Evaluate the performance and efficiency of various drying systems and select suitable dryers for specific industrial applications.

### Teaching and Examination Scheme

Teaching Scheme			Credit	Examination Scheme					Total
Lect Hrs/ Week	Tut Hrs/ Week	Lab Hrs/ Week		External		Internal			
				T	P	T	CE	P	
-	-	2	2	-	50	-	-	50	100

### List of Practical's

1. Introduction to drying and dehydration
2. Study of hot air dryer and modelling drying kinetics
3. Determination of moisture content using hot air oven
4. Study of working principle of spray dryer and spray drying process
5. Study of vacuum dryer and modeling drying kinetics
6. Study of drum dryer and liquid food dehydration using drum drying
7. Pretreatment of food products before drying
8. Study of freeze dryer of food products
9. Sensory Evaluation of Dried Products
10. To study the Effect of Packaging on Dried Foods
11. Industrial Visit to food drying industry

### Suggested Readings

1. Mujumdar, A.S. 2014. *Handbook of Industrial Drying*, 4th edn. CRC Press, Taylor & Francis Group, Boca Raton, FL, USA.
2. Ratti, C. 2009. *Advances in Food Dehydration*. CRC Press, Taylor & Francis Group, Boca Raton, FL, USA.
3. Baker, C.G.J. 1997. *Industrial Drying of Foods*. Springer Science+Business Media, New York, USA.
4. Barbosa-Cánovas, G.V. and Vega-Mercado, H. 1996. *Dehydration of Foods*. Springer Science+Business Media, New York, USA.
5. van Arsdel, W.B., Copley, M.J. and Morgan, A.I. 1973. *Food Dehydration: Volume 1 – Principles*, 2nd edn. AVI Publishing Company, Westport, CT, USA.

## SEMESTER 01

**Course Name:** Introduction to Good Laboratory Practices

**Course Code:** 20105132

**Prerequisite:** Good Laboratory Practices in food technology include a foundational understanding of food science and safety principles. Knowledge of basic laboratory techniques and equipment usage is essential. Additionally, familiarity with regulatory standards and guidelines for food testing and quality control is important.

**Rationale:** Good Laboratory Practices in food technology is to ensure the reliability and accuracy of laboratory results in food safety testing. It helps maintain consistent quality, safeguard public health, and comply with regulatory standards. GLP principles promote effective risk management and support the integrity of food production processes.

**Course Learning Objective:**

<b>CLOBJ 1</b>	Drill- aim, general words of command, attention, stands at ease, stand easy and turning.
<b>CLOBJ 2</b>	Sizing, numbering, forming in three ranks, open and close order march, and dressing.

**Course Learning Outcomes:**

<b>CLO 1</b>	Explain the fundamental principles of drying, including moisture content, drying rate, and mechanisms of moisture removal in food and agricultural products.
<b>CLO 2</b>	Classify different types of dryers and describe their construction, working principles, and applications in the food processing industry.
<b>CLO 3</b>	Analyze the factors affecting the drying process such as temperature, humidity, air velocity, and properties of the material.
<b>CLO 4</b>	Evaluate the performance and efficiency of various drying systems and select suitable dryers for specific industrial applications.

**Teaching and Examination Scheme:**

Teaching Scheme			Credit	Examination Scheme					Total
Lect Hrs/ Week	Tut Hrs/	Lab Hrs/ Week		External		Internal			
				T	P	T	CE	P	
-	-	2	2		50			50	100

**Lect** - Lecture, **Tut** - Tutorial, **Lab** - Lab, **T** - Theory, **P** - Practical, **CE** - CE, **T** - Theory, **P** - Practical

Sr. No	List of Practical
1.	<b>Laboratory Safety and Hygiene Practices:</b> Familiarization with lab safety protocols, emergency procedures, and maintaining a clean laboratory environment.
2.	<b>Preparation of Standard Operating Procedures (SOPs):</b> Writing and demonstrating the implementation of SOPs for various laboratory tasks.
3.	<b>Calibration of Laboratory Instruments:</b> Calibrating and verifying laboratory instruments like pH meters, balances, and spectrophotometers for accurate readings.
4.	<b>Sample Collection and Handling:</b> Techniques for proper sample collection, labeling, storage, and transportation to maintain sample integrity.
5.	<b>Record Keeping and Data Management:</b> Creating and maintaining accurate, legible, and traceable records for laboratory work.
6.	<b>Quality Control Testing:</b> Performing routine quality control checks on food products to assess parameters like moisture content, acidity, and preservatives.
7.	<b>Microbiological Testing of Food Samples:</b> Conducting tests to detect microbial

	contamination in food, such as plate counts or testing for specific pathogens.
8.	<b>Chemical Analysis of Food Products:</b> Conducting tests to determine chemical components in food like fat, protein, sugar content, or preservatives.
9.	<b>Preparation and Handling of Reagents:</b> Safe preparation, storage, and labeling of chemical reagents used in food testing.
10.	<b>GLP Compliance Assessment:</b> Reviewing and applying GLP guidelines to experimental design, data collection, and reporting.
11.	<b>Good Documentation Practices (GDP):</b> Recording laboratory data, observations, and results in an organized and consistent format.
12.	<b>Instrument Maintenance and Troubleshooting:</b> Regular maintenance and troubleshooting of laboratory instruments to ensure optimal performance.
13.	<b>Sensory Evaluation of Food Products:</b> Organizing and conducting sensory analysis tests to assess food quality based on appearance, taste, smell, and texture.
14.	<b>Statistical Analysis of Laboratory Data:</b> Using statistical methods to analyze and interpret experimental results in food testing.
15.	<b>Report Writing and Review:</b> Writing detailed experimental reports that include methodology, results, analysis, and conclusions, adhering to GLP standards.
<b>*Continuous Evaluation:</b> It consists of Assignments/Seminars/Presentations/Quizzes/Surprise Tests (Summative/MCQ) etc.	

## References

1. Organisation for Economic Co-operation and Development (OECD). (n.d.). *OECD principles of good laboratory practice (GLP)*. Retrieved from <https://www.oecd.org>
2. World Health Organization (WHO). (n.d.). *Good laboratory practice for analytical laboratories*. Retrieved from <https://www.who.int>
3. Motarjemi, Y., & Käferstein, F. K. (Eds.). (2003). *Food safety management: A practical guide for the food industry*. Academic Press. <https://doi.org/10.1016/B978-012372558-3/50005-4>
4. Prabhu, S. R. B., & Arokiasamy, T. (2006). *Good laboratory practices: A training manual*. Alpha Science International. ISBN: 978-1842654516
5. Alli, I. (2003). *Food quality assurance: Principles and practices*. CRC Press. <https://doi.org/10.1201/9780203911444>

## SEMESTER 01

**Course Name:** Basic Food Analysis Laboratory Techniques

**Course Code:** 20105133

**Prerequisite:** Basic Food Analysis Laboratory Techniques includes a foundational understanding of food science and basic laboratory skills. Students should be familiar with general chemistry, microbiology, and safety protocols in laboratory settings.

**Rationale:** The Basic Food Analysis Laboratory Techniques subject is essential for developing practical skills in analyzing the composition and quality of food products. It provides students with hands-on experience in conducting essential food tests, ensuring food safety and quality control.

**Course Learning Objective:**

<b>CLOBJ 1</b>	Drill- aim, general words of command, attention, stands at ease, stand easy and turning.
<b>CLOBJ 2</b>	Sizing, numbering, forming in three ranks, open and close order march, and dressing.

**Course Learning Outcomes:**

<b>CLO 1</b>	Understand the principles and importance of basic food analysis techniques used for quality evaluation of food products.
<b>CLO 2</b>	Perform standard laboratory procedures for the estimation of moisture, ash, fat, protein, and other basic constituents in food samples.
<b>CLO 3</b>	Demonstrate proper use, calibration, and maintenance of common laboratory instruments and equipment.
<b>CLO 4</b>	Analyze and interpret experimental data obtained from food analysis and present results in a scientific format.

**Teaching and Examination Scheme:**

Teaching Scheme			Credit	Examination Scheme					Total
Lect Hrs/ Week	Tut Hrs/ Week	Lab Hrs/ Week		External		Internal			
				T	P	T	CE	P	
-	-	2	2		50			50	100

**Lect** - Lecture, **Tut** - Tutorial, **Lab** - Lab, **T** - Theory, **P** - Practical, **CE** - CE, **T** - Theory, **P** - Practical

Sr. No	List of Practical
1.	<b>Determination of Moisture Content in Food:</b> Using the oven-drying method to measure the moisture content in various food samples.
2.	<b>Determination of Ash Content:</b> Analyzing the mineral content in food by combusting food samples in a muffle furnace.
3.	<b>Determination of Total Fat Content (Soxhlet Method):</b> Extracting fats from food samples using the Soxhlet apparatus.
4.	<b>Determination of Protein Content (Kjeldahl Method):</b> Estimating the protein content in food samples by digesting them and measuring the nitrogen content.
5.	<b>Determination of Carbohydrate Content (By Difference Method):</b> Calculating the carbohydrate content by subtracting the sum of moisture, protein, fat, and ash from the total sample weight.
6.	<b>Determination of Fiber Content in Food (Gravimetric Method):</b> Using a gravimetric method to estimate dietary fiber content in food samples.
7.	<b>pH Determination in Food:</b> Measuring the pH of various food samples using a pH meter.
8.	<b>Determination of Sugar Content (Fehling's Method):</b> Estimating the reducing sugar content in food samples using Fehling's solution.
9.	<b>Vitamin C Determination (Titration Method):</b> Determining the vitamin C content in food samples using an iodine titration method.
10.	<b>Determination of Salt (Chloride) Content (Mohr's Method):</b> Estimating the chloride content (salt) in food products using Mohr's method.
11.	<b>Determination of Total Soluble Solids (Brix Method):</b> Measuring the soluble solids content in juices or liquid foods using a refractometer.

12.	<b>Determination of Acid Value in Fats and Oils:</b> Estimating the free fatty acid content in fats and oils as a measure of rancidity.
13.	<b>Microbial Analysis of Food (Total Plate Count):</b> Performing a microbial count of food samples using the pour plate method.
14.	<b>Detection of Food Additives and Preservatives:</b> Identifying common food additives and preservatives through chemical tests (e.g., sodium benzoate, sulphites).
15.	<b>Sensory Evaluation of Food Products:</b> Conducting a sensory analysis of food samples using organized taste tests (e.g., color, texture, flavor, aroma).
<b>*Continuous Evaluation:</b> It consists of Assignments/Seminars/Presentations/Quizzes/Surprise Tests (Summative/MCQ) etc.	

## References

1. AOAC International. (2005). Official methods of analysis of AOAC International (18th ed.). AOAC International.
2. Baines, M. (2017). Food analysis: Principles and techniques (3rd ed.). CRC Press.
3. Fennema, O. R. (2000). Food chemistry (3rd ed.). CRC Press.
4. Haug, W., & Lantzsch, H. J. (1983). Sensitive methods for rapid assays of vitamin C and other antioxidants in foods. *Journal of Food Science*, 48(4), 1047-1050.
5. Lee, H., & Reicks, M. (2018). Introduction to food analysis: Theory and practical applications. Wiley.
6. Miller, E. L., & Johnson, A. (2011). Handbook of food analysis techniques (2nd ed.). CRC Press.

## SEMESTER 02

### Course Name: Post-Harvest Engineering

**Course Code:** 2010561

**Prerequisite:** The subject of Post-Harvest Engineering requires a multidisciplinary background that spans basic food science, engineering principles, food safety, and agriculture. Students must be well-versed in topics such as food preservation, microbial control, basic engineering concepts, and mathematical modeling, all of which are essential for designing efficient systems and processes to handle, store, and process agricultural products after harvest. This foundational knowledge will allow students to apply engineering principles to improve the quality, shelf life, and sustainability of post-harvest systems in food production.

**Rationale:** The study of Post-Harvest Engineering is essential for developing efficient, sustainable, and safe systems for handling and preserving food. It contributes to food security, reduces post-harvest losses, improves food quality, and enhances the economic viability of the agricultural sector. By integrating engineering principles with agriculture and food science, this subject equips students with the skills to tackle the challenges of modern food production and distribution, making it a vital area of focus in the B.Tech. Food Technology curriculum.

### Course Learning Objective:

<b>CLOBJ 1</b>	To understand the basic post-harvest operations
<b>CLOBJ 2</b>	Gain an understanding of various engineering properties

<b>CLOBJ 3</b>	Differentiate between different types of material handling systems
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**Course Learning Outcomes:**

<b>CLO 1</b>	Explain the concept, scope, and importance of post-harvest technology, including characteristics of major agricultural crops, cropping patterns, harvesting practices, and causes of post-harvest losses.
<b>CLO 2</b>	Apply the principles of water activity, water binding, and engineering properties of food materials (physical, thermal, mechanical, rheological, etc.) to understand their effects on food quality, stability, and processing.
<b>CLO 3</b>	Apply the principles of water activity, water binding, and engineering properties of food materials (physical, thermal, mechanical, rheological, etc.) to understand their effects on food quality, stability, and processing.
<b>CLO 4</b>	Analyze and select appropriate material handling and conveying systems (belt, chain, screw conveyors, bucket elevators, pneumatic systems) based on design parameters, capacity, and operational requirements in food processing industries.

**Teaching and Examination Scheme:**

Teaching Scheme			Credit	Examination Scheme					Total
Lect Hrs/ Week	Tut Hrs/ Week	Lab Hrs/ Week		External		Internal			
				T	P	T	CE	P	
2	-	1	3	40	-	0	40	20	100

**Lect** - Lecture, **Tut** - Tutorial, **Lab** - Lab, **T** - Theory, **P** - Practical, **CE** - Continuous evaluation

**Contents:**

Sr. No	Topic	Weightage	Teaching Hrs.
1	Overview of Post-Harvest Technology. Concept and science, Introduction to different agricultural crops, their cropping pattern, production, harvesting and post-harvest losses, reasons for losses, importance of loss reduction, Post-Harvest Handling operations. Water Activity; Water binding and its effect on enzymatic and non-enzymatic reactions and food texture, control of water activity and moisture.	15%	6
2	Engineering Properties of Food Materials; physical, thermal, aerodynamic, optical, mechanical, rheological and electromagnetic properties and their measurement.	10%	4
3	Cleaning; Cleaning of grains, washing of fruits and vegetables, types of cleaners, screens, types of screens, rotary screens, vibrating screens, machinery for cleaning of fruits and vegetables (air cleaners, washers), cleaning efficiency, care and maintenance; Peeling Sorting, grading, methods of grading; Grading- Size grading, colour grading, specific gravity grading; screening, equipment for grading of fruits and vegetables, grading efficiency, care and maintenance Magnetic separator, destoners, electrostatic separators, pneumatic separator.	15%	6

4	Decorticating and Shelling; Principles of working, design and constructional details, operating parameters, maintenance, etc. of various decorticators/dehullers/shellers, description of groundnut decorticators, maize shellers, etc. Milling, polishing, grinding, milling equipment, de-huskers, polishers (abrasion, friction, water jet), flour milling machines, pulse milling machines, grinders, cutting machines, oil expellers, machine efficiency and power requirement.	25%	7
5	Materials Handling; Introduction to different conveying equipment used for handling of grains; Scope and importance of material handling devices. Study of different Material Handling systems; Classification, principles of operation, conveyor system selection/design; Belt conveyor: Principle, characteristics, design, relationship between belt speed and width, capacity, inclined belt conveyors, idler spacing, belt tension, drive tension, belt tripper; Chain conveyor: Principle of operation, advantages, disadvantages, capacity and speed, conveying chain; Screw conveyor: Principle of operation, capacity, power, troughs, loading and discharge, inclined and vertical screw conveyors; Bucket elevator: Principle, classification, operation, advantages, disadvantages, capacity, speed, bucket pickup, bucket discharge, relationship between belt speed, pickup and bucket discharge, buckets types, power requirement; Pneumatic conveying system: types, air/product separators; Gravity conveyor design considerations, capacity and power requirement.	35%	9
<p><b>*Continuous Evaluation:</b> It consists of Assignments/Seminars/Presentations/Quizzes/Surprise Tests (Summative/MCQ) etc.</p>			

### List of Practical

1. Study of cleaners for grains
2. Study of washers for fruits and vegetables
3. Study of graders for grains
4. Study of graders for fruits and vegetables
5. Study of decorticators
6. Study of a maize/ sunflower sheller
7. Study of crop dryers
8. Study of a RF/MW/tray dryer
9. Study of hot air dryer and modelling drying kinetics
10. Study of vacuum dryer and modelling drying kinetics
11. Study of working principle of spray dryer and spray drying process
12. Study of drum dryer and liquid food dehydration using drum drying
13. Study of fluidized bed dryer and drying process
14. Study of freeze dryer and freeze-drying process
15. Study of rice milling machines
16. Study of pulse milling machines
17. Study of different components of flour mill
18. Study of different materials handling equipment

### Reference Books

1. Chakraverty, A. 2008. Post Harvest Technology of Cereals, Pulses and Oilseeds, 3rd edn. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.

2. Chakraverty, A. and Singh, R.P. 2014. Post Harvest Technology and Food Process Engineering.
3. Boumans, G. 1985. Grain Handling and Storage. Elsevier Science Publishers, Amsterdam, The Netherlands.
4. Brennan, J.G. 2006. Food Processing Handbook. Wiley-VCH Verlag GmbH and Co. KGaA, Weinheim, Germany.

## SEMESTER 02

**Course Name: Food Chemistry I**

**Course Code: (20105162)**

**Prerequisite:** Basic knowledge of chemistry, including general principles of organic, inorganic, and physical chemistry, and an understanding of biological sciences such as biochemistry and microbiology.

**Rationale:** This course introduces students to the chemical aspects of food and biomaterials, emphasizing their critical role in food processing. It provides an understanding of water and macromolecules, including their composition, structure, and functions. The course also explores how processing impacts these biomolecules, preparing students to optimize food quality and functionality in various industrial applications.

**Course Learning Objective:**

<b>CLOBJ 1</b>	To understand the basic post-harvest operations
<b>CLOBJ 2</b>	Gain an understanding of various engineering properties
<b>CLOBJ 3</b>	Differentiate between different types of material handling systems

**Course Learning Outcomes:**

<b>CLO 1</b>	Explain the role of water in foods, including moisture content, types of water, functional properties, water activity, sorption isotherms, and their influence on molecular mobility and food stability.
<b>CLO 2</b>	Describe the physicochemical properties of dispersed food systems such as sols, gels, foams, and emulsions, and interpret the rheological behavior of diphasic systems.
<b>CLO 3</b>	Analyze the structure, classification, functional properties, and reactions of carbohydrates and proteins, including their nutritional significance and processing-induced changes.
<b>CLO 4</b>	Evaluate the properties, reactions, and processing of lipids in foods, including rancidity, oxidation, refining processes, and the role of fats and oils in food formulation and stability.

**Teaching and Examination Scheme:**

<b>Teaching Scheme</b>		<b>Examination Scheme</b>	
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Lect Hrs/ Week	Tut Hrs/	Lab Hrs/ Week	Credit	External		Internal			Total
				T	P	T	CE	P	
2	-	1	3	40	-	20	20	20	100

**Lect** - Lecture, **Tut** - Tutorial, **Lab** - Lab, **T** - Theory, **P** - Practical, **CE** - CE, **T** - Theory, **P** - Practical  
**Contents:**

Sr. No	Topic	Weightage	aching Hrs.
1	<b>Water;</b> Moisture in foods, role and type of water in foods, functional properties of water, water activity and sorption isotherm, molecular mobility and foods stability; Dispersed systems of foods: Physicochemical aspects of food dispersion system (Sol, gel, foam, emulsions); Rheology of diphase systems.	20%	6
2	<b>Carbohydrates;</b> Monosaccharaides, disaccharides and polysaccharides, modification of carbohydrates, dietary fibres and carbohydrates digestibility; Enzymatic and chemical reactions of carbohydrates.	20%	6
3	<b>Proteins in foods:</b> Proteins: Classification, structure and properties, Proteins and nutrition, Functional properties of proteins, Processing induced, physical, chemical and nutritional changes in protein, chemical and enzymatic modification of protein.	20%	6
4	<b>Lipids in foods:</b> Classification, structure and properties of lipids; Role and use of lipids/ fat, crystallization and consistency, chemical aspects of lipids, lipolysis, auto-oxidation, thermal decomposition, chemistry of frying technology of fat and oil; Oil processing: Refining, hydrogenations, inter esterification, use of oils and fats in food formulation.	25%	8
5	Enzymatic and chemical reactions of fats; Rancidity and its types, detection techniques, chemical aspects of lipids, antioxidants.	15%	4
<b>*Continuous Evaluation:</b> It consists of Assignments/Seminars/Presentations/Quizzes/Surprise Tests (Summative/MCQ) etc.			

#### List of Practical:

1. Determination of moisture content of foods using different methods;
2. Studies of sorption isotherms of different foods;
3. Swelling and solubility characteristics of starches;
4. Rheological properties of food systems;
5. Determination of crude proteins by micro-Kjeldhal method;
6. Determination of essential amino acids i.e. lysine, tryptophan, methionine, etc.;
7. Isolation of egg and milk protein;
8. Preparation of protein isolate and concentrate of proteins;
9. Determination of acid value, saponification value and iodine number of fat/oil;
10. Assay of amylases, papain and lipases.

#### Suggested Readings

1. Brady, J.W. 2013. Introductory Food Chemistry. Comstock Publishing Associates, Cornell University Press, Ithaca, USA.

2. Belitz, H. D., Grosch, W. and Schieberle, P. 2009. Food Chemistry, 4th edn. Springer-Verlag Berlin Heidelberg.
3. Fennema, O.R. 1996. Food Chemistry, 3rd edn. Marcel Dekker, Inc., New York, USA.
4. Meyer, L.H. 1974. Food Chemistry. The AVI Publishing Co Inc., Connecticut, MA, USA.

## SEMESTER 02

**Course Name:** Unit Operation in Food Processing

**Course Code:** (20105163)

**Prerequisite:** Basic knowledge of physics, chemistry, and mathematics.

**Rationale:** Understanding unit operations is essential for designing and optimizing food processing techniques to ensure efficiency, quality, and safety in food production.

### Course Learning Objective:

<b>CLOBJ 1</b>	Learn the chemical aspects of food and bio- materials and its importance in food processing
<b>CLOBJ 2</b>	Gain an understanding of various water and macro- molecules
<b>CLOBJ 3</b>	Have an idea of about the effect of processing on these biomolecules

### Course Learning Outcomes:

<b>CLO 1</b>	Explain the principles of evaporation, thermodynamics, heat and mass transfer, and the design and operation of various evaporators including single and multiple effect systems, along with factors affecting efficiency and fouling.
<b>CLO 2</b>	Apply principles of food freezing, freeze drying, and frozen storage to evaluate processing conditions, freezing time, quality changes, and heat and mass transfer phenomena in frozen foods.
<b>CLO 3</b>	Demonstrate knowledge of separation and concentration processes such as extraction, leaching, crystallization, and distillation, including their principles, kinetics, equipment, and applications in the food industry.
<b>CLO 4</b>	Analyze thermal and mechanical food processing operations including baking, roasting, frying, blanching, pasteurization, sterilization, aseptic processing, homogenization, and emulsification with respect to process design, equipment, and product quality.

### Teaching and Examination Scheme:

Teaching Scheme			Credit	Examination Scheme					Total
Lect Hrs/ Week	Tut Hrs/	Lab Hrs/ Week		External		Internal			
				T	P	T	CE	P	
3	-	4	5	40	-	30	-	20	100

**Lect** - Lecture, **Tut** - Tutorial, **Lab** - Lab, **T** - Theory, **P** - Practical, **CE** - CE, **T** - Theory, **P** - Practical  
**Contents:**

Sr.	Topic	Weightage	aching Hrs.
1	<b>Chapter 1:</b> <b>Evaporation</b> 1.1 Principles of Evaporation 1.2 Mass and Energy Balance 1.3 Factors Affecting Rate of Evaporation 1.4 Thermodynamics of Evaporation Phase Change, Boiling Point Elevation, Dühring Plot 1.5 Heat and Mass Transfer in Evaporator 1.6 Factors Influencing the Overall Heat Transfer Coefficient 1.7 Influence of Feed Liquor Properties on Evaporation	10%	4
2	<b>Chapter 2: Evaporation Equipment</b> 2.1 Natural Circulation Evaporators 2.2 Horizontal/Vertical Short Tube 2.3 Natural Circulation with External Calandria 2.4 Long Tube and Forced Circulation Evaporators 2.5 Evaporator Ancillary Plant 2.6 Design of Evaporation Systems 2.7 Single Effect and Multiple Effect Evaporators 2.8 Feeding Methods of Multiple Effect Evaporation Systems 2.9 Feed Preheating 2.10 Vapour Recompression Systems 2.11 Fouling of Evaporators and Heat Exchangers 2.12 Recompression Heat and Mass Recovery and Vacuum Creating Devices	10%	4
3	<b>Chapter 3: Food Freezing</b> 3.1 Introduction 3.2 Freezing Point Curve for Food and Water 3.3 Freezing Points of Common Food Materials 3.4 Principles of Food Freezing 3.5 Freezing Time Calculation using Plank's Equation 3.6 Freezing Systems Direct Contact Systems Air Blast Immersion 3.7 Changes in Foods Due to Freezing 3.8 Frozen Food Properties 3.9 Freezing Time and Factors Influencing It 3.10 Freezing/Thawing Time 3.11 Freeze Concentration: Principles, Process, and Methods 3.12 Frozen Food Storage 3.13 Quality Changes in Foods During Frozen Storage 3.14 Freeze Drying: Heat and Mass Transfer, Equipment, and Practice	12%	4
4	<b>Chapter 4: Expression and Extraction</b> 4.1 Liquid-Liquid Extraction Processes 4.2 Types of Equipment and Design for Liquid-Liquid Extraction 4.3 Continuous Multistage Countercurrent Extraction 4.4 Leaching: Process, Preparation of Solids, Rate of Leaching, and Equipment 4.5 Equilibrium Relations	12%	4

5	<b>Chapter 5: Crystallization and Dissolution</b> 5.1 Theory and Principles 5.2 Kinetics of Crystallization 5.3 Applications in Food Industry 5.4 Equipment for Crystallization	10%	6
6	<b>Chapter 6: Distillation</b> 6.1 Principles of Distillation 6.2 Vapour-Liquid Equilibrium 6.3 Continuous Flow Distillation 6.4 Batch/Differential Distillation 6.5 Fractional Distillation 6.6 Steam Distillation 6.7 Distillation of Wines and Spirits	10%	3
7	<b>Chapter 7: Baking, Roasting, and Frying</b> 7.1 Principles of Baking 7.2 Baked Foods and Baking Equipment 7.3 Principles of Roasting 7.4 Roasting Equipment 7.5 Theory and Principles of Frying 7.6 Shallow or Contact Frying and Deep Fat Frying 7.7 Heat and Mass Transfer in Frying 7.8 Frying Equipment	10%	4
8	<b>Chapter 8: Puffing and Blanching</b> 8.1 Puffing Methods 8.2 Puffing Equipment 8.3 Principles of Blanching 8.4 Blanching Equipment	6%	4
9	<b>Chapter 9: Pasteurization and Sterilization</b> 9.1 Purpose of Pasteurization 9.2 Microorganisms and Their Reaction to Temperature 9.3 Methods of Heating 9.4 Design and Mode of Operation of Heating Equipment <ul style="list-style-type: none"> <li>• Vat</li> <li>• Tubular Heat Exchanger</li> <li>• Plate Heat Exchanger</li> </ul> 9.5 Principles of Sterilization 9.6 Process Time and T-Evaluation 9.7 Design of Batch and Continuous Sterilization 9.8 Different Methods and Equipment for Sterilization 9.9 UHT Sterilization 9.10 In-Package Sterilization: Temperature and Pressure Patterns 9.11 Equipment for Sterilizing Goods in the Package	10%	6
10	<b>Chapter 10: Aseptic Processing and Thermal Processing</b> 10.1 Principles of Aseptic Processing 10.2 Analysis of Thermal Resilience 10.3 Duration Mathematics of Conduction Heating 10.4 Thermal Processing and Microbial Death Curves 10.5 Homogenization and Emulsification	10%	4

<p><b>*Continuous Evaluation:</b> It consists of Assignments/Seminars/Presentations/Quizzes/Surprise Tests (Summative/MCQ) etc.</p>		
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### List of Practical's

1. Study of working principle open pan and vacuum evaporator and estimation of heat/mass balance during concentration of liquid foods;
2. Study of single effect evaporator and estimation of heat/mass balance during concentration of liquid foods;
3. Multiple effect evaporator and estimation of heat/mass balance during concentration of liquid foods;
4. Effect of sample particle size and time on solvent extraction process;
5. Effect of temperature on crystallization rate of sugar.
6. Study of freezers/ Design problems on freezers;
7. To study freezing of foods by different methods IQF freezing;
8. Determination of freezing time of a food material;
9. To study simple distillation process and determine the rate of distillation;
10. To study the process of roasting/ To study the effect of time temperature combination roasting;
11. Determination of oil uptake by the food product during frying.
12. To determine the efficacy of a blanching process; time-temperature combination for blanching process; efficacy of a sterilization process;
13. Determination of F value for a product in can/ retortable pouch;
14. Study of sterilizer /blancher/ pasteurizers/ fryers/ homogenizers/ irradiators

### Suggested Readings

1. Earle, R.L. 2004. Unit Operations in Food Processing. The New Zealand Institute of Food Science and Technology, New Zealand.
2. Fellows, P. 2000. Food Processing Technology: Principles and Practice, 2nd edn. CRC Press, Boca Raton, FL, USA.
3. Geankoplis, C.G. 2003. Transport Processes and Separation Process Principles (Includes Unit Operations), 4th edn. Prentice-Hall, NY, USA.
4. Ibarz, A. and Barbosa-Cánovas, G. V. 2003. Unit Operations in Food Engineering. CRC Press, Boca Raton, FL, USA.
5. McCabe, W.L., Smith, J. and Harriott, P. 2004. Unit Operations of Chemical Engineering, 7th edn. McGraw-Hill, Inc., NY, USA.
6. Pandey, H. Sharma, H.K., Chauhan, R.C., Sarkar, B.C. and Bera, M.B. 2010. Experiments in food process engineering. New Delhi: CBS Publisher and Distributors Pvt Ltd.
7. Richardson, J F., Harker, J.H. and Backhurst, J.R. 2002. Coulson and Richardson's Chemical Engineering, Vol. 2, Particle Technology and Separation Processes, 5th edn. Butterworth-Heinemann, Oxford, UK.
8. Saravacos, G.D. and Kostaropoulos, A.E. 2002. Handbook of Food Processing Equipment. Springer Science and Business Media, New York, USA.
9. Singh, R.P. and Heldman, D.R. 2014. Introduction to Food Engineering, 5th edn. Elsevier, Amsterdam, The Netherlands.
10. Sinnott, R.K. 1999. Chemical Engineering, Vol. 6, Chemical Engineering Design, 3rd edn. Butterworth-Heinemann, Oxford, UK.
11. Treybal, R.E. 1980. Mass Transfer Operations, 3rd edn. McGraw-Hill Book Company, Auckland, USA.
12. Valentas, K.J., Rotstein, E. and Singh, R.P. 1997. Handbook of Food Engineering Practice. CRC Press, Boca Raton, FL, USA.

## SEMESTER 02

**Course Name:** Food Thermodynamics

**Course Code:** (20105164)

**Prerequisite:** Food Thermodynamics will require an understanding of basic thermodynamic principles, food composition and behavior under various conditions, heat and mass transfer processes, and some basic engineering concepts applied to food systems. Having a foundation in chemistry, biology, and physics, alongside mathematical and engineering principles involved in food technology.

**Rationale:** This course equips food technology students with necessary tools to design efficient, sustainable, and high- quality food production systems. This knowledge is crucial for improving the overall food supply chain, from raw material processing to consumer-ready products, while maintaining a balance between quality, safety, and environmental impact.

### Course Learning Objective:

<b>CLOBJ 1</b>	Have an idea about basic concepts of energy and laws of thermodynamics
<b>CLOBJ 2</b>	Knowledge about thermodynamic cycles and their application
<b>CLOBJ 3</b>	Knowledge about psychrometric properties of air and its application in drying and other food applications

### Course Learning Outcomes:

<b>CLO 1</b>	Knowledge about psychrometric properties of air and its application in drying and other food applications
<b>CLO 2</b>	Apply the first and second laws of thermodynamics to analyze energy interactions, steady and unsteady flow processes, entropy, and irreversibility in engineering systems.
<b>CLO 3</b>	Interpret the thermodynamic behavior of pure substances, phase diagrams, and performance of thermodynamic cycles including power generation and refrigeration systems.
<b>CLO 4</b>	Analyze psychrometric properties, steam generation systems, and boiler operations, including humidity measurement, steam properties, and draught systems for practical engineering applications.

### Teaching and Examination Scheme:

Teaching Scheme			Credit	Examination Scheme					Total
Lect Hrs/ Week	Tut Hrs/ Week	Lab Hrs/ Week		External		Internal			
				T	P	T	CE	P	
2	-	1	3	50	-	30	-	20	100

**Lect** - Lecture, **Tut** - Tutorial, **Lab** - Lab, **T** - Theory, **P** - Practical, **CE** - CE, **T** - Theory, **P** Practical

### Contents:

Sr. No	Topic	Weightage	aching Hrs.
1	<b>Basic concepts:</b> definitions, approaches, thermodynamic systems, thermodynamic properties and equilibrium, state of a system, state diagram, path and process, different modes of work, Zeroth law of thermodynamics, concept of temperature, heat.	25%	6
2	<b>First law of thermodynamics:</b> Energy, enthalpy, specific heats, applications of first law, steady and unsteady flow analysis	5%	2
3	<b>Second law of thermodynamics:</b> Kelvin-Planck and Clausius statements, reversible and irreversible processes, entropy, availability and irreversibility.	5%	2
4	<b>Properties of Pure Substances:</b> Thermodynamic properties of pure substances in solid, liquid and vapor phases, P-V-T behaviour of simple compressible substances, phase rule.	10%	4
5	<b>Thermodynamic cycles:</b> Carnot vapor power cycle, ideal Rankine cycle, air standard Otto cycle, air standard Diesel cycle, vapor-compression refrigeration cycle.	10%	4
6	<b>Psychrometry:</b> thermodynamic properties of moist air, perfect gas relationship, absolute humidity, relative humidity, percentage humidity, humid volume, total heat, enthalpy, dry bulb temperature, wet bulb temperature, dew point temperature, adiabatic processes, wet bulb depression, humid heat, specific volume, heating, cooling, dehumidifying, sorption isotherms. Three stages of water, phase diagram for water,	30%	8
	vapour pressure-temperature curve for water, heat requirement for vaporization, measurement of humidity.		
7	<b>Boilers and steam generation:</b> fuels for boilers and steam generation, boiler types, boiler mountings and accessories, Introduction to Indian Boiler Regulation Act. Layout of steam pipeline and expansion joints. Boiler Draught: Definition, importance and classification of draught, Natural and artificial draught, Calculation of Height of chimney draught analysis; Properties of steam: Wet, dry saturated, superheated steam, use of steam tables	15%	6
<p><b>*Continuous Evaluation:</b> It consists of Assignments/Seminars/Presentations/Quizzes/Surprise Tests (Summative/MCQ) etc.</p>			

#### List of Practical

1. Demonstration and application of zeroth law of thermodynamics; first law of thermodynamics; and second law of thermodynamics.
2. Study of different types of boilers; boiler mounting and accessories; various types of burners and fuels;
3. Determination of calorific values of different fuels.
4. Study of vapour compression refrigeration test rig; heat pump

5. Properties of wet, dry, saturated and superheated steam
6. Use of steam tables and Mollier charts; dryness fraction of steam
7. Use of psychrometric chart for humidification, dehumidification, heating and drying;
8. Determination of thermodynamic properties on psychrometric charts
9. Study of steam trap and steam line layouts
10. Visit to food plant with steam utilization

### Reference Books

1. Brooker, D.B., Bakker-Arkema, F.W. and Hall, C.W. 1976. Drying Cereal Grains. The AVI Publishing Company, Inc., Connecticut, MA, USA.
2. Geankoplis, C. J. 2003. Transport Processes and Separation Process Principles (Includes Unit Operations), 4th edn. Prentice-Hall, NY, USA.
3. McCabe, W.L., Julian Smith, Peter Harriott. 2004. Unit Operations of Chemical Engineering, 7th edn. McGraw-Hill, Inc., NY, USA.
4. Nag, P.K. 2005. Engineering Thermodynamics, 3rd edn. Tata-McGraw-Hill Education, New Delhi. engineering. New Delhi: CBS Publisher and Distributors Pvt Ltd.
5. Pandey, H., Sharma, H.K., Chauhan, R.C., Sarkar, B.C. and Bera, M.B. 2010. Experiments in food process

### SEMESTER 02

**Course Name:** Engineering Drawing and Graphics

**Course Code: (20105165)**

**Prerequisite:** Knowledge of Physics & Mathematics up to 12<sup>th</sup> science level

**Rationale:** Engineering Drawing and Graphics subject is essential for fostering visual communication skills, enabling students to interpret, create, and communicate detailed drawings and graphics crucial for designing and understanding food processing equipment and components.

#### Course Learning Objective:

<b>CLOBJ 1</b>	To gain an understanding about drawing as per engineering requirement
<b>CLOBJ 2</b>	Have an idea of the isometric, orthographic views and projection
<b>CLOBJ 3</b>	Knowledge about Computer Aided Design

#### Course Learning Outcomes:

<b>CLO 1</b>	Explain the principles of engineering drawing including projection methods, orthographic projection, planes of projection, and first and third angle projection.
<b>CLO 2</b>	Apply dimensioning techniques and develop isometric projections, scales, and working drawings from given models and views.
<b>CLO 3</b>	Illustrate sectional views of machine components and interpret standard symbols for riveted and welded joints, including methods for leak proof joining.
<b>CLO 4</b>	Analyze machine elements such as threads, fasteners, and bolts, and

	demonstrate the use of CAD systems and computer hardware in engineering design.
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### Teaching and Examination Scheme:

Teaching Scheme			Credit	Examination Scheme					Total
Lect Hrs/ Week	Tut Hrs/	Lab Hrs/ Week		External		Internal			
				T	P	T	CE	P	
1	-	4	3	40	-	-	40	20	100

**Lect** - Lecture, **Tut** - Tutorial, **Lab** - Lab, **T** - Theory, **P** - Practical, **CE** - CE, **T** - Theory, **P** - Practical

### Contents:

Sr. No	Topic	Weightage	eaching Hrs.
1	<b>Basics of Engineering Drawing</b> – Definition of projection, principle of projection, methods of projection, orthographic projection, plane of projection, first and third-angle projection.	15%	3
2	<b>Dimensioning and Isometric Projection</b> – Different methods of dimensioning; Isometric scale, isometric axes, isometric projection, preparation of working drawings from models and isometric views.	10%	2
3	<b>Sectioning and Joints</b> – Concept of sectioning; revolved and oblique sections; sectional drawing of simple machine parts; types of rivet heads and riveted joints; symbols for different types of welded joints; processes for producing leak-proof joints.	15%	3
4	<b>Fasteners and Threads</b> – Nomenclature, thread profiles, multi-start threads, left and right-hand threads; square-headed and hexagonal nuts and bolts; conventional representation of threads; different types of lock nuts, studs, machine screws, cap screws, and wood screws; foundation bolts; drawing of missing views.	25%	4
5	<b>Computer-Aided Design (CAD)</b> – Application of computers for design, definition of CAD, benefits of CAD, CAD system components, computer hardware for CAD.	35%	6

#### \*Continuous Evaluation:

It consists of Assignments/Seminars/Presentations/Quizzes/Surprise Tests (Summative/MCQ) etc.

### List of Practicals:

1. Introduction to drawing scales.
2. Principles of orthographic projections.
3. Reference planes, points, and lines in space.
4. Auxiliary planes and true shapes of oblique surfaces.
5. True length and inclination of lines.
6. Projections of solids: change of position method, alteration of ground lines.
7. Section of solids and interpenetration of solid-surfaces.
8. Development of surfaces of geometrical solids.
9. Isometric projection of geometrical solids.
10. Preparation of manual drawings from models and isometric drawings.
11. Preparation of sectional drawings of simple machine parts.

12. Drawing of riveted joints and thread fasteners.
13. Demonstration on computer graphics and CAD.
14. Use of standard software for engineering drawings.
15. Sectional drawings of engineering machines.
16. Computer graphics for food engineering applications.
17. Interpretation of sectional views of food equipment.
18. Practice in the use of basic AutoCAD commands.
19. Generating 2D drawings with dimensioning using AutoCAD.
20. Small projects using CAD/CAM.

### Suggested Readings

1. Bhat, N.D. and Panchal, V.M. 1995. Machine Drawing. Charotar Publishing House, Anand.
2. Bhat, N.D. 1995. Elementary Engineering Drawing. Charotar Publishing House, Anand.
3. Lee, K. 1999. Principles of CAD/CAM/CAE Systems. Prentice-Hall, USA.
4. Zeid, I. 2004. Mastering CAD/CAM. McGraw-Hill Book Co., NY, USA.

## SEMESTER 02

**Course Name:** Environmental Studies and Disaster Management

**Course Code:** (20105166)

**Prerequisite:** Student should have Basic knowledge of science.

**Rationale:** To expose and acquire knowledge on the environment and to gain the state-of-the-art - skill and expertise on management of disasters.

**Course Learning Objective:**

<b>CLOBJ 1</b>	To expose and acquire knowledge on the environment and to gain the state-of-the-art - skill and expertise on management of disasters
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**Course Learning Outcomes:**

<b>CLO 1</b>	Knowledge about psychrometric properties of air and its application in drying and other food applications
<b>CLO 2</b>	Apply the first and second laws of thermodynamics to analyze energy interactions, steady and unsteady flow processes, entropy, and irreversibility in engineering systems.
<b>CLO 3</b>	Interpret the thermodynamic behavior of pure substances, phase diagrams, and performance of thermodynamic cycles including power generation and refrigeration systems.
<b>CLO 4</b>	Analyze psychrometric properties, steam generation systems, and boiler operations, including humidity measurement, steam properties, and draught systems for practical engineering applications.

**Teaching and Examination Scheme:**

Teaching Scheme	Credit	Examination Scheme	
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Lect Hrs/ Week	Tut Hrs/	Lab Hrs/ Week		External		Internal			Total
				T	P	T	CE	P	
2	-	2	3	50	-	30	-	20	100

**Lect** - Lecture, **Tut** - Tutorial, **Lab** - Lab, **T** - Theory, **P** - Practical, **CE** - CE, **T** - Theory, **P** - Practical

**Contents:**

Sr. No	Topic	Weightage	aching Hrs.
1	Introduction to Environment - Environmental studies - Definition, scope and importance - Multidisciplinary nature of environmental studies - Segments of Environment - Spheres of Earth - Lithosphere -Hydrosphere - Atmosphere - Different layers of atmosphere.	13%	4
2	<b>Natural Resources:</b> Classification - Forest resources. Water resources. Mineral resources. Mineral resources Food resources. Energy resources. Land resources. Soil resources.	13%	4
3	Ecosystems - Concept of an ecosystem - Structure and function of an ecosystem - Energy flow in the ecosystem. Types of ecosystem. Biodiversity and its conservation: Introduction, definition, types. Biogeographical classification of India. Importance and Value of biodiversity. Biodiversity hot spots.	17%	5
4	Threats and Conservation of biodiversity Environmental Pollution: Definition, cause, effects and control measures of: a. Air pollution. b. Water pollution. c. Soil pollution. d. Marine pollution. e. Noise pollution. f. Thermal pollution. h. light pollution.	13%	4
5	M Solid Waste Management: Classification of solid wastes and management methods, Composting, Incineration, Pyrolysis, Biogas production, Causes, effects and control measures of urban and industrial wastes.	7%	2
6	Environmental ethics: Issues and possible solutions, climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of Pollution) Act. Wildlife Protection Act.	10%	3
7	Forest Conservation Act. Human Population and the Environment: Environment and human health: Human Rights, Value Education. Women and Child Welf	7%	2
8	Disaster management - Disaster definition - Types - Natural Disasters - Floods, drought, cyclone, earthquakes, landslides, avalanches, volcanic eruptions, Heat and cold waves. Man Made Disasters - Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire, oil fire, road accidents, rail accidents, air accidents, sea accidents. International and National strategy for disaster reduction. Concept of disaster management, national disaster management framework; financial arrangements; role of NGOs, community-based organizations and media in disaster management. Central, state, district and local administration in disaster control; Armed forces in disaster response; Police and other organizations in disaster management. Role of	20%	6

Information Technology in Environment and human health.		
<b>*Continuous Evaluation:</b> It consists of Assignments/Seminars/Presentations/Quizzes/Surprise Tests (Summative/MCQ) etc.		

### List of Practical

1. Visit to a local area to document environmental assets river/ forest/ grassland/ hill/ mountain.
2. Energy: Biogas production from organic wastes.
3. Visit to wind mill / hydro power / solar power generation units
4. Biodiversity assessment in farming system
5. Floral and faunal diversity assessment in polluted and un polluted system.
6. Visit to local polluted site - Urban/Rural/ Industrial/Agricultural to study of common plants, insects and birds. Environmental sampling and preservation
7. Water quality analysis: pH, EC and TDS. Estimation of Acidity, Alkalinity
8. Estimation of water hardness.
9. Estimation of DO and BOD in water samples.
10. Estimation of COD in water samples.
11. Enumeration of E. coli in water sample.
12. Assessment of Suspended Particulate Matter (SPM).
13. Study of simple ecosystem – Visit to pond/river/hills.
14. . Visit to areas affected by natural disaster.

### Reference Books

1. De, A.K. 2010. Environmental chemistry. Published by New Age International Publishers, New Delhi. ISBN:13-978 81 224 2617 5. 384 pp
2. Dhar Chakrabarti, P.G. 2011. Disaster management - India's risk management policy frameworks and key challenges. Published by Centre for Social Markets (India), Bangalore. 36 pp
3. Erach Bharucha, Text book for Environmental studies. University Grants Commission, New Delhi
4. Parthiban, K.T., Vennila, S., Prasanthrajan, M. Umesh and Kanna, S. 2023. Forest, Environment, Biodiversity and Sustainable development. Narendra Publishing House, New Delhi

## SEMESTER 02

**Course Name:** NCC-II/NSS-II

**Course Code:** (20105167)

**Prerequisite:** The Basic understanding of health, awareness, community service, and social awareness gained through NSS-I.

**Rationale:** The NSS-II course aims to deepen student's understanding of social problems and enable them to participate actively in nation-building activities. It seeks to educate in a sense of social responsibility, teamwork, and leadership, In the duration of focusing on youth development by involving them into the programs related to health, lifestyle, environmental conservation and awareness.

### Course Learning Objective:

<b>CLOBJ 1</b>	Student's understanding of social problems and enable them to participate actively in nation-building activities. It seeks to educate in a sense of social
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	responsibility, teamwork, and leadership, In the duration of focusing on youth development by involving them into the programs related to health, lifestyle, environmental conservation and awareness.
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**Course Learning Outcomes:**

<b>CLO 1</b>	Explain the concept, types, traits, and significance of leadership, and describe the role of youth leadership and life competencies in personal and community development.
<b>CLO 2</b>	Apply life competencies such as problem-solving, decision-making, and interpersonal communication in addressing real-life situations and youth-related challenges.
<b>CLO 3</b>	Analyze the structure and functioning of youth development programs and policies at national, state, and voluntary levels, including the role of youth-focused and youth-led organizations.
<b>CLO 4</b>	Evaluate the importance of health, hygiene, sanitation, nutrition, and lifestyle practices, including awareness of national health programs, HIV/AIDS, substance abuse, first aid, and the role of yoga in promoting a healthy life.

**Teaching and Examination Scheme:**

Teaching Scheme			Credit	Examination Scheme					Total
Lect. Hrs/ Week	Tut Hrs/week	Lab Hrs/ Week		External		Internal			
				T	P	T	CE	P	
-	-	2	1	-	-	-	-	100	100

**Lect** - Lecture, **Tut** - Tutorial, **Lab** - Lab, **T** - Theory, **P** - Practical, **CE** - CE, **T** - Theory, **P** - Practical

**Practicals NCC-II:**

- Arms Drill- Attention, stand at ease, stand easy. Getting on parade. Dismissing and falling out. Ground/take up arms, examine arms. Shoulder from the order and vice-versa, present from the order and vice-versa. Saluting at the shoulder at the halt and on the march. Short/long trail from the order and vice- versa. Guard mounting, guard of honor, Platoon/Coy Drill.
- Characteristics of rifle (.22/.303/SLR), ammunition, fire power, stripping, assembling, care, cleaning, and sight setting. Loading, cocking, and unloading. The lying position and holding.
- Trigger control and firing a shot. Range Procedure and safety precautions. Aiming and alteration of sight. Theory of groups and snap shooting. Firing at moving targets. Miniature range firing. Characteristics of Carbine and LMG.
- Introduction to map, scales, and conventional signs. Topographical forms and technical terms. The grid system. Relief, contours, and gradients. Cardinal points and finding north. Types of bearings and use of service protractor. Prismatic compass and its use. Setting a map, finding north and own position. Map to ground and ground to map. Knots and lashings, Camouflage and concealment, Explosives and IEDs.
- Field defenses obstacles, mines and mine lying. Bridging, waterman ship. Field water supplies, tracks and their construction. Judging distance. Description of ground and indication of landmarks. Recognition and description of target. Observation and concealment. Field signals.

Section formations. Fire control orders. Fire and movement. Movement with/without arms. Section battle drill. Types of communication, media, latest trends and developments.

**Practicals NSS-II:**

- Importance and role of youth leadership
- Meaning, types and traits of leadership, qualities of good leaders; importance and roles of youth leadership, Life competencies
- Definition and importance of life competencies, problem-solving and decision-making, interpersonal communication. Youth development programs
- Development of youth programs and policy at the national level, state level and voluntary sector; youth-focused and youth-led organizations
- Health, hygiene and sanitation. Definition needs and scope of health education; role of food, nutrition, safe drinking water, water borne diseases and sanitation (Swachh Bharat Abhiyan) for health; national health programs and reproductive health. Youth health, lifestyle, HIV AIDS and first aid. Healthy lifestyles, HIV AIDS, drugs and substance abuse, home nursing and first aid. Youth and yoga. History, philosophy, concept, myths, and misconceptions about yoga; yoga traditions and its impacts, yoga as a tool for healthy lifestyle, preventive and curative method.

**SEMESTER 02**

**Course Name:** Introduction to Milling (Rice,Dal, Spices)

**Course Code:** 20105180

**Type of Course:** B.Tech Food Technology

**Prerequisite:** Basic knowledge of food grains and spices, along with an understanding of food safety and hygiene practices.

**Rationale:** This skill enhancement course provides hands-on experience in milling processes for rice, dal, and spices. It focuses on developing practical skills in handling equipment, optimizing milling operations, and ensuring product quality, preparing students for technical roles in the food processing industry.

**Course Learning Objective:**

<b>CLOBJ 1</b>	To understand the basic principles and importance of milling operations in rice, dal, and spice processing industries.
<b>CLOBJ 2</b>	To develop knowledge of the structure, composition, and processing characteristics of cereals, pulses, and spices.
<b>CLOBJ 3</b>	To familiarize students with different milling equipment, cleaning, grading, dehussing, polishing, and grinding operations.

**Course Learning Outcomes:**

<b>CLO 1</b>	Explain the basic concepts and importance of milling of agricultural commodities such as rice, pulses (dal), and spices, including objectives and principles involved.
<b>CLO 2</b>	Describe the different milling processes, equipment, and operations used in rice milling, pulse milling, and spice grinding.
<b>CLO 3</b>	Analyze the factors affecting milling efficiency, yield, and quality of milled products, including losses and by-products.

<b>CLO 4</b>	Evaluate the performance of milling systems and suggest suitable methods and machinery for improved processing and value addition.
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**Teaching and Examination Scheme:**

Teaching Scheme			Credit	Examination Scheme					Total
Lect Hrs/ Week	Tut Hrs/	Lab Hrs/ Week		External		Internal			
				T	P	T	CE	P	
-	-	2	2	-	-	30	20	50	100

**Lect** - Lecture, **Tut** - Tutorial, **Lab** - Lab, **T** - Theory, **P** - Practical, **CE** - CE, **T** - Theory, **P** - Practical

**List of Practical:**

**Rice Milling**

1. Study of Rice Quality Parameters
2. Milling Process of Rice (Demonstration/Practice)
3. Evaluation/Separation of Rice Milling Fractions
4. Parboiling and Its Effect on Milling
5. Determination of Milling Yield and Degree of Milling

**Dal Milling**

6. Pretreatment of Pulses Before Milling
7. Demonstration of Dal Milling Process/Machinery
8. Color and Texture Analysis of Milled Dal

**Spice Milling**

9. Study of Spice Grinding Equipment
10. Cryogenic Grinding of Spices
11. Volatile Oil Content Determination in Spices
12. Particle Size Analysis of Ground Spice

**General Milling**

- Cleaning and Preconditioning of Raw Materials
- Moisture Content Determination of Grains and Spices
- Observation of Milling Machinery Components
- Safety Measures in Milling Operations

**SEMESTER 02**

**Course Name:** Introduction to Manufacturing of Bakery Products

**Course Code:** 20105181

**Prerequisite:** Basic understanding of food science, ingredients, and food safety.

**Rationale:** This skill enhancement course focuses on hands-on learning of bakery product manufacturing processes, including ingredient handling, processing, packaging, and storage. It

equips students with practical skills and industry-relevant knowledge essential for roles in the bakery sector.

**Course Learning Objective:**

<b>CLOBJ 1</b>	To understand the basic principles, ingredients, and processing techniques involved in the manufacturing of bakery products.
<b>CLOBJ 2</b>	To develop knowledge of bakery equipment, production methods, and quality control measures used in the bakery industry.
<b>CLOBJ 3</b>	To familiarize students with the preparation and processing of various bakery products such as bread, cakes, biscuits, pastries, and cookies.

**Course Learning Outcomes:**

<b>CLO 1</b>	Explain the principles and processes involved in the manufacturing of bakery products, including ingredients, formulation, and functions of raw materials.
<b>CLO 2</b>	Apply knowledge of mixing, fermentation, baking, and cooling operations in the production of various bakery products such as bread, biscuits, cakes, and pastries.
<b>CLO 3</b>	Analyze the role of process parameters, equipment, and quality control measures in ensuring product consistency, safety, and shelf life.
<b>CLO 4</b>	Evaluate common defects in bakery products and suggest appropriate corrective measures and improvements in processing and storage conditions.

**Teaching and Examination Scheme:**

Teaching Scheme			Credit	Examination Scheme					Total
Lect Hrs/ Week	Tut Hrs/	Lab Hrs/ Week		External		Internal			
				T	P	T	CE	P	
-	-	2	2	-	-	30	20	50	100

**Lect** - Lecture, **Tut** - Tutorial, **Lab** - Lab, **T** - Theory, **P** - Practical, **CE** - CE, **T** - Theory, **P** - Practical

**List of Practical:**

1. Introduction to bakery equipments and tools
2. Determination of ash content in white wheat flour
3. Water absorption and gluten content estimation
4. Preparation of flavoured buns
5. Preparation of plain biscuits
6. Preparation of eggless cake
7. Bread making using straight dough method
8. Preparation of brown bread
9. Preparation of cupcakes
10. Preparation of chocolate brownies
11. Preparation of cookies
12. Preparation of pizza base
13. Preparation of multigrain bread
14. Preparation of croissants and doughnuts
15. Visit to bakery plant

**\*Continuous Evaluation:**

It consists of Assignments/Seminars/Presentations/Quizzes/Surprise Tests (Summative/MCQ) etc.

**Suggested Readings**

1. Amendola, J. and Rees, N. 2003. Understanding Baking: The Art and Science of Baking. 3rd edn. John Wiley and Sons, Inc., Hoboken, New Jersey, USA.
2. Corke, H., Leyn, I.D., Cross, N.A. Nip, W.K., and Hui, Y.H. 2006. Bakery Products: Science and Technology. Blackwell Publishing Ltd., Oxford, UK.
3. Duncan Manley. 2000. Technology of Biscuits, Crackers and Cookies, 3rd edn. Woodhead Publishing Limited, Cambridge, England.
4. Grewling, P.P. 2013. Chocolates and Confections, 2nd edn. John Wiley and Sons, Inc., Hoboken, New Jersey, USA.
5. Hui, Y.H. 2007. Handbook of Food Products Manufacturing: Principles, Bakery, Beverages, Cereals, Cheese, Confectionary, Fats, Fruits, and Functional Foods. John Wiley and Sons, Inc., Hoboken, New Jersey, USA.
6. Jackson, E.B. 1995. Sugar Confectionery Manufacture, 2nd edn. Springer-Verlag, US.
7. Kent, N.L. and Evers, A.D. 1994. Kent's Technology of Cereals: An Introduction for Students of Food Science and Agriculture, 4th edn. Elsevier Science Ltd., Oxford, UK.
8. Kingslee, J. J. 2006. A Professional Text to Bakery and Confectionery. New Age International, New Delhi.
9. Matz, S.A. 1976. Snack Food Technology, 2nd edn. AVI Publishing Co., Inc., Westport, Connecticut, USA.

**SEMESTER 02**

**Course Name:** Introduction to Food Safety

**Course Code:** 20105183

**Prerequisite:** Basic understanding of biology and chemistry, including principles of microbiology, biochemistry, and hygiene practices. Familiarity with food composition, contamination sources, and basic public health concepts is also beneficial for grasping food safety regulations and sanitation protocols.

**Rationale:** Good Laboratory Practices in food technology is to ensure the reliability and accuracy of laboratory results in food safety testing. It helps maintain consistent quality, safeguard public health, and comply with regulatory standards. GLP principles promote effective risk management and support the integrity of food production processes.

**Course Learning Objective:**

<b>CLOBJ 1</b>	To understand the basic concepts, importance, and principles of food safety in food processing and handling.
<b>CLOBJ 2</b>	To develop knowledge of food hazards, including physical, chemical, and biological contaminants affecting food quality and safety.
<b>CLOBJ 3</b>	To familiarize students with food safety standards, regulations, and quality management systems such as HACCP, GMP, and GHP.

**Course Learning Outcomes:**

<b>CLO 1</b>	Explain the fundamental concepts of food safety and sanitation, including sources of contamination and their impact on food quality and public health.
<b>CLO 2</b>	Apply principles of personal hygiene, cleaning, sanitation, and waste management in food handling and processing environments.
<b>CLO 3</b>	Analyze food safety hazards (biological, chemical, and physical) and evaluate control

	measures such as good manufacturing practices and hazard analysis systems.
<b>CLO 4</b>	Evaluate food safety regulations, standards, and quality assurance systems to ensure safe food production and compliance in food industries.

### Teaching and Examination Scheme:

Teaching Scheme			Credit	Examination Scheme					Total
Lect Hrs/ Week	Tut Hrs/	Lab Hrs/ Week		External		Internal			
				T	P	T	CE	P	
-	-	2	2		50		20	30	100

**Lect** - Lecture, **Tut** - Tutorial, **Lab** - Lab, **T** - Theory, **P** - Practical, **CE** - CE, **T** - Theory, **P** - Practical

### List of Practicals:

1. Introduction to Food Safety & Personal Hygiene: Orientation on lab safety, proper handwashing technique, use of PPE (gloves, apron, cap, mask).
2. Identification of Food Hazards: Observe and identify biological, chemical, and physical contaminants in food samples or visuals.
3. Microbial Analysis of Hands and Surfaces: Swab testing before and after handwashing, surface hygiene test using simple culture methods.
4. Detection of Food Spoilage Visual and sensory identification of spoiled foods (vegetables, fruits, milk, bread).
5. Simulated Investigation of Foodborne Outbreak Case study simulation: trace sources of contamination, draw flow diagram, suggest prevention.
6. Temperature Control in Food Safety Demonstrate use of food thermometers, hot-holding/cold-holding equipment, temperature logs
7. Demonstration of Cleaning and Sanitizing Methods Use of detergents, sanitizers; cleaning schedule preparation; sanitizing utensils and surfaces.
8. Pest Identification and Control Measures Identify common food pests, signs of infestation, safe pest control practices (non-chemical focus)
9. Solid Waste Segregation and Management Practice segregation of organic/inorganic food waste; simple composting techniques.
10. Mock HACCP Plan Preparation Prepare HACCP plan for a small-scale food product (e.g., salad, sandwich, jam).

### References:

1. Marriott's Principles of Food Sanitation - Norman G. Marriott & Robert B. Gravani A foundational text on food sanitation, including equipment cleaning, pest control, and regulations.
2. Food Safety and Sanitation for the Food Service Industry - Karen M. Davis & Norman G. Marriott Covers hygiene practices, foodborne illness prevention, and institutional food handling.
3. Essentials of Food Safety and Sanitation - David McSwane, Nancy R. Rue, Richard Linton A practical guide with illustrations and case studies.
4. Food Safety Management: A Practical Guide for the Food Industry - Yasmine Motarjemi et al. Covers food safety systems, HACCP, and global food safety regulations.

4	Examine the principles and implementation of Quality Control (QC), Quality Assurance (QA), and Total Quality Management (TQM) in food industries.
5	Interpret and apply national and international food laws, standards, and certification systems including FSSAI, AGMARK, BIS, FPO, ISO 22000, and CODEX.